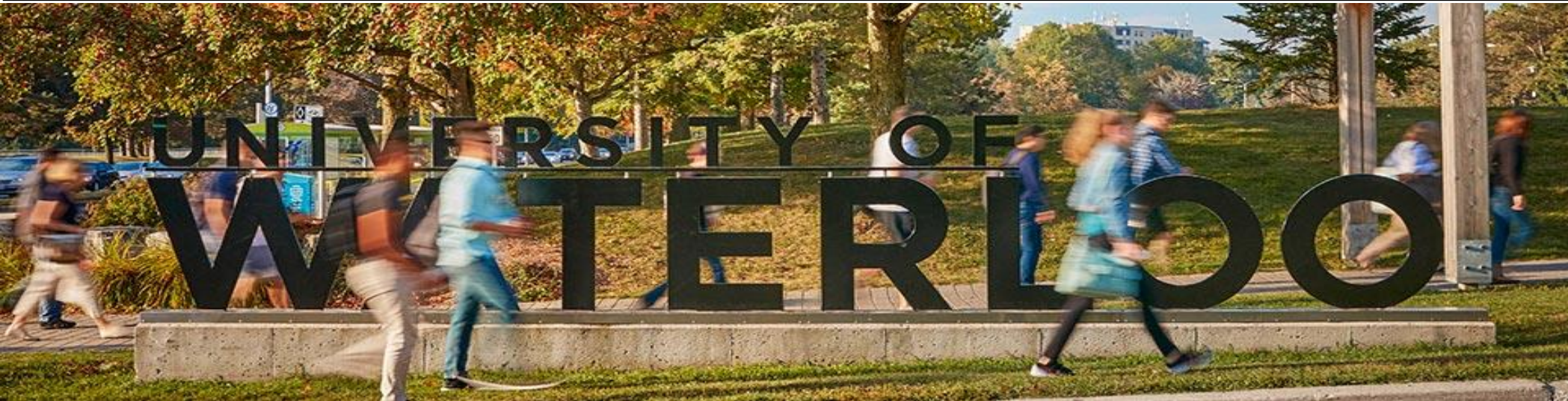


Canadian Society for  
Brain, Behaviour,  
& Cognitive Science

**29<sup>th</sup>**  
**Annual**  
**Meeting**

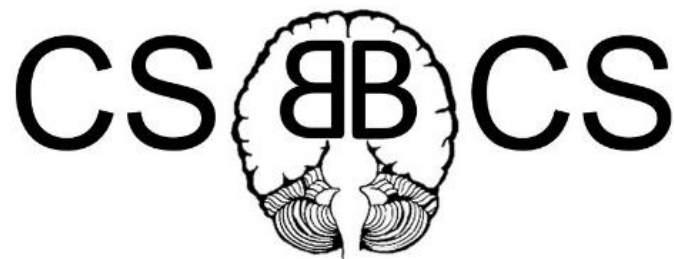
Société Canadienne des  
Sciences du Cerveau,  
du Comportement,  
et de la Cognition



UNIVERSITY OF  
**WATERLOO**



Waterloo, Ontario, Canada



June 7<sup>th</sup>-9<sup>th</sup> 2019



## **Message from the Organisational Committee**

Welcome to CSBBCS 2019! As head of the organising committee for the 29th Annual meeting of the Canadian Society for Brain, Behaviour and Cognitive Science, I am very pleased to welcome you to the University of Waterloo. This meeting represents a vital opportunity for researchers to share their ideas, form new collaborative relationships, and promote our scientific disciplines. This year's program consists of 160 Oral presentations and 185 Posters.

I would like to thank all the people whose hard work and dedication have made this meeting possible. It has been my great pleasure to work with enthusiastic faculty and students, as well as a wonderful administrative team. Thank you all for your great ideas, and hard work.

I would also like to thank our sponsors, Brain Vision Solutions, D2L, Nelson publishing, University of Waterloo Faculty of Arts, and the Department of Psychology. The financial support of these organizations has helped us to put together a conference that we hope will be insightful, educational, enriching, and entertaining!

Finally, thanks to you, for your enthusiastic participation in our national conference. We are showcasing a tremendous diversity in scientific presentations, representative of the high quality of research taking place at Universities and academic institutions across Canada. The scientific contributions from our Society, to the fields of cognition, behaviour, and brain sciences should be celebrated!

I hope you will find the meeting an enjoyable and valuable opportunity to share your ideas and learn from others.

Sincerely,

Myra Fernandes, Head of the CSBBCS 2019 Organisation Committee  
conference@csbbcs.org; Twitter: @OfficialCSBBCS

## **CSBBCS Executive**

President - William Hockley, Laurier University

Member-at-Large – Geneviève Desmarais, Mt. Allison University

Past-President - Randall Jamieson, University of Manitoba

Member-at-Large - Myra Fernandes, University of Waterloo

Treasurer/Secretary - Chris Oriet, University of Regina

Member-at-Large - Steven Lamontagne, Queen's University

## **CSBBCS 2019 Organization Committees**

**Conference Program:** Myra Fernandes, Derek Koehler, Fiona McAlister, Michael Wagoner

**Abstracts & Scientific Review:** James Danckert, Mike Dixon, Colin Ellard, Jonathan Fugelsang, Evan Risko, Jennifer Stolz

**Pre-Conference Workshop:** Britt Anderson

**Symposium Organizer:** James Danckert

**Hebb Student Awards:** Daniel Smilek, Colin Ellard, Penny Pexman (U Calgary), Hong-Jin Sun (McMaster), Genevieve Desmarais (Mt. Allison), Chris Oriet (U Regina)

**Professional Issues Session:** Evan Risko

**Finance:** Jennifer Stolz, Janice DaSilva

**Sponsorship:** Colin MacLeod

**Registration Desk:** James Danckert, Fiona McAlister

**Attendee Swag:** Roxane Itier, Britt Anderson, James Danckert

**Women in Cognitive Science Canada Session:** Melissa Meade, Jhotisha Mugdon, Karissa Parkington (PhD candidates UWaterloo), Penny Pexman (UCalgary), Debra Titone (McGill)

**Audio-Visual and Session Chair Organiser:** Jonathan Fugelsang

**AV Support Volunteers:** Michelle Ashburner, Laura Bianchi, Megan Kelly, Tyler Kruger, Chanel Larche, Shane Littrell, Jeremy Marty- Dugas, Ethan Meyers, Karisa Parkington, Emily Shiu, Madison Stange, Kaiden Stewart, Martin Turpin, Alexander Walker, Ryan Yeung, Craig Zhou, Mona Zhu

**Registration Desk Volunteers:** Anna Hudson, Jatheesg Srikantharajah, Emilie Caron, Sarah McCrackin, Kaiden Stewart, Craig Zhou, Alyssa Smith, Emily Grant, Tyler Kruger, Laura Bianchi, Madison Stange, Allison Drody, Christopher Lee, Ryan Yeung

**Attendee Swag Preparation:** Hannah Negami, Emilie Caron, Tyler Kruger, Christopher Lee, Alyssa Smith, Jeremy Marty-Dugas, Emily Grant, Craig Zhou, Ryan Yeung, Brady Roberts

**Poster Board Set-Up:** Lydia Hicks, Mona Zhu, Michelle Ashburner, Ryan Yeung, Hanna Negami, Chanel Larche

**Music Night coordinators:** Ethan Meyers, Alyssa Smith, Kaiden Stewart, Laura Bianchi, Brady Roberts

**Website & Communications:** Chris Oriet (U Regina)

**Abstract Database Tool:** Matt Crump (Brooklyn College), Harinder Aujla (U of Winnipeg), Randy Jamieson (U Manitoba)

**CSBBCS UW Conference Logo design:** Melissa Meade

**UW Conference and Food Services:** Susanne Keppler

## Table of Contents

List of Sponsors	5	Schedule of Presentations & Events	19
Location	6	Abstracts Speaker Session 1 June 8 8:30-9:30am	25
Travel	7	Abstracts Speaker Session 2 June 8 9:30-10:30am	31
Registration	8	Abstracts Speaker Session 3 June 8 10:45-noon	38
Friday Music Night	9	Abstracts Speaker Session 4 June 8 2:15-3:45pm	41
Saturday night Banquet	9	Abstracts Speaker Session 5 June 8 4:05-5:20pm	50
Pre-Conference Workshop	9	Abstracts Speaker Session 6 June 9 10:15-11:30am	55
Women in Cognitive Science	10	Abstracts Speaker Session 7 June 9 11:30-12:30pm	60
Accommodations	11	Abstracts Speaker Session 8 June 9 1:15-2:15pm	66
Places to Eat	12	Abstracts Speaker Session 9 June 9 2:15-3:15pm	72
Vincent Di Lollo Early Career Award	14	Abstracts Symposia	75
President's Invited Keynote	16	Abstracts Poster Session 1 June 7 5:30-7pm	80
D.O. Hebb Award	17	Abstracts Poster Session 2 June 8 12:45-2:15pm	99
Tees Leadership Award	18	Abstracts Poster Session 3 June 9 8:45-10:15am	120

We would like to thank our generous sponsors for their contribution to CSBBCS 2019

**D2L**

DESIRE2LEARN



**BRAIN VISION** *Solutions*

Solutions for neurophysiological research



psychology

UNIVERSITY OF WATERLOO



**UNIVERSITY OF WATERLOO**  
**FACULTY OF ARTS**

## Location

All sessions will take place on campus at University of Waterloo in Federation Hall (FED) and the Science Teaching Complex (STC).



Friday speakers, Poster Session #1 and Music Night take place in **Federation Hall** (shown below)



Saturday speakers, Posters Sessions #2, and #3, take place in the **Science Teaching Complex** (shown right)



Saturday night banquet is in **Federation Hall** (shown above).

## Travel

University of Waterloo's main campus is in the city of Waterloo, which is centrally located in southwestern Ontario  
The street address is: 200 University Ave. West, Waterloo, Ontario, N2L 3G1

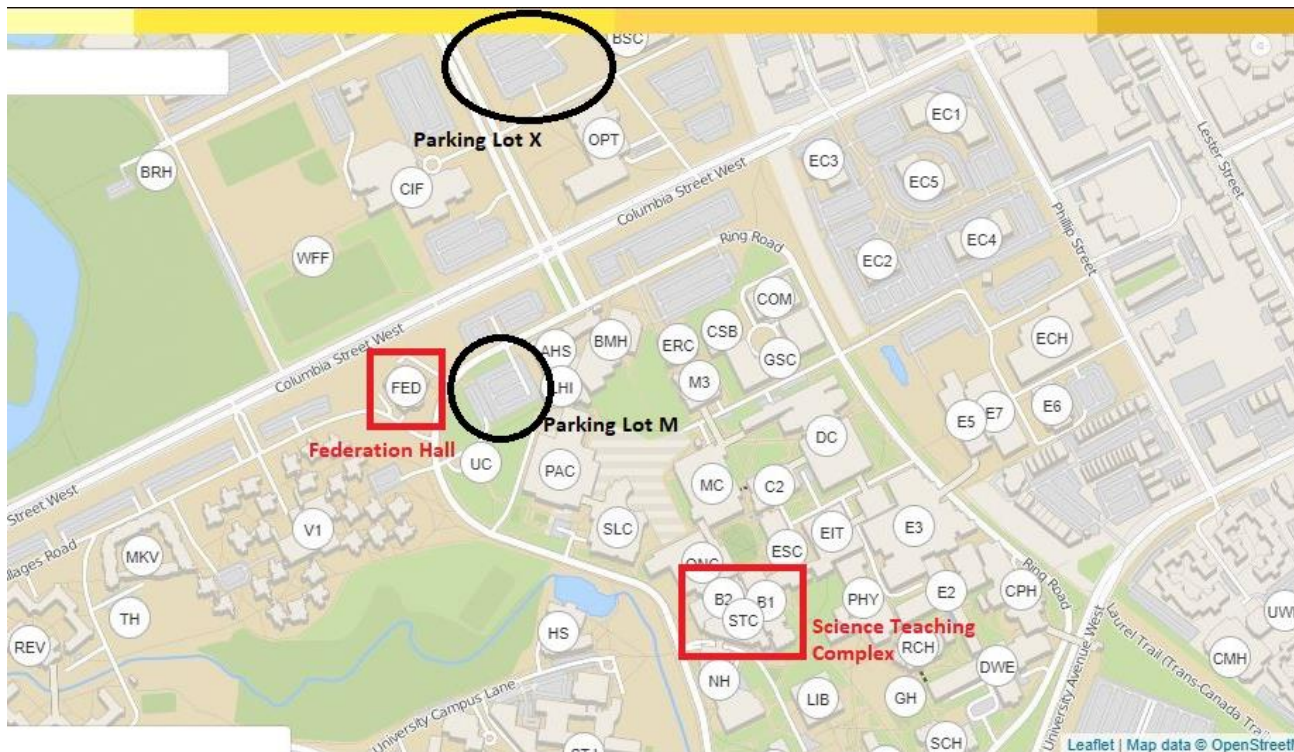
## Getting to campus...

By car from highway 401

- Take exit 278 (from Toronto) or exit 278B (from London) to highway 8 WEST Kitchener/Waterloo
  - From Hamilton/Niagara, take highway 403 to highway 6 NORTH; follow 6 North to highway 401 WEST; follow 401 West to exit 278; proceed as below.
- Follow the signs for 85 NORTH Waterloo.
- Exit at University Avenue West, which is the second University Avenue exit (just past the University Ave East exit when travelling north from the 401).
- Drive about 3 km along University Avenue to Seagram Drive – the main entrance to the University of Waterloo.

<https://uwaterloo.ca/future-students/visit-waterloo/location-directions>

**Visitor parking is available on campus in lot X for \$5 and lot M for \$6**



## By Bus

Coach Canada and Greyhound have bus stops in Kitchener, and some with service directly to University of Waterloo

### By Train

VIA Rail has a station in Kitchener (a 10-minute taxi ride from campus).

Go Transit also has limited train service to Kitchener from the Greater Toronto Area

## By Plane

There are daily flights operated via WestJet to the Waterloo Region Airport. There are also flights to/from nearby Hamilton and Toronto Airports.

## Registration

### On-Site:

On Friday June 7<sup>th</sup>, a Registration Desk is located within Federation Hall. Attendees can pick up their Conference Kit between 1pm to 5pm on Friday.

On Saturday June 8<sup>th</sup>, a Registration Desk is located in the Science Teaching Complex Atrium. Attendees can pick up their Conference Kit between 8am to 4pm.

On Sunday June 9<sup>th</sup>, a Registration Desk is located in the Science Teaching Complex Atrium. Attendees can pick up their Conference Kit between 8am to 10am.

### Online:

To register, please click on "Register for Conference" in the "Quick Links" on the conference website. A current, dues-paid membership in CSBBCS is required to be able to Register for the conference. Please click [here](#) to purchase/renew your membership.

### **Registration fees:**

Student: \$140

Faculty: \$180

Pre-Conference Workshop: \$40

Registration includes: Opening night reception on Friday, breakfast, coffee breaks, & lunch on Saturday, conference banquet dinner on Saturday, breakfast, coffee breaks & lunch on Sunday, plus an ice-cream social on Sunday afternoon!

## Speaker Sessions

Talks will be 15 minutes (12 minutes + 3 minutes for questions per speaker).

Please bring your presentation to your assigned room and session on a USB. A PC computer is available in each room. Presentations for each session should be loaded onto this computer, in your assigned room, prior to the start of your session. If you are a MAC user, please bring your own connection cable and dongle for your laptop.

## Poster Sessions

Your poster can be affixed to the corresponding board listing your assigned number. Maximum poster size is 4' X 4'.

Poster Session #1: Please have your poster mounted anytime between 1pm and 5:30pm, and remove your poster by 7:15pm

Poster Session #2: Please have your poster mounted on the board by 11am on Saturday, and remove your poster by 4pm.

Poster Session #3: Please have your poster mounted on the board by 8:40am on Sunday, and remove your poster by 1:30pm.

## Symposia

Nine symposia are included in the program. These consist of 3 to 4 talks related to a single topic, within a 1h, or 1h15 minute, session.

## Friday Music Night

Following the posters, and open to all. Come see your fellow scientists display their musical talents! Faculty and Student bands will entertain with a mix of blues and rock tunes. There will be a cash bar, and pizzas.

- Come listen to “Young Pilot” featuring Scott Carere, Tyler Frey, and Ethan Meyers

## Saturday Night Banquet

We invite all registered conference attendees to our CSBBCS drinks reception and dinner banquet. This event takes place in Federation Hall, 6:30-7pm drinks followed by 7pm dinner service.

Music will be provided by a team of extremely talented young musicians ranging in age from 6 to 17 years:

- Arlo Quilley and Anna Smilek will headline, and will be joined by their siblings: Jem, Tuuli and Romy Quilley along with Eva, Luke and Grace Smilek, for various numbers.

For more information about these gifted youths, visit the group’s website: [thisfolkinglife.com](http://thisfolkinglife.com) and [annasmilek.com](http://annasmilek.com)

## Drink Tickets

Each registered conference attendee will receive 2 drink tickets which can be used at either the Friday night Welcome reception and/or Saturday night banquet

## Pre-Conference Workshop

Friday June 7th from 8:30am-2pm at Federation Hall, Westmount Room

Topic: *Introduction to Brain Modeling with the Neural Engineering Framework (NENGO)*

Workshop Leader: Dr Terry Stewart

This workshop will introduce the NENGO brain simulation software, a graphical and scripting environment for building spiking neuron-level models of cognitive and non-cognitive behaviour. The workshop is hands-on and will guide participants through building a variety of models.

Please bring a laptop with NENGO installed. Installation instructions can be Downloaded at <https://www.nengo.ai/overview.html>

## Women in Cognitive Science session (open to everyone)

Join us Friday June 7th from 1:30pm-3:30pm for a presentation and panel discussion

### Topic: Demystifying Skill Development

It often seems difficult and intimidating to try to branch out and learn new research skills, however, it is becoming increasingly more important for young researchers to build a repertoire of foundational research skills for careers in both academia and industry. In this session our goal is to demystify the apparent challenges of acquiring new skills by speaking with a panel of researchers who have successfully learned and implemented novel techniques (such as brain imaging, use of special populations, and new statistical analyses) into their existing research programs. They will also discuss any gender-specific challenges they encountered. The panel discussion will be followed by a speed mentoring event which provides the opportunity for students interested in developing specific skills to speak with researchers who have successfully obtained those skills.

We thank University of Waterloo's He for She campaign for additional sponsorship funding

Panel Speakers:

Dr. Hilary Bergsieker, University of Waterloo  
Dr. Barbara Fenesi Western University  
Dr. Caroline Palmer McGill University  
Dr. Jessica Robin (Baycrest)



## Wireless Internet

Wireless Internet access will be available via the **eduroam** network.

Alternatively, follow the instructions below for access:

- Look for available networks and select: **uw-wifi-setup-no-encryption**
- Go to the sign-in page and click the link: [Click here if you are a guest user](#)
- On the subsequent form, provide your name and valid email address.
- You will then be emailed a confirmation code which you will need to copy/paste into the confirmation page. This needs to be done within about 10 minutes or wireless access will be disabled.

## Accessibility

Federation Hall is wheelchair accessible and all Conference rooms are located on the first floor. The Science Teaching Complex is wheelchair accessible and elevators are available to move between floors.

Elevators: There are elevators in two locations in STC. When you enter through the main (west) entrance, continue past the stairwell on the left; the first set of elevators will be on the right. The other set of elevators are located immediately to the left of the south entrance.

Washrooms: Barrier-free men's and women's washrooms with change tables are located on the first floor of STC, and in FED Hall.

## Accommodations

### On Campus

We have a block of rooms available at **St Paul's University College**, located at 190 Westmount Rd N, Waterloo, ON. Rooms are in a brand new addition to St. Paul's Green Wing (opened Fall 2017), and feature their own Ensuite Washroom (toilet, sink, and shower), a double bed, clothing storage, desk and chair.

Group Rate is **\$75 + HST/ night**; Breakfast \$7.08+HST; Parking: \$5.31 +HST, per day.

Reservations can be made at the Group rate by emailing the Manager: [emroy@uwaterloo.ca](mailto:emroy@uwaterloo.ca)

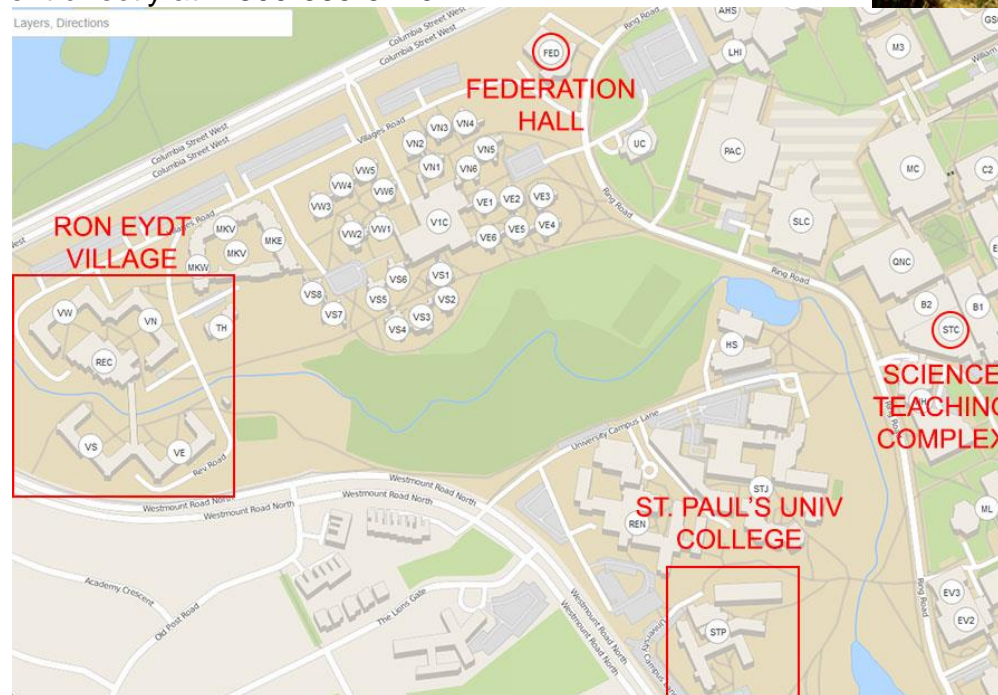


Accommodation is also available at **Ron Eydt Village residence**.

Group Rate is **\$60 + HST/ night** single/double occupancy and includes free WiFi, parking for one vehicle, linens & towels upon check in, daily cleaning of the common areas and weekly linen/towel exchange.

Reservations can be made online using the form

at <https://webreg.uwaterloo.ca/onlinereg/Register/default.aspx?code=C000329> or by calling our Reservation Department directly at 1-800-565-5410.



## Off Campus

We have secured a block of rooms at the rate of \$129/night including breakfast at **The Courtyard by Marriott Waterloo St Jacobs**, a short 5 minute drive from campus at 50 Benjamin Rd, Waterloo. Rooms will be available at the group rate until mid-May.



We have secured a block of rooms at the rate of \$130/night including breakfast at **Best Western Plus Waterloo**, a short 5 minute drive from campus at Waterloo at 547 King St N, Waterloo.



The best way to get from the Best Western Plus to the campus is to take the **BUS Route 200** (Direction: Ainslie Terminal) from Conestoga Mall which is across the street from the hotel. It runs every 15 minutes. There is a stop at the corner by the hotel but it is for the route 9 which will eventually get you to the University but it takes 35 minutes and only runs every half hour. Here is a map with the directions from the hotel to the bus stop at Conestoga Mall:

<https://www.google.ca/maps/dir/Best+Western+Plus+Waterloo,+King+Street+North,+Waterloo,+ON/Conestoga+Station,+King+Street+North,+Waterloo,+ON/@43.4986245,-80.5310936,18z/data=!3m1!4b1!4m13!1m5!1m1!1s0x882bf3c4a4f6624d:0x7b05dfdcdddbed37!2m2!1d-80.5317459!2d43.499122!1m5!1m1!1s0x882bf3c3f37dc741:0x1b6c71c0ed63a5fa!2m2!1d-80.5285684!2d43.4980201!3e2>

## Places to Eat

Registration includes: Opening night reception on Friday, breakfast, coffee breaks, & lunch on Saturday, conference banquet dinner on Saturday, breakfast, coffee breaks & lunch on Sunday, plus an ice-cream social on Sunday afternoon!

There are also many fast food restaurants available in University Plaza, located a short walk from campus. Several restaurants can be found a short drive from campus. Uptown Waterloo offers great restaurants and cafes.

BUS SERVICE runs from campus to various locations. Use Trip Planner website: [www.grt.ca](http://www.grt.ca)

Sole Restaurant and Wine Bar  
83 Erb St W, Waterloo, ON N2L 6C2  
<http://www.sole.ca/>

Angie's Since 1962  
47 Erb Street West, Waterloo, ON N2L 1S8

Beertown Public House

75 King St S, Waterloo, ON N2J  
<http://www.beertown.ca/>  
Famoso Neopolitan Pizzeria  
15 King St S, Waterloo Towne Square, Waterloo, ON N2J 1N9

Raintree Café (Vegetarian, Vegan)  
220 King St N, Waterloo, ON N2J 2Y7  
<http://raintreecafe.ca/>

The Jane Bond (Vegetarian)  
5 Princess St W, Waterloo, ON N2L 2X7  
[janebond.ca](http://janebond.ca)

My-Thai Restaurant  
51 King St N, Waterloo, ON N2J 2W9  
<https://www.mythai.ca/>

Masala Bay

## Things to do in Waterloo

### Uptown Waterloo

[Uptown Waterloo](#) – Main shopping and dining area in Waterloo with over 90 locally owned businesses including live music venues, cafes, bakeries, and restaurants.

[Canadian Clay and Glass Gallery](#) – 25 Caroline Street North; Contemporary artwork from both emerging and established artists.

[Waterloo Memorial Recreation Complex](#) – 101 Father David Bauer Drive, Waterloo; Swimming pool, indoor track, ice rink.

[Waterloo Park](#) – 50 Young Street West; Picnic areas, sports fields, animal farm.

[Uptown Loop](#) – Self guided walking tours of points of interest in Uptown Waterloo

### Surrounding area:

[Laurel Creek Conservation Area](#) – 625 Westmount Rd., RR#3, Waterloo; trails and a beach.

[The Hydrocut](#) – A series of 25 connected mountain bike riding trails in Kitchener. The parking lots and main entrances are located at 1522 Glasgow Street in Kitchener, and 1974 Snyder's Road East in Petersburg.

3B Regina St N, Waterloo, ON N2J 2W7  
<http://masalabay.com/menu.html>

Taco Farm  
8 Erb St W, Waterloo, ON N2L 1S7  
[tacofarm.ca](http://tacofarm.ca)

Belmont Village restaurants  
<http://thebelmontvillage.ca/category/food-dining-drink/>

[West Montrose Covered Bridge](#) – 1232 River's Edge Dr., West Montrose; Built in 1881, it is Ontario's last remaining covered bridge.

[St. Jacobs Farmers' Market](#) – 878 Weber Street North, Woolwich; Canada's largest year-round farmers' market. Hundreds of local vendors. Open Thursdays and Saturdays.

[Village of St. Jacobs](#) – Combination of Mennonite shops and restaurants and modern artisans. It also has a [giant model train](#) set up.

[BATL Axe Throwing](#) – 69 Agnes Street, Kitchener

[Canoeing the Grand](#) – 3734 King Street East, Kitchener; Canoeing and tubing on the Grand River. All equipment can be rented on site and they shuttle you to the start point (you end at the rental site).

[Waterloo Region Museum & Doon Heritage Village](#) – 10 Huron Road, Kitchener. The largest community museum in Ontario contains to indoor galleries as well as Doon Heritage Village, a 60 acre pioneer village.

[The Museum](#) – 10 King Street West, Kitchener. Five floors of exhibits and programs in downtown Kitchener.

[Woodside National Historic Site](#) – 528 Wellington Street North; The preserved boyhood home of Canada's tenth Prime Minister, William Lyon Mackenzie King.

## Vincent Di Lollo Early Career Award

**Dr. Signy Sheldon** received her PhD in Psychology 7 years ago from the University of Toronto and subsequently completed post-doctoral fellowships at St. Michael's Hospital (Toronto), and the Rotman Research Institute. Dr. Sheldon began her appointment at McGill University in January 2015, and has already established herself as a highly successful researcher. Dr. Sheldon publishes at a prolific rate with 34 refereed journal articles submitted or published, including 23 since she began her position at McGill. She has been senior author on publications in leading journals such as *Cortex*, *Hippocampus* and the *Journal of Cognitive Neuroscience*. Critically, many of these publications include her graduate and undergraduate students, demonstrating her excellence as a mentor.

In addition to contributing to research through publications, Dr. Sheldon is also a visible presence at national and international cognitive psychology conferences. She gave talks at the 2016 and 2018 CSBBCS meetings on her work on the cognitive and neural processes that support autobiographical memory retrieval. She recently chaired a symposium at the International Conference on Learning and Memory in April of 2018 and has been invited to speak at several other prestigious International conferences such as the American Psychological Society, 2018, the International Convention of Psychological Science, 2019, and the European Society of Cognitive Psychology, 2019.

What is particularly striking about Dr. Sheldon's record is how her research on memory draws from many different research areas within brain, behavior and cognitive science, including problem solving, psycholinguistics, and visual imagery. Since joining the Psychology faculty at McGill, Dr. Sheldon has established a solid infrastructure for her research program, which examines brain regions implicated in autobiographical memory and how they are recruited differently depending on the way in which events are remembered. Her program focuses on how individual differences in remembering affect the engagement of hippocampally-mediated processes, to provide insights into memory processes and function that can inform understanding of memory-related disorders. She investigates these issues using a combination of behavioural experiments and neuroimaging technology (fMRI) as well as comparisons with groups with hippocampal lesions.

Given Dr. Sheldon's accomplishments, it is not surprising that she was recognized as a "Rising Star" for 2016 by the Association for Psychological Science. Moreover, Dr. Sheldon has also successfully competed within Canada for a Canadian Foundation for Innovation Award to equip her laboratory, and operating grants from NSERC, the Quebec Bio-Imaging Network Grant, and an internal SSHRC development grant to run her laboratory. Furthermore, Dr. Sheldon has been awarded a Tier II Canada Research Chair in the Cognitive Neuroscience of Memory for 5 years. Finally, Dr. Sheldon has an impressive record with respect to scientific communication, and in engaging the next generation of students within her research, and within the larger field of brain, behaviour, and cognitive science. For example, Dr. Sheldon has quickly established an impressive teaching dossier, and has earned top course evaluations at McGill. Dr. Sheldon is a naturally gifted research mentor, currently supervising two PhD students, two Master's students and has served on the thesis committees of 17 other graduate students. Dr. Sheldon has also supervised 14 undergraduate research projects in the last two years. Notably, three of her undergraduate honours students received awards for their research presentations at McGill Undergraduate Research Conferences (2015, 2016, 2018), and, as noted, she has already published with both graduate and undergraduate mentees. Dr. Sheldon's work has also been featured in several popular press outlets including CBC, Science Daily, and NBC news.



**Dr. Signy Sheldon, McGill University**

**Friday June 7<sup>th</sup> 3:30pm – 4:20pm, Federation Hall, Main room**

*The Dynamic Nature of Autobiographical Memory Retrieval*

Retrieving autobiographical memories is an inherently dynamic and reconstructive process. This notion suggests that the simple act of remembering the past will alter the way the underlying memory representation is formed. In this talk, I will present research from my laboratory that has explored how the reconstructive processes of autobiographical memory alter the way we remember. I will first present evidence from neuroimaging experiments and studies on individual differences that suggest that there are distinct neurocognitive systems engaged for different types of remembering. I will propose separable hippocampal-cortical systems designed to construct perceptually-rich versus schematic memory representations. I will then present research that has explored the adaptive functions of these reconstructive memory processes. Here, I will present findings from studies on patient populations that indicate that autobiographical memory processes are critical for flexible everyday problem solving. Together, these two lines of research emphasize how autobiographical memories are dynamically constructed and to adaptively influence cognitive behavior.

## President's Invited Keynote Address

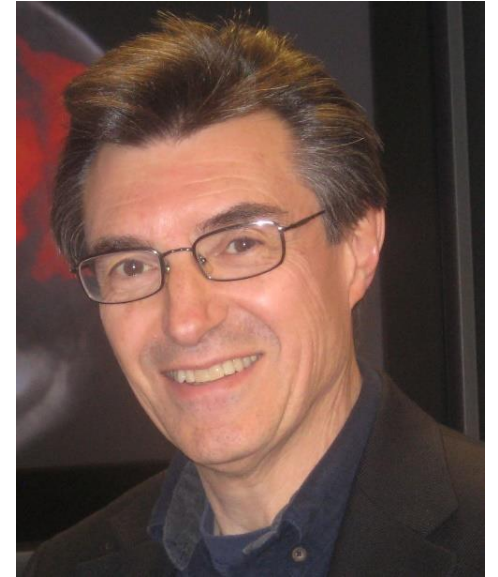
**Dr. Marcel Just, *Carnegie Mellon University***

**Friday June 7<sup>th</sup> 4:20pm – 5:30pm, Federation Hall, Main room**

*The new science of thought imaging:*

*Using machine learning to break the brain's code for representing concepts*

Recent computational techniques, particularly machine learning, are being applied to fMRI brain imaging data, making it possible for the first time to relate patterns of brain activity to specific thoughts. This approach started by identifying and analyzing the neural signatures of concrete concepts, like the thought of an *apple* or a *hammer*. It progressed to identifying the experience of emotions, making it possible to tell whether someone was feeling *happiness* or *disgust*, for example. The scientific significance is that we are beginning to understand the basic neural building blocks of more and more types of concepts, from the thought of an *apple* to the thoughts of abstract physics concepts such as *wavelength*. Moreover, these neural representations have a clear structure, such that in each semantic domain, there are underlying dimensions of neural organization, such as a dimension of periodicity underlying physics concepts, or a dimension of body-object interaction underlying concrete object concepts.



One of the most stunning outcomes of this research is the finding of very high commonality across people and across languages in how concepts are neurally represented. Another outcome is that it is possible to understand how simpler concepts combine to compose more complex thoughts sentence-length or paragraph-length thoughts.

One application of this “brain reading” approach is its potential to diagnose and suggest treatments for some thought disorders or psychopathologies. For example, in Autism Spectrum Disorder, the neural representations of thoughts of social interactions like hugging or insulting are altered in a very specific way, in terms of a key component of the concept. A similar approach applies to the identification of suicidal ideation, where thoughts of death as well as thoughts of positive aspects of life are systematically altered.

A second potential application is in educational design, where knowing the neural end-state of a domain expert in a field like physics might enable the design of an instructional program that optimally provides and assembles the building blocks that compose a targeted concept. The investigation of physics concepts representations reveals how relatively recent physics concepts (formalized only in the last few centuries) are organized in the millenia-old information system of the human brain.

This research is in its infancy, but it is advancing rapidly and is providing a new perspective on the brain's organizational system for representing individual concepts and larger constellations of thought and knowledge. Several relevant publications are available at:

<http://www.ccbi.cmu.edu/publications.html#neurosemantics>

**Donald O. Hebb Distinguished Contribution Award**  
**Saturday June 8<sup>th</sup> 5:20pm-6:05pm, Science Teaching Complex**

**Dr. Doug Mewhort** (Ph.D., 1968, Waterloo) was Professor Emeritus of Psychology at Queen's University in Kingston and a world authority on human memory and computational modeling. He published over a hundred scientific articles, edited two books on computational methods, and garnered over \$59 million to support his research and related initiatives.

In the 1970s, Doug examined visual cognition, iconic memory, and mental organization. This body of experimental work culminated in his scanning model of iconic memory – a theory that exerted a strong influence on how people came to think about memory and visual processing. In the 1980s, Doug shifted his attention to an analysis of memory at large. It was in this period that he began to think about and examine computational theories, including an analysis of the word superiority effect and the interactive activation model by Rumelhart and McClelland. He also spent a sabbatical with the “Perception and Action” group at the Centre for Interdisciplinary Research in Bielefeld, Germany in 1984-85. By the end of the decade, that work was capped off by the paper “Alice in Wonderland, or Psychology Among the Information Sciences” – a classic in the field that had a weighty influence on the emerging discipline of Informatics in Psychology and that doubled as a tribute to Donald O. Hebb – his intellectual grandfather – who published a likeminded paper in 1958 entitled “Alice in Wonderland, or Psychology among the Biological Sciences”. In the 1990s and 2000s, Doug shifted his interest again to examine knowledge representation and large-scale computation. He pursued this line of work by, first, helping to establish the availability of large-scale high-performance computing resources for Canadian academics and, then, using those resources to build and develop a large-scale computational theory for psychology. As usual, his work was on the cutting edge as he developed the BEAGLE theory of semantic memory and he applied related logic and methods to advance the field's understanding of spelling-to-sound conversion, recall, implicit learning, learning, and statistical methods.

Very recently, Doug concentrated his efforts on two problems. The first was a critical re-appraisal of signal detection theory as a valid model for human memory – an analysis spurred by his discovery of the “extra-list feature effect” in recognition memory with his collaborator and wife, Elizabeth Johns. The second was his development of a general theory for memory that incorporates semantic representation to reproduce hallmarks of cognitive control including order of report, clustering, and subjective organization in recall and recognition. Based on his body of work, Doug is recognized as one of, if not the, most dominant Canadian computational psychologist. His ideas are woven into the fabric of the field's formal theories and his empirical work has forced incisive and rigorous constraints onto the field. Doug's contributions represent an unusually coherent and unified picture of scientific and theoretical rigour.

In addition to his scientific work, Doug has mentored a number of scientists who have gone on to establish their own laboratories and served the academic community with exemplary verve and dedication including but not limited to a term as CSBBCS President, Editor of the *Canadian Journal of Experimental Psychology*, Director Representing Science on the Canadian Psychological Association's Governing Board, Associate Editor for *Psychological Research/Psychologische Forschung*, and Consulting Editor for the *Journal of Experimental Psychology: Human Perception and Performance*.

Doug's health had declined for the past several years, although he did not let that get in the way of his research. Sadly, shortly after receiving the news of his Hebb Award, Doug passed away on February 28. Before passing, he noted that the CSBBCS Donald O. Hebb Award was the greatest honour he had received over his notable career.



## Tees Leadership Award

**Dr. Debra Titone** is a respected and important leader in Canadian Psychology and the CSBBBCS community. She has made significant impact through her innovative psychological research, her extensive involvement in Canadian organizations and committee work, and her sustained efforts to advance the knowledge and skills of trainees in the field.

Dr. Titone is a world leader in the field of psycholinguistic research, with a specific focus on multilingualism and reading. As a Tier-2 CRC (2003-2013) and Full Professor since 2014, she has conducted ground-breaking work on the cognitive mechanisms of language processing – particularly in the area of figurative language and bilingualism – that has had significant impact in the research community and beyond. She has pushed the boundaries of her research, either incorporating new techniques (e.g., portable eye tracking devices) or providing new interpretations of important human cognitive functions that change the research landscape. Dr. Titone has received more than 80 invitations for talks, symposia, and colloquia from across the globe. She has published more than 70 peer reviewed articles in psychology, linguistics, and neuroscience, including publications in top-tier journals such as *Journal of Experimental Psychology: General*; *Neuropsychologia*; and *PNAS*. Her work has been supported by NSERC since 2003, SSHRC grants, and provincial grants in Quebec (FRQNT).



As a Canadian psychologist, Dr. Titone makes extraordinary efforts to promote science and psychological research within our country. She has been a member of the Editorial Board of the *Canadian Journal of Experimental Psychology* since 2013 and last year assumed the role as Associate Editor. She has served on CIHR and NSERC granting evaluation panels; she is a current member of the NSERC Discovery Grants Adjudication Committee (Evaluation Group 1502, since 2017). She has organized numerous symposia and workshops within Canada, including methodological training sessions. In addition, Dr. Titone also served on the CSBBBCS Executive as a member-at-large from 2015 to 2018. A particular noteworthy example of Dr. Titone's dedication to the advancement of Canadian psychology is her role as co-founder of the NSERC/CSBBBCS-funded Women in Cognitive Science – Canada (WiCSC) organization. Established in 2016, WiCSC has developed quickly into a thriving national organization, with membership in the hundreds, busy social media channels, an awards program, annual meetings, and a national advisory board. Dr. Titone's foundational role in WiCSC reflects her strong commitment to making our discipline as inclusive as possible.

Dr. Titone also serves as an exemplary ambassador for Canadian cognitive science in her international service activities, as Associate Editor of *Journal of Experimental Psychology: General*, as an Officer of the US-based Women in Cognitive Science (WiCS) Society, through committee work for the European Conference on Eye Movements and the Society for Neurobiology of Language, her membership on National Institutes of Health (NIH) Review Panels, and on the Editorial Boards of international journals such as *Bilingualism: Language & Cognition*. Dr. Titone's extraordinary leadership and commitment is also felt within McGill University. She was an elected Council Member of the McGill Association of University Teachers, and co-organized Tenure & Mentoring workshops through this association. She has chaired ethics review boards and served on numerous fellowship review committees. Dr. Titone has also been a member of many Departmental committees and served as Graduate Program Director.

Dr. Titone is a strong leader and role model for many trainees. Her students have gone on to obtain successful postdocs at Harvard and MIT, tenure track professorships, and positions in industry. Dr. Titone received the Feminist Mentoring Award from the Section of Women and Psychology at the 2017 Canadian Psychological Association conference.

## **Abstract Database Tool**

All CSBBBCS abstracts have been entered into a database that allows attendees to search abstracts to find semantically similar ones: <https://crumplab.shinyapps.io/CSBBBCS2019/>

## **Schedule of Presentations & Events**

### **Friday June 7<sup>th</sup>**

#### **Pre-Conference Workshop: 8:30am – 2pm**

Federation Hall, Westmount room: *Introduction to Brain Modeling with the Neural Engineering Framework (NENGO)*

#### **Women in Cognitive Science Speaker session: 1:30pm – 3:30pm**

Federation Hall, Main room: *Demystifying Skill Development, Panel and Mentoring reception*

#### **Vincent Di Lollo Early Career Award Speaker: 3:30pm – 4:20pm**

Federation Hall, Main room: Dr. Signy Sheldon, McGill University

*The Dynamic Nature of Autobiographical Memory Retrieval*

#### **President's Invited Keynote Address: 4:20pm – 5:30pm**

Federation Hall, Main room: Dr Marcel Just, Carnegie Mellon University

*The new science of thought imaging: Using machine learning to break the brain's code for representing concepts*

#### **Poster Session #1 & Welcome Reception: 5:30pm – 7pm**

Federation Hall, Columbia Room: Listing of posters is below

#### **Music Night: 7pm – 10pm**

Federation Hall, Main room: bands performing!

## **Saturday June 8<sup>th</sup>**

STC = Science Teaching Complex, University of Waterloo; \* = candidate for Hebb Best Talk or Hebb Best Poster Award

### **Breakfast 8:30am – 10:30am in STC lower level**

#### **Speaker Session #1: Saturday June 8, 8:30am – 9:30am**

	<b>STC 0010</b> <b>Perception</b> Chair: Pierre Jolicœur	<b>STC 0020</b> <b>Cognitive Neuroscience</b> Chair: Roxane Itier	<b>STC 0040</b> <b>Attention</b> Chair: James Danckert	<b>STC 0050</b> <b>Decision Making</b> Chair: Jonathan Fugelsang	<b>STC 0060</b> <b>Memory</b> Chair: Myra Fernandes
8:30am	1-01: Simal Signal informativeness modulates human...	1-05: Parkington Typical holistic face and feature...	* 1-09: Abuleil Sparkling Change: Modulation of...	1-13 Turpin Why we Hate Utilitarians: the Search for Predictable...	1-17: Thavabalasingam A matter of time: Representations of...
8:45	1-02: Sheldon Effects of random fluctuations in...	* 1-06: Donkor Primary visual cortex transcranial...	* 1-10: Chow Hidden but not unseen: interocular...	1-14: Soro Logical reasoning of consumers and the...	*1-18: Yeung From tea cakes to trauma: Bridging gaps...
9:00	1-03: Drisdelle ICA can correct saccades in attention...	1-07: Striemer Visuomotor adaptation in the absence of...	1-11: Song Does the near/far effect on target...	1-15: Gabert Easy on the ears? A processing study...	
9:15	1-04: Guo EEG representational dissimilarity...	*1-08: McCrackin Putting the “eyes” in empathising: ...	1-12: Haponenko Divided visual attention in depth: A...	*1-16: Walker The Good, the Bad, and the Manipulative...	1-20: Belchev The human dentate gyrus is critical for...

#### **Speaker Session #2: Saturday June 8, 9:30am – 10:30am**

	<b>STC 0010</b> <b>Attention</b> Chair: Derek Besner	<b>STC 0020</b> <b>Decision Making</b> Chair: Michal Bialek	<b>STC 0040</b> <b>Language</b> Chair: Katherine White	<b>STC 0050</b> <b>Metacognition</b> Chair: Janeen Loehr	<b>STC 0060</b> <b>Concepts</b> Chair: M. Chan-Reynolds
9:30am	2-01: Klein Inhibition of return is suffering from...	2-05: Collins Methods for Improving Probability...	2-09: Spinelli Learning to assign stress in a second...	2-13: Doyle The metamemory behaviors used during an...	2-17: Al-Azary Semantic Effects on Novel Conceptual...
9:45	2-02: Go Eye movements and mental model...	*2-06: Turpin The Environmental Malleability of Base...	2-10: Shiu Can a listener’s race and accent affect...	2-14: Tozios Improving metacognitive accuracy of...	2-18: Kelly Indirect associations in learning...
10:00	*2-03: Goulet The Fast-Same Effect of an Exclusive-OR...	2-07: Bialek Sunk-cost in moral decisions...	2-11: Jouravlev Native language processing is...	*2-15: Stewart Thinking Hard or Hardly Thinking? An...	2-19: Lansue Characterizing semantic neighbourhoods...
10:15	2-04: Besner Another look at eye gaze discrimination...	*2-08: Muda Processing in a foreign language...	2-12: Poitras Bilingual processing costs in L1...	2-16: Loehr “We did it together and we did it...	2-20: Lott Phone Use and Self...

### **Break 10:30-10:45am coffee/tea in STC lower level**

### Speaker Session #3: Saturday June 8, 10:45am – 12 noon

	STC 0010 Cognitive Neuroscience Chair: Roxane Itier	STC 0020 Attention Chair: Evan Risko	STC 0040 Symposium 1-1	STC 0050 Symposium 1-2	STC 0060 Symposium 1-3
10:45am	3-01: Demetri The Role of Post-Encoding Retrieval on...	3-06: Acai Monitoring mind wandering during live...	Boredom: Beyond a search for meaning  Meagher Britton Moynihan Hunter	On the capacity and resolution of visual cognition: Using neural and behavioural evidence to examine the limits of information processing  Feltmate Lockhart Sheldon Dube	Memory in the Wild  Rosenbaum Robin Sheldon Köhler
11:00	3-02: Foo Visuospatial Navigation Strategies as...	*3-07: Petranker Sitting with it: Mindfulness, Sustained...			
11:15	3-03: Hicks “What a view!”; The influence of...	3-08: Walker Mind-wandering in a driving context: A...			
11:30	3-04: Grant An assessment of diverse urban and...	3-09: Plourde Influence of the context and working...			
11:45	3-05: Weech The role of sensorimotor recalibration...	*3-10: Smith Attentional pacing: How the expectation...			

**Lunch      Noon-1pm: Box lunches in STC lower level**

### Poster Session #2: Saturday June 8, 12:45pm – 2:15pm

Science Teaching Complex, Atrium: Listing of posters is below

### Speaker Session #4: Saturday June 8, 2:15pm – 3:45pm

	STC 0010 Learning Chair: Weimin Mou	STC 0020 Cognition & Learning Chair: Jamie Campbell	STC 0040 Memory Chair: Kathleen Hourihan	STC 0050 Social Cognition Chair: Lana Trick	STC 0060 Memory Chair: Colin MacLeod
2:15pm	4-01: Gheidi Evidence of sign- and goal-tracking...	4-07: Nair Assessing the effectiveness of...	4-13: Davis Selective attention and visual...	4-19: Saryazdi Perspective taking while conversing...	4-25: MacLeod Zeigarnik and von Restorff: The memory...
2:30	4-02: Fortin-Guichard Which perceptual-cognitive skills can...	4-08: Campbell Not towing the mental number line for...	4-14: Gurguryan Pushing boundaries: The influence of...	4-20: Latif Social cues in interactions with...	4-26: Todorovic Production benefits studying texts for...
2:45	*4-03: Fortin-Guichard Selective attention and decision making...	4-09: Newsome Is it better to study before or after...	4-15: Lansue Oh forget it: Remembering associations...	4-21: Capozzi Standing out from the crowd: Both...	4-27: Willoughby The pupillometric production effect: ...
3:00	4-04: Tranchant	4-10: Sharma	4-16: Hourihan	4-22: Allidina	4-28: Nantais

	Role of Expertise on Individual...	Optimizing the use of Learning...	It's easier to forget what you want:...	Stereotype maintenance through...	Exploring cognitive maps using sketch...
3:15	4-05: Martin Conceptual similarities between targets...	4-11: McGowan Aerobic fitness and arithmetic...	*4-17: Tan Exploring the Impact of Conflicting...	4-23: Jenkins Salience of racial distinctiveness...	4-29: Meade Drawing Pictures at Encoding Enhances...
3:30	4-06: Mou Updating humans' headings in 3D and...	*4-12: Roberts Re-evaluating the influence of...	*4-18: Kelly The Effects of Offloading...	4-24: Dodwell Do drivers with high scores on an...	4-30: Scheurich Recalling the perceptual elements of...

**Break 3:45pm – 4:05pm coffee/tea/snacks in STC lower level**

**Speaker Session #5: Saturday June 8, 4:05pm - 5:20pm**

	<b>STC 0010</b> <b>Perception</b> Chair: Steve Lupker	<b>STC 0020</b> <b>Individual Differences</b> Chair: Erin Maloney	<b>STC 0040</b> <b>Attention</b> Chair: Daniel Smilek	STC 0050 Symposium 5-1	<b>STC 0060</b> <b>Symposium 5-2</b>
4:05pm	5-01: Clancy On the stimulus-linked affective...	5-06: Gagnon-St-Pierre The dual strategy model in social...	*5-11: Pereira Within-individual oscillatory patterns...	Encoding our world: Exploring the nature and flexibility of representations  Forest Mack Mur Wammes	Reasoning and Metareasoning: What Makes Us Think Analytically?  Pennycook Newman Brisson Thompson
4:20	5-02: Spinelli Proportion Congruent effects do have...	5-07: Retanal The role of the need for cognition and...	*5-12: Harrison The Wandering Eye: A tool for the...		
4:35	5-03: Smith What colour is under? Modelling the ebb...	5-08: Voyer Sex Differences in curve...	*5-13: Marty-Dugas Focus on your breath? The influence of...		
4:50	*5-04: Asare Red Strengthens Response Inhibition...	5-09: Storozuk Spatial processes and performance on...	5-14: Caron Are standing desks as outstanding as...		
5:05	5-05: Siddhpuria Cueing color imagery: A critical...	5-10: Penner How to index subitizing performance:...	5-15: Gorelik The Cognitive Causes of Trait Boredom...		

**D.O. Hebb Award Tribute for Dr. Doug Mewhort: Saturday June 8, 5:20pm-6:05pm**

STC 1012 – Dr. Elizabeth Johns, *Queen's University*

Dr. Michael Jones, *Indiana University*

**CSBBCS Banquet: Saturday June 8, 6:30pm-9pm**

Federation Hall - Welcome drinks: 6:30pm-7pm

Dinner served: 7pm

## Sunday June 9<sup>th</sup>

**Breakfast in STC lower level 8:30am – 10:30am**

**Poster Session #3: Sunday June 9, 8:45am-10:15am**

Science Teaching Complex, Atrium: Listing of posters is below

**Speaker Session #6: Sunday June 9, 10:15am – 11:30am**

	STC 0010 Memory Chair: Britt Anderson	STC 0020 Methods and Models Chair: Bryan Tripp	STC 0040 Cognitive Neuroscience Chair: James Dankert	STC 0050 Symposium 6-1	STC 0060 Symposium 6-2
10:15am	6-01: Dykens Failed it: Using event-related spectral...	6-06: Unwalla Using response demands to test a...	6-11: Dollois Autonomic sensitivity to anticipation:...	Now is the time for cognitive psychologists to work on education, training and policy  Kim Forrin Foot-Seymour Fenesi	Second-Language Influences on First-Language Processing Across the Lifespan  Molnar Palma Friesen Whitford
10:30	6-02: Gul An ERP study of encoding and...	6-07: Tomkins-Flanagan Neural BEAGLE: An analogue to the...	6-12: Mugon Examining the antecedents to...		
10:45	6-03: Curtis The growing computational analysis of...	6-08: Tripp Representations in a deep-network model...	6-13: Larche Escaping the woes through flow?:...		
11:00	*6-04: Vijayarajah Semantic versus perceptual attention...	6-09: Joghataie Topographic Organization in Artificial...	6-14: Anderson Measuring Mind-Wandering,...		
11:15	6-05: Gul Cortical activity during Encoding and...	6-10: Meyers Reducing the Number of Nonnaïve...	6-15: Kurowski Moving forward on the search for the...		

**Speaker Session #7: Sunday June 9, 11:30am – 12:30pm**

	STC 0010 Cognitive Neuroscience Chair: Togg Girard	STC 0020 Memory Chair: Jonathan Fugelsang	STC 0040 Auditory Perception Chair: Frank Russo	STC 0050 Working Memory Chair: Elisabet Service	STC 0060 Memory Chair: Geneviève Desmarais
11:30am	7-01: Ewers More than a hit: Examining...	7-05: D'Alessandro Culture, self-concept and event memory:...	7-09: Armstrong Voice pitch-based size and dominance...		*7-17: Dowling Tests of the Role of the Generation...
11:45	*7-02: Lamontagne Dopamine agonism restores reward...	7-06: Zhang Perceived credibility of children's use...	7-10: Vomberg I've got the music in me: An indirect...	7-14: Service Compound words are more vulnerable to...	7-18: Desmarais The impact of verbal and nonverbal...
12:00	*7-03: Gravelins	*7-07: Walker	7-11: Russo	7-15: Sun	7-19: Saint-Aubin

	Synthetic Estrogen and Cognition: Do...	Investigating the effects of task...	What is the role of the motor system in...	Resources allocation in visual working...	The costs and benefits of producing the...
12:15	7-04: Girard Hippocampal activation and spatial...	7-08: Furlano Pre-diabetes accelerates neurocognitive...	7-12: Gilmore The multimodal enhancement of beat...	7-16: Pereira Recognition-induced-memory-alteration...	7-20: Singer Independence of text explicitness and...

**Lunch 12:30pm – 1:15pm Box lunches in STC lower level**

### **Speaker Session #8: Sunday June 9, 1:15pm – 2:15pm**

	<b>STC 0010</b> <b>Cognitive Neuroscience</b> Chair: Colin Ellard	<b>STC 0020</b> <b>Decision Making</b> Chair: Derek Koehler	<b>STC 0040</b> <b>Language</b> Chair: Katherine White	<b>STC 0050</b> <b>Social Cognition</b> Chair: Mathieu Gagnon	<b>STC 0060</b> <b>Memory</b> Chair: Myra Fernandes
1:15pm	8-01: Tavakoli Auditory P3 indices of attention in...	8-05: Koehler Members of the public see less...	8-09: Grenier Recognition of voices in a foreign...	8-13: Halilova Affective forecasting in older...	8-17: Lee Anxiety-Provoking Context Scenes Can...
1:30	8-02: Addo The neural correlates of a modified...	8-06: Ashburner Why do we give? Testing a two-stage...	8-10: Emond Infants' understanding of reflexive and...	8-14: Basharat The effect of exercise on multisensory...	8-18: MacLellan Assessing the impact of word valence on...
1:45	8-03: MacRae Investigating how the brain represents...	8-07: Soro Debt repayment and anchoring effects:...	8-11: Saryazdi The effects of elderspeak on real-time...	8-15: Rego Does familiar face recognition survive...	8-19: Dastgheib The effects of self-guided meditation...
2:00	*8-04: Goel Patients with lesions in the left...	*8-08: Meyers Inducing feelings of ignorance makes...	8-12: Buchko Parent language and children's...	8-16: Gagnon Emotional vocal bursts associated to...	*8-20: Corpuz On balance, does variability influence...

### **Speaker Session #9: Sunday June 9, 2:15pm – 3:15pm**

	<b>STC 0010</b> <b>Cognitive Neuroscience</b> Ofir Yakobi	<b>STC 0020</b> <b>Language</b> Chair: Brendan Johns	<b>STC 0040</b> <b>Perception</b> Chair: David Shore	<b>STC 0050</b> <b>Symposium 9-1</b>	<b>STC 0060</b> <b>Symposium 9-2</b>
2:15pm	9-01: Bao Neurofunctional impact of chronic...	9-05: Johns Gender bias at scale: Evidence from the...	9-09: Lorentz Uncrossing crossed hands with visual...	Reasoning and belief revision in development  Gualtieri Venkadasalam Ronfard	Approaches to teaching cognitive psychology: On-line experiments, computation, and active learning  Murphy Harding Skye
2:30		9-06: Boylan Humour from familiar and unfamiliar...	9-10: Freud Altered large-scale organization of...		
2:45	9-03: Yakobi Theoretical foundations of association...	*9-07: Reid The conceptual metaphor false memory...	9-11: Aksay The impact of stimulus complexity on...		
3:00	9-04: Paoletti The influence of object affordances on...	9-08: Pan The effects of language on object...	9-12: Man Near, far, wherever you are: Differing...		

**Break 3:15pm – 3:30pm: Ice cream in STC lower level**

**Professional Issues Sessions: Sunday June 9, 3:30pm - 4:30pm**

STC 1012 - CSBBCS Career Workshop: From Graduate School to Beyond!

STC 0040 - NSERC Discovery Grant Information session and Question & Answer period

**CSBBCS General Meeting: Sunday June 9, 4:30pm – 5:30pm**

STC 0040 - Annual Meeting

- Announcement of Hebb Student Awards for Best Talk and Best Poster, plus Honourable Mentions

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## **Abstracts for Speaker Sessions**

**Speaker Session #1: Saturday June 8, 8:30am – 9:30am**

1-01 **Signal informativeness modulates human auditory cortical responses.** **Amour Simal**, Université de Montréal, Patrick Bermudez, McGill University, Christine Lefebvre, Université de Montréal, François Vachon, Université Laval, Pierre Jolicoeur, Université de Montréal.

Participants heard two sequences of 1, 3, or 5 tones (200 ms on, 200 ms off) interspersed by a silent interval (2 s). They decided whether the two sequence were the same or different. In Experiment 1, the length of the tone sequences was randomized between trials. During the first sequence, the amplitude of the auditory P2 was larger for the second tone in trials with 3 tones, and for the second and fourth tones in trials with 5 tones. We hypothesize the increase in P2 reflected a dynamic disambiguation process because these tones were predictive of a sequence longer than 1 or 3 tones. This hypothesis was supported by the absence of P2 amplitude modulation during the second sequence (when sequence length was already known). In Experiment 2 we blocked trials by sequence length. There was no P2 amplitude modulation in either the first or second sequences. Thus, tones 2 and 4 had a larger amplitude only when they provided new information about the length of the current tone sequence. These results suggest a rapid

dynamic adaptation of auditory cortical responses based on the local informativeness of auditory signals.

1-02 **EFFECTS OF RANDOM FLUCTUATIONS IN ALPHA OSCILLATIONS ON ORIENTATION DETECTION: AN EEG STUDY** **Sarah Sheldon**, University of Alberta, Kyle Mathewson, University of Alberta.

Alpha oscillations are known to impair detection of visual stimuli, but it is unclear if this is due to increased guess rate or decreased fidelity of the perceived stimuli. Here we estimated quality and guess rate as a function of pre-stimulus alpha using an orientation detection task. In the current study, participants performed a task that consisted of a target pointing in one direction followed by a backward mask, a short delay, and then a response screen where participants used the mouse to rotate the pointing stimuli so that it matches the orientation of the target. Errors were quantified as the difference between the target orientation and the orientation of participants' response. A median split of alpha power prior to target onset was used to separate trials into high and low alpha power. The errors of each participant on high and low alpha trials were fit to a standard mixture

model to get the parameter values  $g$  (guess rate) and  $\sigma$  (precision). We found that  $g$  was significantly greater on trials with high alpha power compared to low alpha power while the  $\sigma$  did not differ significantly. These results indicate that fluctuations in alpha power can influence the biasing of perception but not the precision of visual perception.

**1-03 ICA can correct saccades in attention ERP experiments Brandi Lee Drisdelle**, Université de Montréal, Jean Colombel, Université de Montréal, Pierre Jolicoeur, Université de Montréal.

In event-related potential (ERP) research, saccades and blinks can contaminate the EEG signals of interest. Participants are generally required to fixate during experimental trials and trials with ocular artefacts are rejected. For blinks, many researchers implement correction methods (e.g., regression or independent component analysis (ICA)), however, trials with saccades are usually rejected because attention is no longer considered covert but instead overt, causing significant loss of data for some participants. We assessed whether ICA could correct saccades in an attention experiment with lateral stimuli (participants were instructed to maintain fixation). We examined the N2pc, a lateralised, posterior, ERP indexing the deployment of attention, that begins approximately 200 ms post-stimulus. With a sample of 140 participants, a conservative approach (rejecting saccade-contaminated trials) rejected 44 participants, leaving 96 in the final sample. When saccades were corrected using ICA, the participants rejected using the conservative approach showed similar patterns for the N2pc to the participants that fixated, both overall and across experimental manipulations. These results extend those of Drisdelle et al., (2017), reinforcing the notion that, under certain conditions, saccade correction using ICA can be an acceptable practice even in attention studies with lateralised stimuli. Implications for basic and applied research are discussed.

**1-04 EEG representational dissimilarity analysis reveals the timecourse and hierarchy of grasp features Lin Guo**, University of Toronto Scarborough, Yazan Shamli Oghli, University of Toronto Scarborough, Adam Frost, University of Toronto Scarborough, Matthias Niemeier, University of Toronto Scarborough.

Grasping requires integration of motor parameters that are represented at varying levels. Recently it has been found that the goal to grasp an object generalizes across effectors, indicating that action goals are represented upstream from specific motor parameters. However, at a finer scale the hierarchy of motor parameter computations during grasp planning and execution is unclear. Here, we recorded EEG while participants grasped 3D objects with their left, right, or both hands, using two different grasp orientations. Each trial began with a Preview of the object followed by an auditory Go signal. Crucially, grasp orientation was instructed prior to each block of trials while effector choice varied from trial to trial specified by the Go signal. We hypothesized that if orientation is represented upstream from effector choice, then its representation should be robust before effector specification. If the converse was true, then orientation representation should emerge after effector specification. To infer the representations of motor parameters and their timecourse, we applied representational dissimilarity analysis to spatiotemporal EEG patterns across ~10ms temporal windows. Our results showed that effector representation sustained significance from ~100ms after Go onset (and ~350ms before movement onset). This was followed by orientation representation, which attained significance ~200ms after Go onset. These results suggest that representations of grasp orientation emerge downstream from effector representations. Further analyses showed that left hand and bimanual grasps shared overlapping representations, consistent with findings that both grasp types involve the right anterior intraparietal sulcus (aIPS). Additionally, we found representational overlap between right hand and bimanual grasps. Together, these results reveal the timecourse and representational hierarchy of motor parameters over the course of planning and executing one- and two-handed precision grasps.

**1-05 Typical holistic face and feature processing in autism spectrum disorder: Evidence from early neural markers of face- and eye-sensitivity Karisa Parkinson**, University of Waterloo, Roxane Itier, University of Waterloo.

Disruptions in holistic and/or eye processing are theorized to be at the core of social difficulties in autism spectrum disorder (ASD). However, electrophysiological studies evaluating the early face- and eye-sensitive N170 event-related potential in adults with ASD have yielded mixed

findings. Importantly, no studies have simultaneously evaluated face inversion and featural sensitivity within the same participants, nor controlled for visual attention (a factor known to impact N170 responding). Here, N170s were measured in adults with and without ASD during gaze-contingent presentation of upright and inverted faces and cars, as well as isolated eye regions and mouths. Overall, N170 responses were earliest and largest for faces, and eye regions elicited the largest N170 compared to mouths or faces. Typical inversion effects were also found; however, no group differences or interactions were significant. Interestingly, symptom severity (as measured by ADOS scores) was correlated with neural indices of holistic and featural processing in adults with ASD. These findings suggest that when visual fixation is enforced, adults with ASD do not reliably differ from neurotypical adults on early neural measures of holistic face and feature processing at the group level, and highlight the importance of accounting for heterogeneity in autistic symptom severity and expression.

**1-06 Primary visual cortex transcranial random noise stimulation improves contrast sensitivity in adults with amblyopia \* Richard Donkor,** School of Optometry and Vision Science, University of Waterloo, Caroline Teske, School of Optometry and Vision Science, University of Waterloo, Margaret Wallis-Duffy, School of Optometry and Vision Science, University of Waterloo, Benjamin Thompson, School of Optometry and Vision Science, University of Waterloo.

**Purpose:** Non-invasive brain stimulation of the primary visual cortex increases neural excitability and transiently improves contrast sensitivity in adults with amblyopia. Recently, a new transcranial electrical stimulation paradigm called transcranial random noise stimulation (tRNS) has been developed. We tested the hypothesis that a single session of visual cortex tRNS would improve contrast sensitivity, crowded and uncrowded visual acuity in adults with amblyopia.

**Methods:** 19 healthy adults with amblyopia ( $44.2 \pm 14.9$  yrs, 10 female) underwent active or sham tRNS of the visual cortex (active  $n = 9$ , sham  $n = 10$ ). Monocular contrast sensitivity, uncrowded and crowded visual acuity were measured before, during, 5 minutes and 30 minutes post stimulation. **Results:** We observed a significant interaction between Group (active vs. sham) and time points for amblyopic eye contrast sensitivity and uncrowded visual acuity, whereby active tRNS significantly improved both outcomes

post tRNS relative to baseline ( $t > 2.5$ ,  $p < 0.04$  for all comparisons) whereas sham tRNS had no effect at any time point ( $p > 0.05$ ).

**Conclusions:** Amblyopic eye contrast sensitivity and uncrowded visual acuity improved for at least 30 minutes following a single session of tRNS, however this effect did not occur for measures of crowded visual acuity.

**1-07 Visuomotor adaptation in the absence of visual awareness: Evidence from a patient with cortical blindness. Christopher Striemer,** MacEwan University, Edmonton, James Enns, University of British Columbia, Robert Whitwell, University of British Columbia.

For over a century prism adaptation has been used to examine how the motor system adapts to visual perturbations. Past research on the neural substrates of prism adaptation has implicated the posterior parietal cortex (PPC) and cerebellum. Here, we examine whether input from early visual cortex is required for visuomotor adaptation. To investigate this, we examined prism adaptation in 'MC' who is clinically blind to static stimuli following bilateral lesions that encompass much of her occipital cortex and caudal-most areas of ventrotemporal cortex. Remarkably, we find that MC shows significant negative after effects – a hallmark of spatial realignment – when adapting to leftward or rightward shifting prisms with either her left or right hand. In addition, further examination of MC's data indicated that the magnitude of her pointing error reduction (i.e., "strategic recalibration") and negative after-effects (i.e., "spatial realignment") were similar to healthy controls. These findings suggest that the geniculostriate pathway is not necessary for prism adaptation to take place. Alternatively, we suggest that an extrageniculostriate pathway which provides visual inputs to the cerebellum from area MT and the PPC via the dorsolateral pons plays a significant and appreciable role in the guidance of unconscious automatic visuomotor adaptation.

**1-08 Putting the "eyes" in empathising: Electrocortical and behavioural responses during a positive empathy task are modulated by perceived gaze direction \* Sarah McCrackin,** University of Waterloo, Roxane Itier, University of Waterloo.

Not only does looking at people's eyes inform us about their thoughts and emotions, but it affects our own emotional state too. When we perceive

direct gaze, we experience increased positive affect and reward activation. However, it is unknown how the perception of direct and averted gaze impacts our ability to share the gazer's positive and negative emotional states, abilities referred to as positive and negative empathy. We presented participants (n=44) with sentences eliciting positive, negative or no empathy (e.g. "Her newborn was saved/killed/fed yesterday afternoon."), followed by direct or averted gaze faces of the individuals described. Participants rated their empathy and emotional valence for each individual. Event-related potentials (ERPs) time-locked to face onset tracked the time-course of when empathy impacted the visual processing of the faces. Relative to averted gaze, direct gaze was associated with increased positive valence in the positive and no empathy conditions. Direct gaze was also uniquely associated with increased positive empathy. A similar pattern was found at the neural level. The Early Posterior Negativity (EPN), a marker of affective face perception, was modulated by gaze direction only in the positive empathy condition. These results suggest that perceived gaze direction uniquely modulates positive empathy.

**1-09 Sparkling Change: Modulation of binocular rivalry with non-invasive brain stimulation of the visual cortex \* Dania Abuleil**, School of Optometry and Vision Science, University of Waterloo, Daphne McCulloch, School of Optometry and Vision Science, University of Waterloo, Benjamin Thompson, School of Optometry and Vision Science, University of Waterloo.

Purpose: Binocular rivalry (BR) alternation rates (ARs) have been associated with GABA concentration within the primary visual cortex, whereby faster ARs are correlated with lower GABA levels. We assessed the effect of anodal transcranial direct current stimulation (a-tDCS) and continuous thetaburst stimulation (cTBS) on BR, which reduce and increase GABA concentration in the motor cortex, respectively. If similar effects occur over the visual cortex, the two techniques should have opposing effects on ARs.

Methods: ARs were recorded using dichoptic red/green orthogonal gratings of 0.5cpd before and 5-min and 30 min after a-tDCS (N=15 active, 15 controls) or cTBS (N=14 active, 14 controls). Gratings were presented for 6-min while participants indicated red, green or piecemeal percepts using a keyboard.

Results: a-tDCS had no effect on BR dynamics. cTBS showed a significant increase in time spent in piecemeal 5-min post stimulation.

Discussion: a-tDCS and cTBS did not modulate ARs. cTBS seemed to slow down alternations indirectly seen with an increased time spent in piecemeal, the transition from one percept to another. The changes in GABA concentration may not be large enough to induce significant changes in ARs.

**1-10 Hidden but not unseen: interocular suppression of form but not motion in dichoptic plaids \* Amy Chow**, Department of Optometry & Vision Science, University of Waterloo, Andrew Silva, Department of Optometry & Vision Science, University of Waterloo, Benjamin Thompson, Department of Optometry & Vision Science, University of Waterloo.

Does the brain still process visual information that is suppressed from conscious awareness? Previous studies of dichoptic plaid perception have shown that motion integration can occur between the eyes even when form information in one eye is suppressed (Andrews & Blakemore, 1999; Carney, Shadlen, & Switkes, 1987; Cobo-Lewis, Gilroy, & Smallwood, 2000). This suggests that suppression can have differential effects on the ventral (form) and the dorsal (motion) cortical processing streams. If this is the case, suppression in a neurodevelopmental disorder of vision called amblyopia may not be absolute. Although it is assumed that the suppressed amblyopic eye makes minimal contribution to visual processing in the brain, suppression in amblyopia is not fully understood. In this study, we explored whether differential suppression of the ventral and dorsal streams also occurs in amblyopia. We found that participants with amblyopia experienced reduced rates of form and motion integration as compared participants with normal vision. Although perception was dominated by the fellow eye in amblyopia, participants with amblyopia reported intermittent motion integration despite form suppression and vice versa comparable to participants with normal vision. These results raise the possibility that suppression in amblyopia is not absolute and that suppressed eyes may continue to provide information to higher level cortical processing areas.

**1-11 Does the near/far effect on target detection depend on distance from the observer or from the fixation plane? The case of a simulated driving task with distance indicated by pictorial cues and forward motion Jiali Song**, McMaster University, Hong-jin Sun, McMaster University, Patrick J. Bennett, McMaster University, Allison B. Sekuler, Rotman Research

Institute, Baycrest Health Sciences; University of Toronto; Department of Psychology, Neuroscience & Behaviour, McMaster University.

Previously, Song et al. (VSS 2016) reported an advantage for detecting near targets compared to far targets in a simulated driving task even when the retinal characteristics of the targets were equated across distances. The current study examines whether this near advantage reflects the fact that a target's detectability may decrease as a function of its distance from the observer or as a function of its distance from the plane of fixation. We measured the detectability of visual targets presented at two eccentricities (12 & 24 deg) and at three simulated distances from the observer (9, 18.5, & 37 m). Participants were instructed to fixate on and follow a lead car at a constant distance of 18.5m. Hence, targets could appear at a distance that was nearer than the distance to the lead car, at the same distance as the lead car, or beyond the lead car. Results showed that, at both eccentricities, target detection was best (i.e., highest accuracy & lowest reaction time) when targets appeared at the same distance as the lead car, and worst when targets appeared beyond the lead car. These results provide further support for the idea that distance, even when simulated, modulates attention.

**1-12 Divided visual attention in depth: A driving simulator study Hanna Haponenko, McMaster University, JIALI SONG, McMaster University, Hongjin Sun, McMaster University.**

Allocation of attention across depth in 3D space has not been well studied. We placed participants in a driving scenario, simulated in 3D space with monocular depth cues, where they maintained a constant headway with a lead car. During travel, they also needed to make left or right responses to indicate the location of the onset of two targets that were simultaneously presented in their central and peripheral visual fields. While the central target was always located on the lead car, peripheral targets were located at different depths relative to the lead car's position, thereby requiring attentional switch across simulated depths. Retinal size and eccentricity (24°) of the peripheral targets were kept constant, which allowed us to identify the effect of depth. We found greater accuracy in detecting both central and peripheral targets when peripheral targets were presented in a depth plane close to the central target's position. A similar pattern of results

was found for reaction times, but shorter reaction times were made for the target distances located nearer rather than farther from the participant's position in space.

**1-13 Why we Hate Utilitarians: the Search for Predictable Moral Partners, Martin Turpin, Alexander C. Walker, Michał Białek, Jonathan A. Fugelsang, Igor Grossmann, Department of Psychology, University of Waterloo**

Classical theories of moral reasoning emphasize two distinct approaches for morality: Utilitarianism, that the right choices are those that maximize benefits in outcomes, and deontology: that the right choices are those that follow moral rules. Conceptually, neither deontology nor utilitarianism should be sensitive to the predictability of an agent: Either a moral rule has been violated and an act is therefore immoral, or disutility has been created and therefore an act is immoral. Whether or not a person is predictable should have no bearing on judgements of their moral character given these two rationalist perspectives. However, if the emergence of moral intuitions and norms serve to suppress social uncertainty and foster cooperation among groups, then attaching a moral premium to behaving predictably makes perfect sense. We find across multiple studies that the perceived unpredictability of those willing to make sacrificial decisions in moral dilemmas drives much of the dislike of these individuals. We integrate this into functionalist frameworks focusing on the evolved purpose of moral intuitions, and the reduction of social uncertainty in groups.

**1-14 Logical reasoning of consumers and the impact of emotions evoked by different forecasts of economic development Jeronimo Soro, Mário Ferreira, Karen Gouveia, Joana Reis, Catarina Nunes, Faculdade de Psicologia da Universidade de Lisboa, Portugal.**

Contexts of poverty and financial difficulty decrease the cognitive resources available for decision-making and reasoning (e.g., Mani, et al., 2013). In the other hand, although emotional contents may negatively affect the logical judgment of syllogisms, the opposite is observed when the evoked emotion is relevant to the problems' content (Blanchette & Campbell, 2012). With this in mind, we set out to test how emotions evoked by negative vs. positive economic future scenarios may affect logical reasoning, especially in judging syllogism problems with financial content. Participants (N=XXX)

were primed either with negative or positive media news about Portugal's economic future and then judged the logical validity of syllogisms with neutral and emotional content (financial or non-financial related), and indicated their confidence in their responses. Participants primed with negative news showed better performance in logical judgment of syllogisms (particularly those with financial content), but had lower confidence in their answers. We discuss this dissociation between performance and confidence in light of the impact that emotions evoked by forecasts about the country's economy may have on consumers' logical reasoning.

**1-15 Easy on the ears? A processing study across sensory modalities Nina Gabert**, University of Waterloo, Martin Harry Turpin, University of Waterloo, Alexander Walker, University of Waterloo, Jennifer Stolz, University of Waterloo, Jonathan Fugelsang, University of Waterloo.

Are we more critical when listening or reading? This study examines the differences in people's ability to navigate deceptive language when presented in different sensory modalities - auditorily versus visually. Participants were presented with three types of deceptive statements (pseudo-profound bullshit, doublespeak, and scientific verbiage); half were presented auditorily through headphones and half were presented as text on a computer screen. They were asked to provide ratings for each statement presented (profundity, permissibility of action, and satisfaction - respectively). It could be predicted that we are better skeptics in one mode of sensory presentation compared to the other for various reasons. We might predict that we excel in critical evaluation when a stimulus is presented visually thanks to certain human biological traits such as our reliance on our well-adapted eyesight. It could also be hypothesized that auditory stimuli are less critically evaluated due to our long history with spoken language and the salience of its presentation through our tendency to adopt a pedagogical stance. These findings have implications for the way we choose to consume information and further how successfully we engage in critical evaluation of that information.

**1-16 The Good, the Bad, and the Manipulative: An Initial Investigation into the Effectiveness of Doublespeak \* Alexander Walker**, University of Waterloo, Martin Turpin, University of Waterloo, Ethan Meyers, University of Waterloo, Garni Assadourian, University of Waterloo, Jennifer Stolz,

University of Waterloo, Derek Koehler, University of Waterloo, Jonathan Fugelsang, University of Waterloo.

Doublespeak is a form of deceptive language in which information is purposefully obscured or distorted, often via the careful and strategic use of terms. In order to assess the effectiveness of doublespeak, we created thirteen agreeable-disagreeable term pairs (e.g., enhanced interrogation-torture), all of which contained real-world examples of doublespeak and were judged by participants (N = 301) as permissibly interchangeable (i.e., distinct from objectively false lies). Next, we examined whether the simple substitution of a disagreeable term (e.g., "torture") with a more agreeable one (e.g., "enhanced interrogation") in an otherwise identical description of an action could influence participants' (N = 805) evaluation of an action. The results of our study demonstrate the effectiveness of doublespeak in moving participants' evaluations of actions. Specifically, action descriptions featuring an agreeable term were judged more positively compared to those featuring a disagreeable term. Importantly, this was true both when participants had little information about an action and when they were given a full detailed description of each action prior to their evaluations. However, providing participants with a full detailed description did substantially reduce the effectiveness of our doublespeak terms, suggesting that ambiguity plays an important role in facilitating the effectiveness of doublespeak.

**1-17 A matter of time: Representations of duration in the human hippocampus Sathesan Thavabalasingam**, Department of Psychology at Scarborough, University of Toronto, Edward O'Neil, Department of Psychology at Scarborough, University of Toronto, Andy Lee, Department of Psychology at Scarborough, University of Toronto, Adrian Nestor, Department of Psychology at Scarborough, University of Toronto, Jonathan Tay, Department of Psychology at Scarborough, University of Toronto.

The hippocampus (HPC) has been suggested to represent time in support of memory and rodent hippocampal time cells have been shown to signal the passage of time on the order of seconds between events. To explore whether a similar hippocampal mechanism exists in humans, we used fMRI and multi-voxel pattern analysis in three experiments. In Experiments 1 and 2, participants made match-mismatch judgements on each trial between a

study sequence of events and a subsequent test sequence. Participants explicitly remembered event order or interval duration information (Experiment 1), or monitored order only, with duration being manipulated implicitly (Experiment 2). Hippocampal study-test pattern similarity was significantly reduced by changes to order or duration in mismatch trials, even when duration was processed implicitly. In Experiment 3, participants learned 4 distinct sequences varying in stimulus interval duration and image content and were administered a recognition memory task for these learned sequences. The anterior HPC carried information about individual sequences during recognition memory, that reflected the combination of image content and temporal duration information unique to each sequence. Our findings align with rodent time cell research, suggesting that human hippocampal sequence representations can incorporate duration information on the order of seconds.

**1-18 From tea cakes to trauma: Bridging gaps between involuntary memory and mental health \* Ryan Yeung**, University of Waterloo, Myra Fernandes, Department of Psychology, University of Waterloo.

Memories of one's personal past that come to mind unintentionally and effortlessly are termed involuntary autobiographical memories (IAMs), and are reported to occur frequently in daily life within the general population (Berntsen, 1996; Rasmussen & Berntsen, 2011). In the current study, we investigate the properties of recurrent IAMs experienced in the general population, and assess their relation to mental health. Over two months, 2184 undergraduates responded to surveys querying the contents of their recurrent IAMs, as well as numerous qualitative aspects including their frequency and valence. Our findings show that recurrent IAMs are experienced by the majority of our sample (52%), and that these memories are mostly reported as being negative in valence. Additionally, those who report a negative IAM as their most frequently recurring one also report significantly more mental health concerns, including post-traumatic stress, social anxiety, and depression. We also found that the frequency at which an IAM recurs is predicted by the memory's level of detail, emotional intensity, and its centrality to one's life story. Finally, recurrent IAMs are described using significantly more words when they are emotionally positive, relative to negative or neutral. Recurrent IAMs may serve as a window into one's mental health.

1-19

**1-20 The human dentate gyrus is critical for associative inference and visual statistical learning Zorry Belchev**, University of Toronto; Rotman Research Institute at Baycrest, Hannah Marlatte, University of Toronto; Rotman Research Institute at Baycrest, Asaf Gilboa, University of Toronto; Rotman Research Institute at Baycrest.

The hippocampus is implicated in forming indirect associations through associative inference (AI), and statistical learning (SL; learning of environmental regularities). Both abilities require integrating information across time, presumed to depend on the CA1 of the hippocampus. However, computational models suggest that AI and SL depend on distinct hippocampal pathways. The monosynaptic pathway (MSP; entorhinal cortex>>CA1) should be sufficient to support SL, but not AI with limited stimulus exposure. AI requires an intact trisynaptic pathway (TSP; entorhinal>>dentate gyrus (DG)>>CA3>>CA1). We tested this pathway specificity model in patient BL, who has rare selective bilateral DG lesions, presumably interrupting the TSP but not MSP. BL should show preserved SL and impaired AI. During AI, BL and matched controls studied overlapping paired associates (AB, BC) and were tested on premise pairs (AB, BC) and on indirect associations (inferred AC). As predicted, BL was impaired on AI (inferring AC) despite intact memory for the premise pairs. During SL, participants passively viewed continuous picture sequences containing an underlying structure of triplets, which they later had to recognize. Unexpectedly, BL's lesion was sufficient to lead to below-chance performance, suggesting the MSP is insufficient for SL. These results implicate the DG in both explicit and implicit cross-event generalization.

**Speaker Session #2: Saturday June 8, 9:30am – 10:30am**

**2-01 Inhibition of return is suffering from multiple personality disorder: We will show how to fix it Raymond Klein**, Dalhousie University, Ralph Redden, Dalhousie University, Matthew Hilchey, University of Toronto.

Since its discovery in the mid-1980's inhibition of return (IOR) has been the subject of intense interest and disagreements (see Dukewich & Klein, 2015) about its nature. We believe that these disagreements are rooted, at least in part, in IOR's split personality: In the typical sequence of processing one form of IOR operates on early/input stages while the other form operates on later/output stages. Negative priming effects on performance that are NOT IOR also contribute to this confused state. We will present evidence using several diagnostics (central versus peripheral targets, joint consideration of speed and accuracy, and the locus of slack logic embedded in the psychological refractory period effect) to illustrate this dissociation and show the input form of IOR is generated when the reflexive oculomotor system is suppressed while the output form is generated when this system is not suppressed. We believe that despite these differences, both forms of IOR can serve the novelty seeking function proposed by Posner & colleagues: the input form operates on a salience map that influences what we will attend to and the output form operates on a priority map that influences what behaviors (including orienting) we are likely to engage in.

**2-02 Eye movements and mental model updating Hanbin Go**, University of Waterloo, James Danckert, University of Waterloo, Britt Anderson, University of Waterloo.

What can eye movement metrics reveal about mental models? Participants looked at randomly located visual targets while their eyes were tracked. When targets appeared in areas of higher spatial probability saccadic responses were quicker. The length of time participants looked at targets, dwell time, increased when target locations were surprising. In a second study, participants looked at targets presented one at a time radially around an invisible perimeter. The target locations were normally distributed and changed during the task. Participants reported whenever they thought a distribution change had occurred by clicking a mouse. Participants were poor at determining the true distributional adjustments. On trials where they reported a distribution change, target dwell times were longer and saccadic latency increased. When presented with distribution changes, saccadic latency was slower for targets in lower probability regions without changes in dwell time. Our results suggest that planning of saccades are responsive to target probabilities, and dwell time distinguishes when slower

saccades to low probability locations are surprising (unexpected low probability occurrences).

**2-03 The Fast-Same Effect of an Exclusive-OR Task \* Marc-André Goulet**, University of Ottawa, Denis Cousineau, University of Ottawa.

Participants are faster to detect that two stimuli are identical than to detect they are different. Opposing theories suggested that this fast-same effect is due to a) an inherent bias of participants for similarity or b) facilitation caused by the repetition of the stimuli attributes. Although both theories predict the fast-same effect in a conventional Same-Different task, they make distinct predictions for tasks in which bias is removed. The bias theory predicts that the fast-same would disappear whereas the facilitation theory predicts that the fast-same would remain. We tested those hypotheses using an exclusive-OR Same-Different task, in which participants had to indicate whether all the attributes of the stimuli were matching or mismatching by pressing a specific answer key, or if some attributes were matching and some were mismatching by pressing another answer key. Results show that participants were much faster in the all-matching condition compared to the all-mismatching condition, therefore supporting the facilitation theory. Accumulator model fits further support that the fast-same effect is not caused by bias, but by a faster accumulation rate of evidence in the all-matching condition.

**2-04 Another look at eye gaze discrimination yields a different perspective Derek Besner**, U of Waterloo, David McLean, University of Waterloo.

We generated schematic faces in which the majority of observers said that the eyes looking left or right were more salient than arrows in the middle of the face pointing left or right. We then had participants do two tasks. In one, participants ignored the arrows and indicated whether the eyes looked left or right. In the second, participants ignored the eyes and indicated whether the arrow pointed left or right. Two hypotheses were considered. In one (a strong account of automatic processing) the prediction is that the arrows would not impact judgments about the eyes because eye gaze discrimination is "automatic" in the sense of being impervious to interference from a less automatic process. A second account (a weaker automaticity account) is that the irrelevant arrow will interfere less with the

eye discrimination task than the irrelevant eyes will interfere with the arrow task. The majority of observers predicted that the eyes would interfere more with the arrow task than the arrows would interfere with the eye task. The results undermine both strong and weak accounts of automatic processing in the present context.

**2-05 Methods for Improving Probability Judgments: Effects of Presentation Formats, Coherentization, and Aggregation Robert Collins,** Intelligence, Influence and Collaboration Section, Toronto Research Centre, Defence Research and Development Canada, David Mandel, Intelligence, Influence and Collaboration Section, Toronto Research Centre, Defence Research and Development Canada, Chris Karvetski, Black Swan Technologies Ltd., Charley Wu, Max Planck Institute for Human Development, Berlin, Germany, Jonathan Nelson, Max Planck Institute for Human Development, Berlin, Germany; University of Surrey.

Accurate forecasts are critical for predicting and responding to future events. While there has been much research on developing methods for improving forecast accuracy—using information presentation formats, recalibration of judgments, and aggregation—relatively little research has examined how the various approaches work in tandem. We address this gap by reanalyzing a rich set of data (Wu et al., 2017) where 2858 participants provided probability judgments for a two class, binary feature classification task given the result of a diagnostic test. We examined how presentation format, aggregation, and Bayesian coherentization (a method for transforming judgments into the closest set of mutually coherent probabilities) influenced posterior probability judgment accuracy. We find that structuring information as posterior-salient and countable natural frequencies yielded the best accuracy among all 14 types of presentation formats. In contrast, coherentization and aggregation with an unweighted average showed little promise for improving accuracy. However, aggregation using coherence weighting (in which more coherent judges contributed more to the pooled judgment) improved accuracy. Importantly, some accuracy-boosting methods conflicted with one another, indicating the need for further research and theory development on multi-method approaches to optimizing judgment accuracy.

**2-06 The Environmental Malleability of Base Rate Neglect \* Martin Harry Turpin,** University of Waterloo, Ethan Meyers, University of Waterloo, Alexander Walker, University of Waterloo, Jonathan Fugelsang, University of Waterloo, Jennifer Stolz, University of Waterloo, Derek Koehler, University of Waterloo.

How does the environment we live in change the way we apply heuristics like the use of stereotypes when making judgements? A sample of 300 participants was given common base rate problems where they predicted a given person's occupation in the presence of both individuating information (stereotypes) and base rate statistics. We varied the type of society the participants were to imagine making their decisions about. These were: a society where personality completely determines occupation, a society where personality has no impact on occupation, and a third condition that gave no information about the society type, leaving participants free to imagine their own society. It was found responding in line with the base rate differed depending on the type of society participants were asked to imagine, preferring base rates when personality was not diagnostic of occupation, and preferring stereotype/personality information when it was. These results are interpreted as supporting a diagnosticity account of base rate neglect; that is, people rely on stereotype information when it is appropriately diagnostic, and abandon it when it is not.

**2-07 Sunk-cost in moral decisions Michal Bialek,** University of Waterloo, Ethan Meyers, University of Waterloo, Jonathan Fugelsang, University of Waterloo, Derek Koehler, University of Waterloo, Ori Friedman, University of Waterloo.

Moral judgements are affected by two types of considerations: consistency with universal moral rules, and possible consequences of an action. We introduce a third factor that might affect moral judgements: past actions. Specifically, in three experiments ( $n > 1500$ ) we found that when having made a moral transgressions for the greater good (so called utilitarian judgement) one is willing to continue with this action also when the potential benefit disappears. We explain this by referring to sunk-cost fallacy - a willingness to continue with a failing endeavor simply because one already invested some resources to it. In this research we show that sunk-cost affects moral judgements at least to the same extent as it affects

economic decisions. Additionally, we provide evidence that sunk-cost affects moral inclinations per se, as it is not only boosting utilitarian responding (Experiments 1 and 2), but also increases permissibility of a moral transgression (Experiment 3).

**2-08 Processing in a foreign language prompts positive thinking and increases willingness to take risks \* Rafal Muda**, Maria Curie Skłodowska University, Poland, Paweł Niszczoła, Poznań University of Economics and Business, Poland, Damian Pieńkosz, Maria Curie Skłodowska University, Poland, Boaz Keysar, University of Chicago, USA.

Using a foreign language causes people to make different decisions than using their native language. This effect might be due to the context of learning of the languages, as people are in a less emotional and more formal context when they learn a foreign language than their native tongue. This might result in different representations of past experiences and weaker emotional connotations. In three pre-registered experiments we tested whether the foreign language effect affects risk-taking, and whether this is due to (1) reduced anticipated regret and (2) differences in the valence of thoughts that came to mind. All three studies robustly demonstrated that people are more willing to take risks when using a foreign language. The data is weakly suggestive that this results from attenuated regret anticipation. However, results revealed that people are more prone to think about positive aspects of risk-taking when using a foreign language what was connected with increased willingness to take the risks. We suggest that the increased willingness to take risks in a foreign language arises from differences in the valence of the thoughts that are triggered while making the decision in a foreign language as opposed to a native tongue.

**2-09 Learning to assign stress in a second language: The role of second-language vocabulary size and transfer from the native language Giacomo Spinelli**, University of Western Ontario, Luciana Forti, University for Foreigners of Perugia, Italy, Debra Jared, University of Western Ontario.

Learning to translate a written word into sound implies assigning a stress pattern to that word. This task can present a challenge for languages like Italian, in which stress information cannot be easily derived from the orthography and, in most cases, must instead be computed from

distributional properties of the language. This is especially true for individuals who learn Italian as a second language. In this research, we aimed to characterize the processes underlying the development of stress assignment in native English speakers and native Chinese speakers learning Italian as a second language. We obtained evidence from both types of bilinguals in support of a role of vocabulary size in modulating the type of distributional information used in stress assignment, with an early bias for the dominant stress pattern in the language (i.e., stress dominance information) being gradually replaced by a tendency to utilize associations between orthographic final sequences and stress patterns (i.e., stress neighborhood information) in more advanced bilinguals. In addition, some evidence was produced that suggests a role for a transfer of stress assignment habits from the bilinguals' native language to Italian, although only in English native speakers.

**2-10 Can a listener's race and accent affect a bilingual's speech production? Emily Shiu**, University of Waterloo, Katherine White, University of Waterloo.

The degree to which a bilingual's two languages are activated changes across contexts, but the cues that trigger these changes are not well understood. We ask whether activation of a non-target language increases due to the race and accent of a live experimenter, and whether this activation can be observed in an individual's accent (measured by voice-onset-time of word-initial stops). Late and early Chinese (L1)-English (L2) bilinguals performed an English picture-naming task in front of a live experimenter. Experimenter race and accent combinations were manipulated between participants (Caucasian/Native-English, Chinese/early-ESL, Chinese/late-ESL), with the number of race/accent cues suggesting the experimenter's possible knowledge of Chinese increasing across conditions. Target words for the naming task were designed to determine if any effect of these cues would be a result of a general increase in Chinese activation or the activation of specific words with shared onsets. Preliminary results (n=63): Both early and late learners exhibited significantly higher (Chinese-like) VOTs in their English productions when speaking to both Chinese experimenters compared to the Caucasian/Native-English experimenter. There was also a significant linear trend across

conditions, suggesting that race and accent cues may have additive effects on language activation.

**2-11 Native language processing is influenced by L2-to-L1 translation ambiguity** Olessia Jouravlev, Carleton University, Debra Jared, Western University, Canada.

Words of one language often have multiple translations into another language, a phenomenon known as translation ambiguity. Most prior research examined the effects of the mapping of a single L1 word onto multiple L2 words. We examined whether mapping of a single L2 word onto multiple L1 words impacts how these L1 words are represented in the bilingual lexicon. To this end, Russian-English bilinguals processed pairs of Russian words that served or did not serve as alternative translations of an English word. In addition, conceptual relatedness of words in these pairs was manipulated. Participants completed a primed lexical decision task combined with ERP recordings (Exp1) or decided on the conceptual relatedness of these words (Exp2). We obtained strong evidence for the facilitative effect of L2-to-L1 translation ambiguity in behavioral (faster RTs in Exp1 and higher conceptual relatedness ratings in Exp2) and neural measures (reduced N170 and N400) for L2-to-L1 translation ambiguous compared to non-ambiguous words. Further, the conceptual similarity of alternative translations influenced findings in all measures. These findings provide evidence that learning an L2 can impact L1. The presence of a shared L2 translation may lead to a certain degree of convergence of corresponding L1 lexical and conceptual representations.

**2-12 Bilingual processing costs in L1 production are restricted to non-cognate, high-frequency words.** Isabella Poitras, Carleton University, Olessia Jouravlev, Carleton University.

Co-existence of multiple languages in the minds of bilinguals has been claimed to cause bilingual processing costs (e.g., Ivanova & Costa, 2007; Sadat et al., 2016). Bilinguals are slower and make more errors in speech production than monolinguals. This bilingual disadvantage is present in L2 and L1 (Sadat et al., 2016). We hypothesized that bilingual processing costs in L1 production arise due to a conflict between two competing words (L1 and L2) that bilinguals activate when naming objects. We predicted that

bilinguals will be slower in naming objects compared to monolinguals if (a) these objects activate different lexical representations across languages (i.e., non-cognates) and (b) if competing words are retrieved from the lexicon at approximately the same time. The simultaneous co-activation of competing words is more likely for high frequency (e.g., dog – chien) than for low frequency words (e.g., raccoon – raton-laveur). To test our predictions, we asked English monolinguals and English-French bilinguals to name images of objects in English. Lexical frequency and cognate status of words corresponding to the objects were manipulated. As predicted, bilingual processing costs in L1 production were restricted to non-cognate, high-frequency words.

**2-13 The metamemory behaviors used during an associative memory task** Mario Doyle, Wilfrid Laurier University, William Hockley, Wilfrid Laurier University.

The purpose of this study was to examine how people monitor their associative memory. In Experiment 1 participants studied a list of word pairs of various associative strength. Judgments of learning (JOLs) and study time were recorded during study, while confidence judgments (CJs) and response time were recorded during the yes/no associative recognition test. Overall the results indicated that compared to weakly or unrelated pairs, highly related pairs had higher hit rates but also higher false alarm rates (concordant effect) and no differences in discriminability ( $d'$ ). Highly related pairs also had higher JOLs and CJs, but lower study time and reaction time at test compared to weakly or unrelated pairs. Experiment 2 used a different stimulus manipulation (concrete vs abstract words), which resulted in concrete pairs having higher hit rates and lower false alarm rates (mirror effect), with no difference in  $d'$ . Corresponding to memory performance, JOLs and CJs were higher for concrete pairs compared to abstract pairs, while response time was the opposite. Surprisingly, there was little difference in study time. Future experiments will further explore different patterns in memory performance to examine the corresponding changes in metamemory behavior.

**2-14 Improving metacognitive accuracy of visual working memory representations through performance feedback** Caitlin Tozios, University of

Toronto, Anjali Pandey, Dalhousie University, Keisuke Fukuda, University of Toronto.

Accurately representing task-relevant information in mind is critical to any cognitive task. Visual working memory (VWM) allows us to represent a limited amount of visual information with great precision in a readily accessible state. However, recent studies demonstrated that the perceived accessibility (i.e., confidence of report) of VWM representations does not always guarantee the accuracy of its representation, thus resulting in confident-but-inaccurate representations (e.g., Adam & Vogel, 2017). Here, we examined whether it is possible to improve metacognitive accuracy in judging the accessibility of VWM representations. In two experiments, participants remembered an array of simple objects (e.g., colored squares) over a one-second retention interval. After the retention interval, they reported each object along with the confidence of report. Subsequently, they received feedback based on the accuracy of perceived accessibility of VWM representations. In other words, confident-and-accurate reports led to positive feedback while confident-but-inaccurate reports led to negative feedback. The results demonstrated that feedback improved the metacognitive accuracy of the accessibility judgement, and this improvement remained after the feedback was removed. Interestingly, the training effect generalized to a memory task with different stimuli (e.g., oriented lines). Thus, our results demonstrate that VWM metacognitive judgements can be trained in a stimulus-general manner.

**2-15 Thinking Hard or Hardly Thinking? An Investigation of Cue Source and Effects on Reflection \* Kaiden Stewart**, University of Waterloo, Evan Risko, University of Waterloo, Jonathan Fugelsang, University of Waterloo.

Metacognitive Reasoning Theory (Thompson, Prowse Turner, and Pennycook, 2011) suggests that characteristics of initial processing, specifically fluency, produce metacognitive Feelings of Rightness, which then dictate the deployment of Type II, reflective thinking. Unclear is how fluency contributes to the ultimate decision to reflect when other cues are available to the individual. In the present investigation, we examine how participants integrate the experience of fluency and overt difficulty information to arrive at the ultimate decision to reflect on a problem. We find that participants reflect more when reasoning with syllogisms that are

accompanied by an indication of difficulty. Interestingly, the observed correlation between response time and rethinking time (which is fundamental to Metacognitive Reasoning Theory) is not significantly altered by this overt information. The present investigation provides evidence that participants will integrate objective difficulty information into their ultimate decision to reflect, but that this integration will not overwrite the subjective, metacognitive cues generated as a result of the fluency experienced during initial processing. That is, the mechanisms proposed by Thompson and colleagues' Metacognitive Reasoning Theory are robust to the inclusion of overt cues about difficulty, despite the fact that those cues are influential in the ultimate decision to reflect.

**2-16 "We did it together and we did it well": Metacognitive assessments of joint action Janeen Loehr**, University of Saskatchewan, Juan Del Castillo Cabada, University of Saskatchewan.

When people coordinate their actions with others, they experience a sense of joint agency, or shared control over actions and their effects. Joint agency is determined in part by the degree of coordination between partners and the overall accuracy of the joint performance. The current study examined whether judgments of joint agency simply reflect subjective perceptions of joint performance. Pairs of participants coordinated their actions to produce eight-tone sequences that matched a metronome pace. On half of the trials, they rated their feelings of joint agency; on the other half, they rated their perception of how well they performed the task. Two measures of objective performance were derived from the pair's inter-tap intervals: how well the pair matched the metronome pace (accuracy) and how well they maintained a steady pace (variability). Although joint agency and subjective performance ratings were correlated, objective performance measures more strongly influenced subjective performance than joint agency. These findings indicate that metacognitive assessments of joint agency and joint performance are related but dissociable, in line with findings for metacognitive assessments of solo action. Implications for people's experiences of responsibility for, and adaptation in light of, joint action outcomes will be discussed.

**2-17 Semantic Effects on Novel Conceptual Combinations Hamad Al-Azary,** University of Alberta, Christina Gagné, University of Alberta, Thomas Spalding, University of Alberta.

Conceptual combinations, such as spider web, involve the semantic representations of two constituent concepts (e.g., spider, web), wherein the first (i.e., modifier) typically modifies the second (i.e., head). Importantly, a concept's semantic representation can vary in richness. For example, some concepts are rich because they are amenable to physical interaction (e.g., bicycle), whereas others are less rich because they are difficult or impossible to interact with (e.g., rainbow). This variability is captured in the body-object interaction (BOI) variable. Additionally, concepts can vary in how many semantic neighbours they have, which is characterized by the semantic neighbourhood density (SND) variable. In this experiment, participants rated randomly created novel conceptual combinations (e.g., candy bird) for comprehensibility. The results show that semantic richness of the head affects the degree to which a novel conceptual combination is comprehensible. In particular, when the head is low-BOI (e.g., rainbow), its SND value does not affect the comprehensibility of the combination. However, when the head is high-BOI (e.g., bicycle), higher SND values make the combination less comprehensible. Thus, when a concept is semantically rich its meaning is resistant to being modified.

**2-18 Indirect associations in learning semantic and syntactic lexical relationships Matthew Kelly,** The Pennsylvania State University, USA, David Reitter, The Pennsylvania State University, USA, Robert West, Carleton University, Moojan Ghafurian, University of Waterloo.

Computational models of distributional semantics represent word meanings in terms of words' relationships with all other words in a corpus. Although distributional models are sensitive to topic (e.g., tiger and stripes) and synonymy (e.g., soar and fly), the models have limited sensitivity to part-of-speech (e.g., book and shirt are nouns). How lexical-syntactic knowledge is encoded and how it meshes with semantic representations are open questions. Word co-occurrence relationships define a connected graph such that any two words have some degree of separation on the graph. Models of distributional semantics are typically sensitive to only one or two degrees of separation. By recursively adding higher levels of representations to a

computational, holographic model of semantic memory, we build a model sensitive to arbitrary degrees of separation.

We find that word associations at four degrees of separation increase the similarity between words that share part-of-speech or syntactic type and improve the ability of the model to construct grammatical sentences. Our model provides evidence that human memory must be sensitive to indirect associations to accommodate lexical syntactic relationships as well as evidence that semantics and syntax exist on a continuum that emerges from a unitary cognitive system.

**2-19 Characterizing semantic neighbourhoods based on word features Brette Lansue,** University of Windsor, Tara McAuley, University of Windsor, Lori Buchanan, University of Windsor.

A linguistic-based model of semantics posits that semantic information is organized based on the statistical co-occurrences of words, and proposes that the spread of activation from one semantic representation to another is dependent upon the associative relationship between the two concepts (Buchanan, Westbury, & Burgess, PBR, 2001). Semantic neighbourhood density (SND; Durda & Buchanan, BRM, 2008) is one measure derived from such a model, and it captures the variability in the distribution of semantically related words in a target word's semantic neighbourhood. Although SND has been found to affect single-word processing of concrete and abstract nouns differentially (Danguécan & Buchanan, FiP, 2016), there have been no attempts to characterize the semantic neighbourhoods of different parts of speech. The present study examined the SNDs of a random sample of 300 adjectives, 300 verbs, and 300 nouns, with half concrete and half abstract words. Adjectives and nouns were found to have denser semantic neighbourhoods than verbs, with no difference found between adjectives and nouns. Additionally, concrete words were found to have denser semantic neighbourhoods than abstract words. Our findings highlight that differences in the organization of semantic representations exist dependent on the part of speech and concrete features of the word.

**2-20 Phone Use and Self Regulation Kristen Lott,** Trent University, Christina Neerland, Trent University, Michael Reynolds, Trent University.

It is well established that cellphones are distracting. Indeed, evidence suggests that the mere presence of a smartphone can directly interfere with performance on a concurrent task. Consequently, people are often told to ignore their phone across a wide range of tasks (e.g., learning, driving, etc.). Here, we examined whether there is an indirect cost to ignoring smartphones. Smartphone use has been shown to be habit forming and has even been argued to be addictive (Oulasvirta, Rattenbury, Ma & Rita, 2011; Cheever, Rosen, Carrier & Chavez, 2014). Importantly, previous research has shown that resisting a habitual behavior is tiring and affects our ability to exert self-control at a later time, a phenomenon referred to as ego-depletion. We examined whether having to resist using a smartphone for a brief period of time (15 minutes) leads to ego depletion as measured using an anagram task. Resisting using a smartphone yielded greater self-reported fatigue and resulted in fewer solved fewer anagrams consistent with ego-depletion illustrating the indirect cost of smartphone resistance on self-control.

### **Speaker Session #3: Saturday June 8, 10:45am – 12 noon**

**3-01 The Role of Post-Encoding Retrieval on Cognitive Representations of Spatial Environments Brooke Demetri**, State University of New York at Geneseo, Dr. Jason Ozubko, State University of New York at Geneseo.

Spatial memory is an important ability for navigating around one's surrounding environment. However, due to the challenges of developing experimental paradigms that utilize large scale, real-world environments, little research has analyzed, in detail, the development of cognitive maps over time. Past research in rodents has shown that hippocampal place-cells replay during periods of quiet wakefulness, suggesting that mental replay of recent spatial experiences is tied to the development of cognitive maps. In humans, we hypothesize that the development of cognitive maps could therefore be manipulated by having participants selectively recall recent navigational experiences. We analyzed the development of cognitive maps for novel, real-world spatial environments over a period of 2 weeks using Google Street View software. Though all participants experienced the environments in the same way, after navigating through the environment

participants' spatial memories were tested with either rote retrieval or spatial sequencing recognition tests. Ultimately, both groups showed effective navigation on learned routes, however, the sequencing group was more successful in finding alternate routes around blockages and shortcuts between routes, suggesting more flexible cognitive maps. These findings are the first to demonstrate that the way in which navigational experiences are recalled can directly influence the development of mental maps.

**3-02 Visuospatial Navigation Strategies as Predictors of Empathy Shanny Foo**, McGill University, Todd Girard, Ryerson University, Bev Fredborg, Ryerson University.

Visuospatial memory strategies and empathy, although disparate constructs, appear to share common underlying processes. To examine these relationships, 100 participants completed a computer-generated virtual maze followed by questionnaires about their strategy use and daily-life visuospatial habits. The virtual maze conditions successfully elicited expected egocentric or allocentric strategies as demonstrated in correlations between participants' reported task strategy-use and trait visuospatial tendencies. To address relations with cognitive and affective components of empathy we administered the Interpersonal Reactivity Index. Multiple regression analyses revealed that empathy related positively to egocentric and negatively to allocentric strategy use. These findings suggest that empathy is generally self-referential, involving self-other projections into emotions and thought processes, unlike allocentric strategies, which do not necessitate a self element. Therefore, individuals with a propensity towards using egocentric spatial-memory strategies may also have more empathic tendencies.

**3-03 "What a view!"; The influence of natural and urban images on sustained attention Lydia Hicks**, University of Waterloo, Daniel Smilek, University of Waterloo.

Natural environments are believed to be more attentionally restorative than urban environments. However, in many prior studies, images have been selected based on a researcher's intuitions or participants' "perceived restorativeness". In Study 1, we developed a novel stimulus set by asking participants to rate 100 images for how much they matched their

prototypical understanding of “natural” and “urban” settings. Difference scores were calculated by subtracting urban typicality ratings from nature typicality ratings to determine which images were most prototypical for each environment, and then the 25 largest positive difference scores were selected for a natural image stimuli set, while the 25 largest negative difference scores were selected for an urban image stimuli set in the subsequent study. In Study 2, students participated in a study that replicated and extended a previous study by Berto (2005) examining the influence of viewing nature vs. urban stimuli on performance in the Sustained Attention to Response Task (SART). Participants completed two SART sessions separated by a viewing period in which they were exposed to either natural or urban images. We discuss our findings in the context of the robustness and replicability of prior studies examining the impact of nature exposure on cognition.

**3-04 An assessment of diverse urban and greenspace environments using the Perceived Restorativeness Scale and measures of attention, affect, and stress Emily Grant**, University of Waterloo, Colin Ellard, University of Waterloo.

Greenspaces have been shown to have a restorative effect, restoring attention, increasing positive affect, and reducing stress. However, most studies in this field use one greenspace and one urban environment. Those that have used multiple environments use pictures and the Perceived Restorativeness Scale (PRS) to determine the restorative potential of diverse urban and natural environments. Therefore, research is needed to compare diverse urban and natural environments with assessments of actual restorativeness based on measures of attention, affect and stress. The study, to be presented assesses the restorative effects of four different environments measured using attention, affect, and continuous blood pressure, heart rate, and skin conductance. Participants will be exposed to two urban environments (Time Square and Venice) and two natural environments (Winter and Rain Forest) using virtual reality. Between-subject comparisons will be assessed using ANOVA. In addition, the measures will be correlated with their PRS scores to determine how accurately participants rate the potential restorativeness of the environments. It is anticipated that there will be differences between restorative effects for the urban vs natural settings, but the magnitude of

the differences may vary. It is also anticipated, that prediction of restorative potential of the environments may not be accurately predicted.

**3-05 The role of sensorimotor recalibration in motion sickness and motor adaptation in virtual reality Séamas Weech**, University of Waterloo, Canada, Michael Barnett-Cowan, University of Waterloo.

In conditions of sensory incongruence, such as sea voyage or air travel, the central nervous system faces challenges to sensory integration that often result in motion sickness. We discuss evidence showing that the sensory reweighting capacity of the central nervous system, which underpins adaptation to changing environmental statistics, is a key contributor to individual differences in resistance to motion sickness. We show that individual variance in motion sickness rates are predictable using a combination of sensorimotor indices, such as postural sway during illusory self-motion (vection), and that sickness rates are reduced using sensory stimulation techniques that tap into the sensory reweighting mechanism. In addition to its central role in resolving sensory mismatches, we present evidence showing that the sensorimotor integration system can readily develop novel contingencies between perception and action in virtual reality. Our results suggest that experimentally coupling kinematics to the flow of time in a virtual environment produces motor-specific adaptation aftereffects, suggesting a recalibration of the time perception mechanism responsible for reproducing the duration of events. Together, the findings highlight the unique capacity of virtual reality for probing sensorimotor recalibration. This knowledge may provide valuable insights that relate to rehabilitation initiatives predicated on sensory learning in simulated environments.

**3-06 Monitoring mind wandering during live lectures using EEG and machine learning Anita Acai**, McMaster University, Kiret Dhindsa, McMaster University, Canada; Vector Institute for Artificial Intelligence, Natalie Wagner, McMaster University, Dan Bosynak, McMaster University, Stephen Kelly, McMaster University, Canada, Mohit Bhandari, McMaster University, Brad Petrisor, McMaster University. Ranil R. Sonnadara, McMaster University, Canada; Vector Institute for Artificial Intelligence.

Mind wandering (MW) can negatively impact learning. Current detection approaches typically rely exclusively on self-reported measures, which may be disruptive and biased. Here we develop a method of detecting MW during live lectures using electroencephalography (EEG) and machine learning. We collected EEG and behavioural data (thought probes and quizzes) during a teaching day in orthopaedic surgery. Fifteen individuals participated in both the EEG and behavioural components and eight participated in the behavioural-only component. We interrupted lectures approximately every four minutes with a prompt instructing participants to report their state of attention just prior to the probe. EEGs were artifact-corrected and used to train a predictive machine learning model of MW based on common spatial patterns. We found that it is possible to predict MW with above-chance level accuracy in individuals; however, the neural patterns of MW differed across participants. With further study, these results may allow for the development of technological applications that can enable real-time attention monitoring in the classroom.

### **3-07 Sitting with it: Mindfulness, Sustained Attention, and Boredom \***

**Rotem Petranker**, York University, John Eastwood, York University.

Concentrating on a stimulus or an activity seems like a trivial ability. Sustaining attention for extended periods of time, however, is a challenging experience which becomes increasingly difficult with time. When sustaining attention on an easy task, with the increase in difficulty over time, one also begins experiencing negative affect such as boredom and discomfort. Increased negative affect during the task is related to poorer performance on the task. The present research aims to replicate previous findings from the coming together of sustained attention and mindfulness research, and extend the extant literature. We focus on a mechanistic account suggesting that the relationship between mindfulness and sustained attention is a function of enhanced affect regulation. While only replicating some findings in the literature, the results provide support for our novel hypotheses, linking mindfulness to sustained attention through enhanced affective regulation.

### **3-08 Mind-wandering in a driving context: A comparison of self-report measures**

**Heather Walker**, University of Guelph, Lana Trick, University of Guelph.

Mind-wandering can be measured using different reporting techniques, but they may have a differing impact on the experience. For instance, thought-probes are more likely to capture mind-wandering episodes, but interrupt the task. Post-task reports do not, but episodes may not be recognized or remembered. We investigated the impact of thought-probes versus post-task techniques on patterns of mind-wandering and performance in a driving context, and further examined differences using individual difference measures: the Operation Span (OSPAN) and Sustained Attention to Response Task (SART). During two simulated drives participants were probed to make a mind-wandering report, or estimated the percentage of time they mind-wandered after each drive. Response time to a vehicle braking was also measured. Although more mind-wandering was reported in the thought-probe condition, response times were slower in the post-task condition. Interestingly, those with high OSPAN scores reported more mind-wandering, but only in the post-task condition. Conversely, in the post-task condition those with low SART scores were slower to brake than those with high scores; in the probe condition they didn't differ. Findings indicate a differential impact of report-type on participant experience, emphasizing the need for covert measures that provide accurate estimates of task-engagement but don't interfere with task flow.

### **3-09 Influence of the context and working memory on reading and mind**

**wandering Vickie Plourde**, Faculté Saint-Jean, University of Alberta, Gladys Sina, Faculté Saint-Jean, University of Alberta, Katheryne Soucy, Faculté Saint-Jean, University of Alberta, Geneviève Therrien, Faculté Saint-Jean, University of Alberta.

Mind wandering (MW) can affect daily cognitive activities and working memory (WM) has been shown to modulate its impact. The goal of this study was to test how the context (quiet or distracting) during reading could affect MW and the WM modulation effect. University students (N=60, 67% females) first completed complex working memory span tasks (with no sounds) and then were divided in two equal groups (with nature sounds or no sounds) to read a short story (942 words) and answer probes. A reading comprehension test followed. When comparing the proportion of answers on the probes, we observed no significant differences on non-intentional (10-12%) MW between groups. Significant differences were obtained on

external distraction, more often reported in the group with sounds (15%) than no sounds (8%). However, the sounds did not impact reading performance. WM (symmetry span) was significantly and positively associated with reading, more so in the group with sounds. A similar trend was observed between symmetry span and unintentional MW, with a moderate negative association in the group with sounds. These results suggest that despite no overall impact on reading and MW, a context with nature sounds could create higher cognitive load that demands more from WM.

**3-10 Attentional pacing: How the expectation of task length influences mind wandering \* Alyssa C. Smith**, University of Waterloo, Brandon C. W. Ralph, University of Waterloo, Paul Seli, Duke University, Daniel Smilek, University of Waterloo.

Research has found that people can strategically modulate their attention in response to changing task demands. Building on this work, we examined whether people are able to strategically pace the use of their attentional resources by “saving” their attentional resources for later components of tasks that are expected to take a long time. Along these lines, we hypothesized that people will be less attentive at the beginning of a task that is expected to be long than at the beginning of a task that is expected to be brief. Two groups of participants completed the Sustained Attention to Response Task (SART). One group was told they would complete the SART for 10-min, whereas the other was told they would complete the SART for 45-min. We measured attentiveness via thought-probes administered to both groups during the first 10-min of the task. We will discuss our results in the context of how expectations influence both intentional and unintentional bouts of mind wandering.

## **Speaker Session #4: Saturday June 8, 2:15pm – 3:45pm**

**4-01 Evidence of sign- and goal-tracking behavior in humans Ali Gheidi**, Lora Cope, University of Michigan, Tyler Allerton, University of Michigan, Sanjeev Billing, University of Michigan, Andrew Drumheller, Jonathan Morrow, University of Michigan.

Sign-tracking is a form of Pavlovian conditioned approach to reward-associated cues. Sign-tracking is often contrasted with goal-tracking, which

is cue-triggered approach directed toward the location of reward delivery. Individual variation in sign-tracking has been shown to predict addiction-like behaviors in animals. Though sign-tracking has been observed in a wide variety of species, including rodents, primates, fish, cephalopods, and insects, there have been very few attempts to document sign-tracking in humans. For this study, we directly translated a rat PCA task for human subjects, using a retractable lever as a conditioned stimulus that predicts reward delivery into a different physical location (reward magazine). Physical contacts as well as eye-gaze directed toward the lever or magazine were recorded as outcome measures. Subjects also completed questionnaire-based measurements of trait impulsivity. There was significant inter-individual variation in the extent to which subjects interacted with the “sign” (lever) or the “goal” (magazine) during lever presentation. Analysis of impulsivity in a subset of subjects revealed a positive correlation with sign-tracking behavior. These experiments demonstrate that sign- and goal-tracking behavior can be measured in humans. Furthermore, inter-individual variation in sign-tracking behavior appears to correlate with impulsivity, which is a known risk factor for addiction.

**4-02 Which perceptual-cognitive skills can the Neurotracker improve? Preliminary data from expert ice hockey players Daniel Fortin-Guichard**, Université Laval, Emie Tétreault, Université Laval, Alain Vigneault, Alain Vigneault consultants inc., Simon Grondin, Université Laval.

Perceptual-cognitive skills play a major role in expert performance in sports. Because of their importance, it is not surprising to see companies commercializing devices intended to improve them. CogniSens Inc. commercialized the Neurotracker, a three-dimensional multiple objects tracking device. According to CogniSens Inc, the Neurotracker can improve selective attention, working memory, decision-making, processing speed, and sports performance. However, few studies have been published for testing its efficacy. This study aims at testing the Neurotracker’s efficacy to improve perceptual-cognitive skills in hockey. Thirty-five major junior hockey players were trained with the Neurotracker throughout the season, and completed some or all tests of a battery either before and/or late during the season. The battery included the Attention Network Test, the Composite Complex Span, a time reproduction task, a pattern recognition

task, a temporal equivalence task, a decision making task and a hockey performance task. Analyses of variance revealed that the Neurotracker could improve some aspects of time perception, temporal equivalence and decision making. However, results are discussed in absence of a control condition and therefore, it is not possible to determine whether the improvements were due to the use of the Neurotracker or to some improvement over the course of hockey season.

**4-03 Selective attention and decision making among volleyball experts: Are setters different from other players? \* Daniel Fortin-Guichard**, Laval University, Émie Tétreault, Laval University, Nicola Thibault, Laval University, Simon Grondin, Laval University.

When facing sports situations, expert athletes focus on fewer areas of their field-of-view, but for longer than controls. However, some factors such as a player's position in team sports could modulate this pattern. In volleyball, the setter must quickly decide to which attacker he should pass the ball in order to maximise scoring chances. The aim of the study is to verify if there are differences between expert setters, other expert volleyball players and controls on selective attention and decision-making when facing typical volleyball situations. Eighty-two participants (25 expert setters, 37 experts from other positions and 20 controls) viewed 50 video sequences: 10 serves, 10 passes, 10 receptions, 10 attacks and 10 blocks. Sequences stopped right before ball contact and participants had to predict the direction of the ball. A Tobii X3-120 device recorded their eye movements. Generalized estimating equation revealed that expert setters and controls performed fewer fixations and for less time than other experts did. However, both expert groups predicted more accurately than controls the direction of the ball. Results are discussed in terms of eye movement patterns typically found in expert athletes and the absence of loss in efficacy in prediction accuracy for setters despite more fixations.

**4-04 Role of Expertise on Individual Differences in Performance Rates** **Pauline Tranchant**, McGill University, Eleonore Scholler, McGill University, Caroline Palmer, McGill University.

Individuals display considerable rate differences during production of movement sequences. One theory proposes that movement rates are

constrained by energy efficiency in simple (walking) sequences and complex (music performance) sequences. Individual rate differences have consequences for joint behaviors; they are predictive of musicians' synchronization in a joint task. It is unknown whether differences in production rates constrain joint actions of inexperienced participants. Musically trained and untrained participants tapped in individual (Solo) and joint (Duet) tasks. In Solo tasks, participants tapped isochronously in the absence of auditory feedback (SMT). They also tapped the rhythm of familiar melodies at a regular spontaneous rate (SPR) as they heard auditory feedback of tones generated by the taps. In Duet tasks, participants synchronized their tapping with a partner, after a metronome cue of eight beats set to each duet partner's SPR. Findings with 20 individuals indicated significant correlations between the variability of individuals' SMT and SPR tasks; the mean tapping rates were uncorrelated across tasks. The asynchrony during Duet performance was correlated with the difference in partners' Solo SPR rates, but not with SMT rate differences. These findings suggest that joint synchronization of trained and untrained partners is related to spontaneous rates of the individuals.

**4-05 Conceptual similarities between targets and distractors influences visually-guided reaching** **Chris Martin**, University of Toronto, Ziming Cheng, University of Toronto, Morgan Barensse, University of Toronto; Rotman Research Institute.

The ability to adaptively interact with a complex and cluttered world requires that we process the meaning and visual form of multiple objects. Previous research has demonstrated that multiple competing action plans are simultaneously represented in the brain when there is uncertainty regarding which object will ultimately become a target. Behaviourally, this competition can be quantified as the bias toward a distractor in continuous measures of rapid reach movements. In the current study, we examined how the visual and conceptual similarities between objects influenced visuomotor decisions in the context of a rapid reaching task. Importantly, degree of visual and conceptual relatedness varied independently across potential targets. Reach trajectory was indeed influenced by conceptual similarities between targets and distractors. Critically, when participants reached to a target in an automatic manner (i.e., rapidly initiated movement), bias toward distractors increased linearly with degree of

conceptual similarity. Conversely, when participants reached to a target in a controlled manner (i.e., slowly initiated movement), bias toward distractors decreased with increases in conceptual similarity. Reach trajectory was not influenced by visual similarity. These results suggest that the meaning of objects critically shapes competition among multiple action plans prior to the decision to act on a target.

**4-06 Updating humans' headings in 3D and across-boundary spaces based on path integration Weimin Mou, University of Alberta.**

During navigation, humans have to update their spatial relations relative to the surrounding environments (spatial updating). Previous studies showed that when people navigate only based on self-motion cues, spatial updating one's relation relative to immediate environments occurs automatically during self-movement (path integration). However, it is no human study demonstrating that people can update their headings relative to a remote space or different surface using path integration. In our studies, in immersive virtual environments, participants learned an array of objects on the floor of the learning room and then locomoted to a different room or a different surface (i.e. moving from the floor to the wall). While standing at the testing position, participants mentally took different perspectives in the original learning space. The imagined heading was manipulated to be aligned or misaligned with participants' actual heading. The better performance for the aligned heading than misaligned heading (sensorimotor alignment effect) was used to indicate that spatial updating based on path integration occurs in 3D and across-boundary spaces. The results showed sensorimotor alignment effects in some conditions but not in others. These results for the first time showed that people can update their headings in 3D and across-boundary spaces but with some constraints.

**4-07 Assessing the effectiveness of mathematically enhanced reading intervention for word problem solving in grades 4 & 5 Aishwarya Nair, McGill University, Adam Dube, McGill University.**

Students' reading ability is correlated with their achievements in mathematics and math texts require reading involving decoding, comprehension, and numerical understanding to solve problems. Students with weak reading comprehension strategies tend to have poor problem

solving in mathematics. Therefore, it is important to know whether a mathematically enhanced reading program can be leveraged to improve children's mathematical performance. The study will test the effectiveness of a mathematically enhanced reading intervention as compared to a general reading intervention for supporting math word problem solving. Students in Grades 4 and 5 ( $n = 40$  per grade) will complete reading and problem-solving tasks to identify those with below average reading scores. They will then be assigned to one of two reading conditions ( $n = 25$  per condition). The design will compare the difference in pre- and post-tests scores on primary (reading comprehension & problem solving) and secondary outcomes (reading accuracy and fluency). The expected outcome is that a math-enhanced reading intervention will lead to greater gains in mathematical performance than a standard, best practices reading program. This may suggest that poor performance in math word problems is indicative of a contextual reading deficit rather than a general reading deficit.

**4-08 Not towing the mental number line for arithmetic Jamie Campbell, University of Saskatchewan, Yalin Chen, University of Saskatchewan, Maham Azhar, University of Saskatchewan.**

Numerous phenomena implicate visuo-spatial processes in numerical skills, which often are linked to a theoretical mental number line. We pursued the paradigm developed by Mathieu, Gourjon, Couderc, Thevenot and Prado (2016) for basic addition ( $4 + 3$ ) and subtraction ( $7 - 4$ ). They found with the three problem components (O1, +/-, O2) presented sequentially, addition was faster if O2 was displaced to the right of centre and subtraction was faster when O2 was displaced to the left. Mathieu et al. suggested that addition directed attention rightward on the number line whereas subtraction directed attention leftward. We set out to determine if these effects depended on mixing operations unpredictably within blocks of trials. With 74 participants, we did not replicate the Mathieu et al. results, because only addition showed the expected O2 displacement sensitivity and only in mixed-operation blocks. But, mixed-operation blocks always followed single-operation blocks. We repeated the experiment but with mixed-operation blocks occurring first. With  $n = 74$ , we found a spatial bias effect but only for subtraction and only in mixed blocks. We conclude that

consistent effects of spatial manipulations on arithmetic are illusive, at least in the participant samples we have tested.

4-09 **Is it better to study before or after sleep?** Rachel Newsome, University of Toronto, Chris Martin, University of Toronto, Morgan Barense, University of Toronto.

Sleep is critical to memory consolidation, and many studies show that studying over a longer period of time is better for memory performance than cramming over a short period of time. However, many of these studies have focused on elements of semantic knowledge. What is the best way to study event details? In the present study, we systematically investigated episodic memory for a naturalistic stimulus – a TV episode. After an in-lab episode viewing, participants were administered a study session at home, where they replayed scenes of the original episode. Participants either watched the full episode in the lab in the morning and replayed select scenes at home that evening before sleep, or came into the lab in the evening and replayed at home after a night of sleep. We compared the replay groups' memory performance of all scenes in the episode to performance of controls, who had the same initial viewing and test, but no replay sessions. We found differential improvements in performance such that participants who replayed prior to sleep had the most benefit, both in replayed as well as non-replayed content. These results suggest that the timing of first study session after initial exposure is crucial to later memory performance.

4-10 **Optimizing the use of Learning Objectives via Pretests** Mrinalini Sharma, McMaster University, Faria Sana, McMaster University, Joseph Kim, McMaster University.

Learning objectives (LOs) are statements that typically precede lecture content and identify goals for learning. However, limited research has investigated its effect on retention. In experiment 1, we examined if LOs can enhance student learning, and attempted to increase their pedagogical value by converting them into multiple-choice questions (MCQs). Participants studied several passages on a psychology topic during which LOs were presented in 1 of 3 ways: no LOs, traditional LO statements, and statements converted into MCQs. Performance on a delayed final test, that

measured how well they learned the topic, was highest when LOs were presented in the form of MCQs. This finding is intriguing because majority of the students scored less than chance on the MCQs. Perhaps attention is heightened during subsequent study because MCQ alternatives provide additional cues to target content, and not knowing the correct responses to the MCQs can facilitate feedback seeking behaviours. To test these two hypotheses, in experiment 2, LOs were presented in either MCQ or short-answer question (SAQ) format, and participants were either given feedback on their responses or not. Final test performance was higher with MCQs than SAQs when no feedback was provided, but lower with MCQs when feedback was provided than not.

4-11 **Aerobic fitness and arithmetic processing in college-aged adults** Amanda L McGowan, Michigan State University, Madison C Chandler, Michigan State University, Matthew B Pontifex, Michigan State University.

Although evidence demonstrates improved math achievement scores for individuals higher in aerobic fitness, such standardized assessments fail to capture precise domains of mathematical cognition influenced by fitness. Accordingly, the present investigation examined fitness-related differences in behavioral and pupillometric indices of approximate arithmetic processing. A sample of 61 undergraduate students were separated into higher and lower aerobically-fit groups based upon aerobic fitness. Pupil size was recorded while participants performed an arithmetic task presenting operands  $a + b$  consecutively in which participants were instructed to use approximation to indicate whether the problem sums were greater than or less than 100. Problems were distributed across conditions that varied the numerical distance between operands. Replicating previous findings, faster reaction time and increased response accuracy were observed with greater numerical distance. Lower aerobic fitness was associated with poorer response accuracy only for the most difficult condition — when the numerical distance between operands was small. However, no fitness-related differences were observed with regards to pupillary reactivity in response to approximate arithmetic processing. These results suggest that individual differences in aerobic fitness relate to differences in approximate arithmetic processing.

**4-12 Re-evaluating the influence of bilateral eye movements on memory performance \* Brady Roberts**, University of Waterloo, Colin MacLeod, University of Waterloo, Myra Fernandes, University of Waterloo.

Several recent studies have reported enhanced memory when retrieval is preceded by repetitive horizontal eye movements (as opposed to vertical or no eye movements). This memory boost has been referred to as the saccade-induced retrieval enhancement effect (SIRE). This effect has been reported to be effective both in healthy adults and in clinical populations, as well as with both word and picture stimuli. The eye movement-related memory benefit has been theorized to stem from either enhanced top-down attentional control or increased interhemispheric interaction. Additionally, the same mechanism has been hypothesized to serve as the basis for eye movement desensitization and reprocessing (EMDR) styles of therapeutic treatment. Thus, due to the theoretical and clinical importance of the SIRE effect, we sought first to replicate the effect and then to explore the underlying mechanism. Across a series of three experiments, memory performance was compared following repetitive horizontal or vertical eye movements, as well as a control condition of no eye movements. Bayesian statistical analyses demonstrated significant evidence for a null SIRE effect. We suggest that the SIRE effect as it exists in the literature is inconsistent at best or entirely spurious at worst.

**4-13 Selective attention and visual degradation: Two perceptual desirable difficulties Hanae Davis**, McMaster University, Bruce Milliken, McMaster University.

Previous work in our lab reported superior recognition performance for targets presented as incongruent selective attention trials than congruent selective attention trials in a previous word naming phase (Rosner, D'Angelo, et al., 2015). This result was originally discussed in terms of response conflict enhancing memory encoding for incongruent target items. Here, we describe subsequent research that challenges our original proposal; the recognition benefit for incongruent relative to congruent targets may not be driven uniquely by selective attention demands. Two lines of evidence will be presented. First, we show that variables that reliably affect congruency effects in studies of selective attention do not impact the recognition benefit for incongruent items (Davis, Rosner, et al.,

in press). Second, in a similar study we manipulated visual clarity rather than selection demands of study items and found superior recognition for visually degraded targets than intact targets (Rosner, Davis, & Milliken, 2015). Subsequently, we examined pupil dilation at study—an index of task difficulty—and found that it was greater for the degraded targets (Davis, Hashemi, et al., in prep). Taken together, selective attention demands appear to one of a broad class of encoding difficulty manipulations that enhance recognition memory.

**4-14 Pushing boundaries: The influence of context shifts on memory for temporal order Lauri Gurguryan**, McGill University, Elizabeth Dutemple, McGill University, Signy Sheldon, McGill University.

The Event Horizon Model posits that our continuous experiences are segmented into discrete episodes as a function of salient changes encountered in the environment. These changes, which can take the form of spatial or conceptual information, are used to create boundaries between events that are stored separately in memory. As such, memory for the order of information that crosses these boundaries is impaired. Here, we investigate how conceptual information affects the level of impairment to temporal memory for information learned across contexts. Young healthy participants studied the order of faces that were presented within the same context (e.g., a room) or across contexts with overlapping (two kitchens) or non-overlapping (a kitchen and bedroom) conceptual features. Although a context boundary impaired temporal memory, this impairment was reduced when faces were presented in contexts with overlapping conceptual features. A follow-up experiment confirmed that the reduced impairment to temporal order memory from boundaries with shared conceptual features was not due to shared perceptual information. These findings suggest that conceptual knowledge can be used to link together information across discretely stored events, providing new insights into how episodes are stored, organized, and can be subsequently accessed.

**4-15 Oh forget it: Remembering associations as a function of cue timing. Brette Lansue**, University of Windsor, Daniela Wong Gonzalez, University of Windsor, Lori Buchanan, University of Windsor.

In tests of associative memory, the directed forgetting procedure typically reveals that information followed by Remember (R) cues is better remembered than information followed by Forget (F) cues. Nevertheless, even the information followed by F-cues elicits higher than chance recognition. Ahmad, Hockley, and Nicholson (2016) showed that words with pre-experimental associations (i.e., compound word – CW) pairs) are more likely to show this effect than are random word pairs (i.e., noncompound word – NCW pairs). We examined depth of processing effects on associative memory using a modified directed forgetting procedure, where the R- and F-cues were presented either before or after the pairs. With a more surface level encoding strategy participants were able to discriminate CW pairs better than NCW pairs, regardless of cue timing. In contrast, memory was similar for both word pair types in the deep encoding condition. Finally, NCW pairs showed an effect of cue timing for the R-cue condition that was not found for CW pairs. In sum, we found that familiar associations are easier to remember with shallow processing regardless of cue timing whereas novel word pairs require a deeper level of processing and an explicit instruction to remember.

**4-16 It's easier to forget what you want: Directed forgetting of self-selected words** Kathleen L. Hourihan, Memorial University of Newfoundland, Tracy L. Taylor, Dalhousie University.

In item method directed forgetting, participants are instructed to either Remember (R) or Forget (F) individual items in a study list. When memory for all items is tested, memory is better for R than for F items: a directed forgetting (DF) effect. However, cues are always assigned by the experimenter. In the real world, learners can choose whether to intentionally remember or forget information. Research has shown repeatedly that learners can make sensible decisions about which items to study in order to maximize memory performance; when participants' study choices are honoured, memory performance exceeds conditions in which choices are dishonoured. Are people able to similarly select items to maximize intentional forgetting? In a series of experiments, participants were first asked to choose from a list of items what they would like to study. The study phase honoured half of their choices (R cues for chosen items and F cues for non-chosen items), but dishonoured half of their choices. Results show that item choice strongly influences DF, with the magnitude of the DF

effect much larger when choices are honoured than when they are dishonoured. Participants can choose which items they are more or less likely to remember and forget.

**4-17 Exploring the Impact of Conflicting Memory Instructions on Intentional Forgetting** \* Pelin Tan, Queen's University, Geoffrey Harrison, Queen's University, Tyler Ensor, Memorial University of Newfoundland, Daryl Wilson, Queen's University.

In item-method directed forgetting (DF), participants are instructed to remember some items from the study list and forget others. On a subsequent memory test, we observe better memory for remember items than forget items. This difference in memory performance has been attributed to the selective rehearsal account. Here, we used a novel variant of the paradigm where we presented participants with unrelated word pairs: On “pure” trials, participants were instructed to remember or forget both words; on “mixed” trials, participants were instructed to remember one word but forget the other. We predicted that because what to selectively rehearse is clearly defined for each pair on the mixed trials, the magnitude of the DF effect would be larger than the DF effect in the pure condition. Although we found this pattern of results, our findings were primarily driven by the large benefit to Remember items in the mixed condition than in the pure condition. Performance for Forget items in the mixed condition was also higher than in the pure condition. We believe that our findings emphasize how individuals select information to be remembered or forgotten while attending to multiple stimuli, a skill that is critical in our everyday processing of information.

**4-18 The Effects of Offloading Memory** \* Megan Kelly, University of Waterloo, Evan F. Risko, University of Waterloo.

Despite the pervasiveness of cognitive offloading as a memorial strategy, its cognitive consequences are poorly understood. Our first two experiments investigated the extent to which offloading resembles intentional/directed forgetting by examining the serial position effect for offloaded information. When comparing a group that was expecting to use an aid during recall (offloading) with a group that was not (no offloading), a memory impairment was found for offloaded items that was characterized by

reduced primacy but intact recency effects. This resembles the findings in intentional/directed forgetting research and supports the idea that similar processes might be engaged during offloading and intentional/directed forgetting. For example, both may be associated with a reduced engagement of top-down mnemonic strategies (e.g., rehearsal). A resulting prediction is that memory phenomenon not solely a by-product of such mechanisms should remain even when we offload. Our final two experiments tested this prediction using the Von Restorff effect (when a salient item is better recalled than surrounding items). We found robust Von Restorff effects in both offloading and no offloading conditions. This supports the notion that phenomenon not solely dependent on top-down mnemonic strategies should remain even when we offload.

**4-19 Perspective taking while conversing with a social robot Raheleh Saryazdi**, University of Toronto, Joanne Nuque, University of Toronto, Craig Chambers, University of Toronto.

The area of social robotics is attracting increased attention in view of robots' promise for applications such as education, elder care, and companionship. However, little is known about patterns of spoken communication with robot partners, particularly at the fine-grained levels explored in psycholinguistic accounts of conversational interaction. The current study uses a spoken language eye-tracking methodology to explore the extent to which listeners spontaneously ascribe human attributes to a robot during spoken communication. Human partners followed instruction from a Furhat-model robot to click on objects on a screen. On critical trials, the name of the target referent (e.g., "blacksmith") overlapped with a color term ("black"). Of interest was whether listeners could remember a previously-stated limitation of the robot (that it cannot see colour) and apply this knowledge during real-time language processing. As the target word unfolded, the likelihood of fixating the competitor object (e.g., black flag) relative to the target showed that listeners in fact had difficulty suppressing an expectation that the robot could be referring to objects using a colour adjective. Interestingly, this difficulty was more pronounced in older (60+) compared to younger adults, consistent with independent findings showing reduced working memory and inhibitory control abilities in adult aging.

**4-20 Social cues in interactions with familiar and unfamiliar partners Nida Latif**, McGill University, Jelena Ristic, McGill University.

Interactions with familiar people are often perceived as easy and fluid. However, it remains unknown which visual cues are used to judge interaction quality and how their perception may be modulated by partner familiarity. To address this, participants were first introduced to a confederate and then interacted with either the same (Familiar) or a different (Unfamiliar) confederate. After the conversation, each participant watched a video playback of their interaction and was asked to continuously rate the perceived quality of that interaction while their eye movements were tracked. Overall, participants rated the interaction quality with familiar and unfamiliar confederates similarly. They also, on average, looked longer at themselves than at the confederate. An interaction between familiarity and talker indicated that in the unfamiliar condition, participants looked longer at their own head region specifically. Linking social cues with interaction quality, a correlation between quality ratings and looking time showed that when participants looked at the confederate, in the familiar condition, longer looking times were related to a higher social interaction quality rating. This suggests that social cues used to judge interaction quality may depend on partner familiarity, such that cues from familiar partners are attended more than cues from unfamiliar ones.

**4-21 Standing out from the crowd: Both social information and cue numerosity affect attention in multi-agent contexts Francesca Capozzi**, McGill University, Andrew Bayliss, University of East Anglia, United Kingdom, Jelena Ristic, McGill University.

Humans often face multiple and conflicting social cues, like several people looking in different directions. How do such cues affect our attention? One possibility is that cue numerosity guides attention, in that we follow the gaze direction displayed by the majority. Another is that attention is biased by social information, in that we follow the gaze of individuals deemed important in a particular context. To test this, we first exposed participants to a gaze-cuing procedure in which stimulus faces could carry high (i.e., systematically cuing/not cuing the target) or low social information (i.e., cuing the target at chance level). Then, in a group-cuing procedure, displaying three faces simultaneously, we independently manipulated cue

numerosity (i.e., whether the target was cued by one or two faces) and social information (i.e., whether the target was cued by faces carrying high or low social information). Results indicated that responses to targets cued by more faces were facilitated relative to responses to targets cued by fewer faces. However, this was modulated by social information such that responses to targets cued by individuals carrying high social information were facilitated the most regardless of numerosity. Thus, both numerosity and social information guide attention in multi-agent settings.

**4-22 Stereotype maintenance through approach-contingent information gain Suraiya Allidina**, University of Toronto, William Cunningham, University of Toronto.

Research on stereotype formation has proposed a variety of reasons for how and when inaccurate stereotypes arise, focusing largely on accounts of motivation and cognitive efficiency. Here, we instead consider how stereotypes are maintained through the asymmetrical manner in which information is sampled from the environment. Examining group-based generalizations in the context of approach/avoid decisions, we propose that initial negative interactions with a few group members cause subsequent avoidance of the entire group, even when these interactions are unrepresentative of the group overall. Such avoidance leads to the maintenance of stereotypes in two ways. First, since information gain is contingent on approaching the target, avoidance causes a failure to update one's beliefs about the group even when the group has drastically changed. The results of 9 experimental studies provide support for this first hypothesis, demonstrating that approach-contingent information gain results in failures to accurately update beliefs about initially negative groups. Second, we apply computational models of reinforcement learning to our data and find that avoidance has direct reinforcing effects, with the very act of avoidance serving to reinforce the belief that the avoided person is negative. We discuss the implications of these results for stereotype reduction.

**4-23 Salience of racial distinctiveness enhances expectation of social exclusion: An ERP analysis Michael Jenkins**, McMaster University, S.S. Obhi.

A popular experimental paradigm, called Cyberball, has been used to induce social inclusion or exclusion under controlled settings. Participants engage in

an online virtual ball-throwing game with ostensibly real co-players who are actually computer-controlled, and may include or exclude the participant. ERP studies using this paradigm have demonstrated a reliable enhancement in the P3b, specifically when participants receive the ball during a period of exclusion. This is believed to reflect context-updating mechanisms in response to an event (receiving the ball) that does not match the participant's representation of their social status (being excluded). Here, we employed the Cyberball task, but we manipulated the displayed skin-tone of the participant and the co-players. For some participants, the skin-tone of the co-players differed from their own (e.g., White skin-tone participant and Brown skin-tone co-players); for others, skin-tone was the same. Standard exclusion effects were seen when skin-tone matched, whereby the P3b was enhanced only when receiving the ball during periods of exclusion. However, when skin-tone differed, the P3b was enhanced whenever receiving the ball, even during periods of inclusion. Further analysis explored whether the order of social inclusion/exclusion (i.e., included first and then excluded, or excluded first and then re-included) modulates these effects.

**4-24 Do Drivers with High Scores on an Autism Spectrum Disorder (ASD) Diagnostic Exhibit Performance Deficits when Engaging in a Social Secondary Task? Alison Dodwell**, University of Guelph, Lana Trick, University of Guelph.

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by symptoms such as repetitive behaviours, social communication deficits, and attentional abnormalities. Nonetheless, many young adults with these symptoms are capable of independent living. Driving is a critical step towards independence for any young adult, but it places demands on attention because it involves coordinating multiple tasks (steering, braking, hazard response). Furthermore, given that individuals with symptoms of ASD may have special difficulties with social tasks, we predicted that in-vehicle conversation would interfere more with their driving than it would for others. The Adult Autism Quotient (AQ) was used in mass testing on the university participant pool to create a community sample of 60 licensed drivers who either scored in the top or bottom 15% of the scale (30 each). These drivers participated were tested in a high fidelity driving simulator in three conditions (order was counterbalanced).

Participants either simply drove, drove while listening to an audiobook, or drove while carrying on a hands-free phone conversation. The simulator measured driving speed, steering, and braking times to pedestrian and vehicle hazards. We also assessed mental workload and self-perceived performance using self-report measures. Results revealed effects of both driving condition and ASD symptomatology.

**4-25 Zeigarnik and von Restorff: The memory effects and the women behind them Colin M. MacLeod, University of Waterloo.**

Bluma Zeigarnik (1927) first reported that memory is better for incomplete than for completed tasks, a phenomenon known since then as the Zeigarnik effect. Hedwig von Restorff (1933) first reported that memory is better for isolated pieces of information, a phenomenon known since then as the von Restorff effect. I will outline the evidence for two of the most famous empirical findings in memory research and present brief biographical sketches of the researchers behind them.

**4-26 Production benefits studying texts for tests Daniel Todorovic, University of Waterloo, Colin MacLeod, University of Waterloo.**

Memory for words spoken out loud has been shown to be superior to memory for words read silently, a finding called the production effect. This finding has significant implications in various domains – such as students studying for an exam, adults reading a furniture assembly instruction manual, lawyers reviewing evidence for a case, and so on. And yet the vast majority of the production effect literature has been concerned with retention of word lists and not more ecologically valid materials. With this in mind, we examined the production effect with more “real world” materials. We had participants read two articles one might find in a textbook (approximately 1900 words each), with one article read entirely aloud and the other read entirely silently. Results show that a production effect was obtained, although it was stronger for one of the two articles. This finding is discussed in terms of its applied and theoretical significance, as well as its relevance to possible boundary conditions of the production effect. We also will be examining what happens when participants choose for themselves what to read aloud, as opposed to being directed what to read aloud.

**4-27 The pupillometric production effect: Measuring attentional engagement during a production task Hannah Willoughby, Memorial University of Newfoundland, Jenny Tiller, Memorial University of Newfoundland, Kathleen Hourihan, Memorial University of Newfoundland, Jonathon Fawcett, Memorial University of Newfoundland.**

The production effect refers to the finding that words read aloud are better remembered than words read silently. This is often attributed to the aloud items being associated with a distinctive “production trace” that can serve as a strategic retrieval cue at test. The present experiments aim to challenge the sufficiency of this account, using pupil diameter as an unobtrusive psychophysiological index of attentional engagement: By measuring changes in pupil diameter during a typical production task, we are able to gauge variation in mental effort during each trial type. In our studies, we identify a pupillary production effect characterized by greater pupil dilation for aloud than silent trials; specifically, pupil dilation increases following an aloud instruction but drops off precipitously following a silent instruction. The magnitude of this pupillary production effect is itself correlated with the behavioural production effect measured using recognition memory. We conclude from these results that participants engage differently with items that are read aloud compared to items read silent and the production effect may be driven in part by such attentional differences.

**4-28 Exploring cognitive maps using sketch maps Melissa M. Nantais, Brescia University College, Western University, Chantelle Cocquyt, Brescia University College, Western University, Jennifer E. Sutton, Brescia University College, Western University.**

Robust individual differences exist in the ability to form a cognitive map of a novel environment, yet we still do not understand why these differences occur. Periodic testing that assesses current knowledge of a virtual environment during exploration has been found to improve the accuracy of participants’ cognitive maps when an onscreen map is provided (Parush et al., 2007). However, it is not clear whether the same results would occur without the aid of an onscreen map. The current study investigated whether having participants draw a map periodically while exploring the virtual environment Silcton would improve cognitive map accuracy. Participants

explored Silcton and were stopped every 4 minutes to either sketch a map of Silcton, identify items seen in Silcton, or colour an unrelated picture, and a baseline group was not stopped during exploration. All groups drew a final sketch map and completed a direction estimation task that assessed their spatial memory for Silcton. It was predicted that sketching a map periodically during exploration would lead to more accurate spatial memory for Silcton versus other conditions, and furthermore, that sketching maps periodically during exploration would document the development of cognitive maps during learning. Preliminary results will be discussed.

**4-29 Drawing Pictures at Encoding Enhances Memory in Healthy Older Adults and in Individuals with Probable Dementia Melissa Meade,** University of Waterloo, Myra Fernandes, University of Waterloo.

We measured the effectiveness of drawing pictures at encoding to boost memory in individuals with probable dementia. Participants were given 40 seconds to either draw a picture of, or write out, each word from a set of 30 common nouns. Memory performance was compared in a group of healthy older adults to individuals with probable dementia (MMSE/MOCA range 4 to 26). In 2 experiments we showed that both healthy older adults and probable dementia participants' written recall, and visual recognition, was higher for words that were drawn than written during encoding. We suggest that incorporating visuo-perceptual information into memory, by drawing pictures during the encoding phase, enhanced memory by increasing reliance on visual-sensory brain regions, which are relatively intact in normal aging and dementia. Our findings suggest that drawing is a valuable technique leading to measurable gains in memory performance, and remarkably, is effective in helping individuals with probable dementia preserve valuable episodic memories.

**4-30 Recalling the perceptual elements of episodic events Rebecca Scheurich,** McGill University, Caroline Palmer, McGill University. Signy Sheldon, McGill University.

Episodic memory retrieval involves binding together the various details of a past event into a single memory representation. Contemporary research has linked visual imagery to the ability to construct memory representations. This link leads to the question of whether visual content from a past event is

recruited to a greater extent than other perceptual content, such as auditory information. In the current study, participants learned a series of narratives that contained the same content but differed in whether this content was presented through the visual or auditory modality. When participants later recalled narratives that presented content through the visual modality, they tended to recall details through the visual modality, indicating that narrative information was being reactivated at retrieval. When participants recalled narratives that presented content through the auditory modality, they were more likely to recall details in the incorrect modality compared with when presented content through the visual modality, indicating that information was being retrieved at a broader (non-perceptual) level. These findings highlight how perceptual components of a memory can be recalled by either reactivation or integrative memory processes.

## **Speaker Session #5: Saturday June 8, 4:05pm - 5:20pm**

**5-01 On the stimulus-linked affective consequences of visual search and Go-No-go tasks: Feeling suppressed or merely conflicted? Elizabeth, M. Clancy,** University of Guelph, Amanda, C. Wyman, University of Guelph, Mark, J. Fenske, University of Guelph.

Stimuli that are ignored, or from a response are withheld, subsequently receive more negative affective ratings than targets of attention/response. Leading accounts propose that such stimulus-devaluation effects result from negative affect elicited when attention- or response-related inhibition is applied to distracting or otherwise-inappropriate stimulus/response representations. Thus, the inhibition not only helps to resolve conflict between competing neurocognitive representations, but also has a lingering negative impact on the value of associated stimuli. However, recent results suggest that stimulus/response conflict may itself elicit negative affect. This raises important questions about the extent to which the stimulus devaluation effects previously attributed to inhibition may actually reflect the affective consequences of cognitive conflict, per se. Thus, we used modified versions of visual-search and Go/No-go tasks to obtain affective ratings of stimuli that had just appeared under experimental conditions designed to vary in the level of stimulus/response conflict and the need for attention- or response-related inhibition. Our results revealed no evidence

that conflict leads to stimulus devaluation. Instead, stimulus ratings appear to critically depend both on whether an item has been subjected to inhibition (à la devaluation-by-inhibition), and the total number of times it has previously been the focus of attention/response (à la mere exposure).

5-02 **Proportion Congruent effects do have something to do with congruency: Adaptation to item-specific conflict frequency in the Stroop task** Giacomo Spinelli, University of Western Ontario, Stephen Lupker, University of Western Ontario.

A robust finding in the Stroop literature is that congruency effects are larger for color words presented mainly in their congruent color than for color words presented mainly in incongruent colors. However, the nature of this item-specific proportion congruent (ISPC) effect is debated, as it might be produced by either a conflict adaptation strategy (e.g., prepare for conflict when the word RED appears) and/or a more general learning mechanism of stimulus-response contingencies (e.g., prepare to respond blue when the word RED appears). Thus far, attempts to directly dissociate the two processes appear to indicate no role for conflict adaptation, at least in situations in which contingency learning is also possible. We re-examined this conclusion in a Stroop task in which contingency learning and item-specific conflict frequency were manipulated partially independently. In addition to a contingency-learning effect emerging from stimuli matched on conflict frequency, a conflict-adaptation effect also emerged on stimuli matched on contingency. This result challenges not only the contingency learning account of the ISPC effect, an account which denies the existence of conflict adaptation, but also accounts that assume that such a mechanism does exist but is not used when contingency learning is also possible.

5-03 **What colour is under? Modelling the ebb and flow of associations in contingency learning.** Bradley Smith, University of Manitoba, Randall Jamieson, University of Manitoba.

Instance theory offers a fundamentally different understanding of associative learning than connectionist theories. With instance theory, associations are exhibited as a corollary of retrieval rather than being directly represented in memory. To study this account, I developed an instance-based learning model and applied it to the materials and

procedures from a recent study of colour-word learning by Lin and Macleod (2018). The theory fits their data. Beyond fitting the data, simulations with the model also predicted a subtle but persistent dissociation in the rates at which people unlearn associations in the Lin and MacLeod task. I report experimental data that confirms the dissociation. The theory gives a precise mechanistic account of contingency learning and supports a closer and more precise analysis that can help researchers identify and inspect aspects of people's experimental behaviour that have thus far escaped detection and scrutiny.

5-04 **Red Strengthens Response Inhibition Over Other Colors in a Visual Stop Signal Paradigm** \* Gifty Asare, York University.

An intrinsic color hierarchy affects visual processing by modulating response inhibition such that, response inhibition but not execution is affected differently by red and green colored stimuli. To further study the role of color in cognitive processes, our first aim was to identify whether this effect was due to color opponency, color space, or specific to red/green by testing red, green, yellow and blue. Our second aim was to determine if color modulation of response inhibition was contingent upon the color change occurring on the target. In the first experiment, participants performed a modified stop signal task (SST) with red and green colors and we replicated stop signal reaction times being faster for red compared to green stimuli. In the second experiment, participants were tested with yellow and blue stop signals and no difference was observed in stop signal reaction times. In a third experiment, we compared all four colors within subjects. Green stop signals were the slowest followed by blue, yellow, and then red. Post-hoc testing showed that red stop signals were significantly faster than green ones supporting that red facilitates and green delays response inhibition. Therefore, color modulation of response inhibition is dependent upon the red/green color opponency.

5-05 **Cueing color imagery: A critical analysis of imagery-perception congruency effects** Shailee Siddhpuria, McMaster University, Brett A. Cochrane, McMaster University, Bruce Milliken, McMaster University.

This study focuses on the relation between mental imagery and visual perception, a long debated topic in experimental psychology. Wantz, Borst,

Mast, and Lobmaier (2015) described a series of experiments demonstrating that color imagery in response to a cue benefits subsequent color perception in a forced-choice color discrimination task. We examined the Wantz et al. study further, with a particular focus on whether their method warrants strong inferences about the role of color imagery in color perception. In Experiments 1-3, we replicated the imagery effect reported by Wantz et al., but also showed that it was sensitive to cue-target contingencies, and did not occur when the imagery and response dimensions were orthogonal; that is, when participants imagined a color but responded to the position of a target feature. In Experiments 4-6, we pursued this orthogonal imagery/response method further, and confirmed that a cued imagery effect does not occur for lone targets, but does occur for singleton color targets embedded amidst homogenous color distractors. Overall, the results strongly suggest that endogenously cued imagery can influence visual search performance.

**5-06 The dual strategy model in social bias. Émilie Gagnon-St-Pierre,** Université du Québec à Montréal, Henry Markovits, Université du Québec à Montréal.

The dual strategy model suggests that people have access to two different processes to evaluate the logical validity of an inference. They can either use the statistical strategy (SS) and estimate the likelihood of a conclusion or they can use a counterexample strategy (CES) to examine the presence of examples which invalidate the conclusion. (Markovits & al, 2013; 2015; 2017, Vershueren & al, 2005, Vershueren & Schaeken, 2010). Although this model was first elaborated in the context of conditional reasoning, recent findings suggest it represents a broad distinction in the way people process information, which also applies to social reasoning. In three studies we examined how this model applied to known social bias such as self-serving bias (Study 1) essentialist bias (Study 2) and racism (Study 3). In all studies, participants using a SS showed a higher level of bias than those using a CES. In the third study, this was the case even while controlling for their need for closure (Roets & Van Hiel, 2011). Those results support the hypothesis of an important distinction in reasoning which should be considered to understand individual differences in social bias.

**5-07 The role of the need for cognition and cognitive reflection in math anxious students' mathematic achievement Fraulein Retanal,** University of Ottawa, Erin Maloney, University of Ottawa.

While it is clear that math anxiety is negatively related to math achievement, it is less clear why. We propose the novel theory that math anxiety (MA) is, in part, related to lower math achievement due to higher-math-anxious students' unwillingness to struggle with complex problems and reflect on their answers. Participants completed measures of MA, general anxiety, math ability, the Need For Cognition scale (NFC) and the Cognitive Reflection Test (CRT). NFC refers to an individual's tendency to engage in and enjoy activities that require thinking. The CRT is designed to measure a person's tendency to override an incorrect "intuitive" response and engage in further reflection to find a correct answer. While there was a significant relation between MA and math achievement, even after controlling for general anxiety and gender, the strength of this relation decreased when NFC was added to the model. Additionally, MA significantly predicted performance on the CRT. This study provides evidence that MA is associated with a lower NFC and less reflective thinking. This reluctance to struggle through complex problems and reflect on answers may explain, in part, the relation between MA and math achievement.

**5-08 Sex differences in curve tracing Daniel Voyer,** University of New Brunswick, Benjamin R. MacPherson, University of New Brunswick.

Curve tracing is believed to reflect primarily visual attention processes. However, our contention is that it also taps into the distinction between local and global processing and, as such, it should produce a male advantage. Accordingly, we conducted two experiments to examine this possibility. In Experiment 1, 35 males and 52 females completed a curve tracing task whereas in Experiment 2, 60 males and 59 females completed both a curve tracing task and the Navon (1977) local-global task. In both experiments, a male advantage emerged for accuracy in the curve tracing task. The expected effect of distance emerged both on accuracy and response time, although the distance effect was unaffected by sex in both experiments. On the Navon task (Experiment 2), the global precedence effect was replicated on both accuracy and response time. Males were

significantly faster than women in the local condition but not in the global condition. Finally, the correlation between curve tracing performance and Navon task performance was significant on accuracy and response time. Results are interpreted in terms of the local/global distinction and their implications for models suggesting a male preference for holistic processing compared to piecemeal processing preference in females.

**5-09 Spatial processes and performance on numerical and mathematical tasks: Where do the relations exist?** Andie Storozuk, University of Ottawa, Sabrina Di Lonardo, Carleton University, Heather Douglas, Carleton University, Rebecca Merkle, Carleton University, Helena Osana, Concordia University, Sheri-Lynn Skwarchuk, University of Winnipeg, Chang Xu, Carleton University, Jo-Anne LeFevre, Carleton University, Erin Maloney, University of Ottawa.

People vary in their ability to generate, recall, maintain, and transform visual-spatial information. Those with stronger spatial ability perform better in mathematics; a relation that occurs throughout development, across various tasks, and helps predict individuals' success in STEM careers. This study aims to better understand precisely where the relations between mathematics and spatial processing exist.

Children (N=342; 192 girls) in grade 2 or 3 completed a series of tasks to assess various numerical, mathematical, and spatial abilities. Spatial processing was measured with a spatial span task and a matrix-reasoning task; respectively, these assess memory for visual-spatial sequences versus visual-spatial reasoning. We conducted multiple regression analyses, predicting performance on a variety of numerical and mathematical tasks with the spatial measures.

Performance on the spatial span and matrix-reasoning tasks related to arithmetic fluency, math problem solving, number line, and math symbol knowledge tasks. However, only the spatial span task was related to performance on the number ordering task. Neither spatial span nor matrix-reasoning related to performance on the symbolic comparison task. By better understanding where the link between mathematical and spatial abilities lies, we come closer to understanding how strengthening performance on spatial tasks may strengthen performance in mathematics, and vice versa.

**5-10 How to index subitizing performance: Comparing the concurrent validity of individual subitizing range and subitizing slope measures in predicting kindergarten numeracy** Marcie Penner, King's University College, Aaron Cecala, Western University, Michael Moes, D King's University College, Rylan Waring, University of Guelph.

Individual differences in subitizing, the ability to enumerate small sets without counting, are related to numeracy skill (LeFevre et al., 2010). As a result, subitizing has been used as a predictor of numeracy skill in children (Penner et al., in press). Leibovich-Raveh et al. (2018) propose using a novel measure of performance termed the individual subitizing range (ISR), combining previous sigmoid and bilinear fitting methods, which reflects the upper bound that an individual can subitize. One possible concern is that ISR will demonstrate less variability (Leibovich-Raveh et al.'s values ranged from 2 – 5 in children) than some other measures of subitizing, such as RT slope as a function of set size (i.e., the increase in response time to enumerate each additional item), and thus less predictive power for numeracy. Here we tested the predictive power of ISR and subitizing slope concurrently in kindergarten (N = 154 children). Both ISR and subitizing slope accounted for significant unique variance in numeracy skill (i.e., KeyMath Numeration subtest), even after controlling for processing speed. Thus, our concerns were unwarranted regarding the predictive power of ISR for kindergarten numeracy outcomes. The two subitizing measures in combination, however, accounted for considerably more variability in numeracy scores.

**5-11 Within-individual oscillatory patterns in mind wandering and attentive states are associated with functional life outcomes** \* Effie Pereira, McGill University, Canada, Jelena Ristic, McGill University

Mind wandering has been linked with both detriments (e.g., poor task performance) and gains (e.g., enhanced creativity) in behaviour; however, the factors that drive such disparate consequences remain poorly understood. Recently, we demonstrated that individual differences in trait-levels of attentional control predicted academic performance. In the present study, we examined whether individual variability in mind wandering and attentive episodes within tasks may also be informative in predicting the same life outcome. One hundred participants performed

several mind wandering tasks and their academic performance was measured. For each individual, mind wandering was assessed for repeating temporal patterns across tasks, with participants clustering into distinct groups based on the strength of these temporal patterns. Those with strongly repetitive patterns, who oscillated rhythmically between mind wandering and attentive states, were found to have lower academic performance, whereas those with weakly or no repetitive patterns, who showed no consistent oscillations between mind wandering and attentive states, had greater academic performance. Thus, within-individual variability in mind wandering and attentive states can be used to tease out meaningful differences in real world outcomes, and as such may be a useful determinant in understanding how mind wandering exerts both negative and positive effects on behaviour.

**5-12 The Wandering Eye: A tool for the objective and reliable measurement of mind-wandering at high temporal resolutions \* Geoffrey Harrison**, Queen's University, Phillip Aucoin, University of Ottawa, Jordan Poppenk, Queen's University, Daryl E. Wilson, Queen's University.

Mind-wandering (MW) describes our mind's natural fluctuations between task and non-task focus. Despite evidence that the brain operates at rapid timescales, MW research suggests that we switch between internal and external focus at a slow meandering pace. This is evidenced by existing paradigms used to assess MW, which measure performance at low temporal resolutions, rely exclusively on introspective self-report to determine the occurrence of MW, and arbitrarily defining the duration of MW episodes. We present a tool for the objective and reliable measurement of MW at a high temporal resolution. Participants track a single target dot while their eye positions are recorded at 1000Hz and MW is objectively defined as failure to track the target. Critically using a test-retest design, our task reliably measures the occurrence and duration of MW episodes. Further we show MW occurs at rapid timescales, is highly idiosyncratic and that participants are often unaware of their performance failures. These findings question the validity of current methods used to assess MW and its impact on task performance.

**5-13 Focus on your breath? The influence of mindful breath-counting on flow experience and performance in a game-like cognitive task. \* Jeremy**

**Marty-Dugas**, University of Waterloo, Colm Williamson, University of Waterloo, Daniel Smilek, University of Waterloo.

There has been considerable interest in the influence of mindfulness practices on cognition and performance. However, because mindfulness practices often involve focusing one's attention on the breath, it remains unclear whether any benefits conferred by the practice are due simply to the act of focusing attention, or specifically to the act of focusing attention on the breath. To address this issue, we investigated the influence of a mindful breathing task (i.e. breath-counting, Levinson et al., 2014) on the experience of flow (i.e. Deep, Effortless Concentration; DEC) and performance during a game-like task. Critically, however we also included a condition that was closely matched to the breath counting task, where participants instead focused their attention on counting the occurrence of a rhythmic external event (i.e. a cross-counting task). In a large sample of participants, we found that those who engaged in 15-minutes of mindful breath-counting did not experience significantly more DEC or perform significantly better on the game-like cognitive task than those who engaged in the cross-counting. These results suggest that focusing attention specifically on one's breathing may not confer any special benefit above and beyond focusing attention in general.

**5-14 Are standing desks as outstanding as they seem? Emilie Caron**, University of Waterloo, Brandon C.W. Ralph, University of Waterloo, Micheal Chan-Reynolds, Trent University, Jonathan S.A. Carriere, Bishop's University, Derek Besner, University of Waterloo, Daniel Smilek, University of Waterloo.

Intriguing findings obtained by Rosenbaum, Mama, and Algom (2017, Psychological Science, 28, 1864-1867) suggest that variations in posture (sitting vs. standing) can influence basic cognitive processes. Specifically, they showed that when the Stroop task – which involves naming the hue of a colour word when the hue and word meaning are congruent or incongruent – is completed while standing, the difference in response times (RTs) between congruent and incongruent trials (i.e., the Stroop effect) is smaller than when the task is completed while sitting. In an attempt to replicate Rosenbaum et al.'s findings, we conducted four experiments that included large samples and were conducted across two institutions. Across

experiments we also explored the impact of adding neutral trials, changing the response mode (vocal vs. manual) and varying the nature of the standing posture (e.g., standing on one foot vs. two feet). While all four experiments yielded the standard Stroop effect, we were unable to detect any influence of posture (sitting vs. standing) on the magnitude of the Stroop effect. Taken together, our studies provide no evidence to support the notion that posture (sitting vs. standing) influences the magnitude of the Stroop effect.

**5-15 The Cognitive Causes of Trait Boredom Dana Gorelik**, York University, John Eastwood, York University.

Trait boredom is associated with a host of psychosocial problems including poor job and school performance, pathological gambling, substance abuse, accidents, depression, anxiety and anger. It is therefore critical to understand what gives rise to trait boredom. One theory suggests that cognitive impairments might be the root cause of trait boredom, and there is some evidence to support this. For example, those high on trait boredom perform poorly on attention tasks, and report difficulties with executive function. However, performance on cognitive tasks beyond attention has not been examined. This hinders our understanding of whether people high on trait boredom indeed have broader cognitive impairments or if they have a problem more specific to attention. Also, current measures of trait boredom are limited, further hindering our ability to understand this relationship. We addressed these gaps by first evaluating and revising a new measure of trait boredom. Armed with a psychometrically sound measure, we examined the relationship between trait boredom and performance on executive function, processing speed and attention tasks. This study will contribute to our understanding of the precise relationship between cognition and trait boredom.

## **Speaker Session #6: Sunday June 9, 10:15am – 11:30am**

**6-01 Failed it: Using event-related spectral perturbations to examine performance on a challenging memory task Perry Dykens**, University of New Brunswick, Jenna Wright, University of New Brunswick, Kenneth Troy Harker, University of New Brunswick.

This study sought to determine if failures in recognition memory can be measured using event-related spectral perturbations (ERSP) in response to a challenging test of recognition memory. Previous work by Harker and Connolly (in preparation) has demonstrated that as memory performance declines, so too does the amplitude of event-related potential (ERP) responses. As ERSPs can expose features of event-related brain activity not apparent in ERP waveforms, we re-analysed the data from a recognition memory test for faces for which participants had a low behavioural accuracy and for which ERP responses were not different between old and new faces. We found that for both old and new faces, ERSPs showed decreased alpha activity at 8-12 Hz. These results are discussed in relation to the behavioural performance on this task, results obtained from ERP, and the potential use of neurophysiological responses to predict cognitive performance and future applications of neurophysiology in the clinical assessment of memory.

**6-02 An ERP study of encoding and recognition memory for pictures of common objects Asiya Gul**, Wilfrid Laurier University, Jeffery Jones, Laurier Centre for Cognitive Neuroscience.

Studies suggest that recognition memory relies on two distinct processes, familiarity and recollection. To better understand the neural correlates of familiarity and recollection, we recorded EEG during the encoding and recognition phases of a memory task. During encoding, subjects viewed pictures of common objects and later during a recognition test phase they made remembered/not-remembered judgments about previously seen (old) pictures along with some new pictures. During the encoding phase, a comparison between the subsequently remembered (SR) and subsequently-not-remembered (SNR) stimuli revealed marginally significant subsequent memory effects at the FN400 and LPC components. The FN400 effect in the absence of repetition of the stimuli indicates that it was driven by conceptual fluency. Subsequent recognition was observed to correlate with a “fluency effect” (SR were more negative than SNR stimuli) during encoding. The event related potentials (ERPs) results suggest that the fluency effect during the encoding phase significantly distinguished SR stimuli from SNR stimuli, indicating that processing during encoding determined the stimuli to-be-remembered during the recognition test. Additionally, the fluency effect was found to be independent of the old/new

effect. During the recognition test, the FN400 component correlated with the behavioral indicators of recollection and appeared to benefit from repetition.

**6-03 The growing computational analysis of selective impairments in amnesia: Extending to dissociations between word-stem completion and recognition Evan Curtis, Booth University College.**

The memory impairment observed in anterograde amnesia is selective, affecting some behaviours but not others. For example, amnesic patients show notable impairment in recognition memory but near-normal levels of priming in word-stem completion tasks. The standard interpretation of the empirical dissociation is that the two tasks rely on separate memory systems. A competing interpretation is that the dissociation, and others like it, is the result of a global deficit that manifests itself differently in various experimental tasks. Many computational analyses have accommodated dissociations between a variety of different tasks. However, dissociations involving word-stem completion have remained elusive. I simulate the dissociation in MINERVA2, a classic instance-based model of memory. The analysis assumes that amnesia reflects a global deficit to the quality of encoding, which interacts with the different requirements of the behavioural tasks to produce the dissociation. In conjunction with the successes of the model in accommodating other empirical dissociations, as well as the success of other models, I argue that single-system computational analyses are painting an increasingly complete picture of an empirical database traditionally thought to provide strong evidence for a multiple-system perspective of memory.

**6-04 Semantic versus perceptual attention impacts encoding mechanisms in hippocampus and prefrontal cortex \* Sagana Vijayarajah, University of Toronto, Margaret Schlichting, University of Toronto.**

Recent work has shown that attentional states influence both hippocampal (HPC) activation patterns and memory behaviour. However, the specific mechanism by which attention influences memory remains unclear. We propose that attending to semantic vs. perceptual information may engage different HPC subregions: specifically, semantic attention may recruit anterior HPC (aHPC) and medial prefrontal cortex (mPFC), promoting the

integration of new information into pre-existing knowledge. Here, participants viewed blocks of storybook illustrations that varied in both artist style (perceptual) and story content (semantic) during fMRI scanning. We manipulated participants' attention to artist or story across blocks by asking them to find cued repeats. Afterwards, participants completed a memory test. Behaviourally, story attention was associated with not only better memory (hits) for studied illustrations, but also more false alarms to lure illustrations depicting studied stories. Whole-brain analyses at encoding revealed a broad network of regions—including aHPC and mPFC—that were more engaged during story than artist attention. Furthermore, individual differences in aHPC activation during story attention were positively correlated with memory for illustrations. Our findings suggest semantic vs. perceptual attention engages aHPC encoding to incorporate new memories into prior story knowledge, consequently benefiting recognition at the expense of detailed memory for experience.

**6-05 Cortical activity during Encoding and Recognition: a time-frequency analysis Asiya Gul, Wilfrid Laurier University, Jeffery Jones, Wilfrid Laurier University.**

The formation of a memory trace depends on the depth of the processing during encoding and the level of interaction between encoding and retrieval patterns. To better understand the mechanisms of encoding, we analyzed EEG data from two separate experiments with similar paradigms but different stimuli. In each experiment, there was a study session where subjects viewed pictures and a test session where subjects made remembered/not-remembered judgments about previously seen pictures mixed with new pictures. The stimuli in Experiment 1 were meaningful pictures of common namable objects whereas in Experiment 2 the stimuli were pictures of fractals, which were complex geometric objects that were unfamiliar and difficult to unitize. Time-frequency analysis demonstrated that stronger event-related de-synchronizations in the alpha and beta bands reflected successful encoding as well as retrieval during semantic memory processing. Using independent component analysis decomposition, we found that different types of stimuli engaged different EEG sources, which is in line with the level of processing framework theory and the encoding specificity principle that claim that different levels of encoding reflect engagement of different mechanisms and that the retrieval of an encoded

item requires reactivation of the areas of the brain that were involved and active during encoding.

6-06 **Using response demands to test a Bayesian model of the crossed-hands deficit** Kaian Unwalla, McMaster University, Daniel Goldreich, McMaster University, David I. Shore, McMaster University.

When the hands are crossed over the midline, performance on a tactile temporal order judgement task (TOJ) is impaired. This crossed-hands deficit occurs because of a conflict between an internal (somatotopic) reference frame and an external (visual) reference frame (Shore, Spry, & Spence, 2002). Biasing individuals to the internal reference frame (by demanding left hand vs. right hand responses) versus the external reference frame (by demanding left side vs. right side responses) alters the magnitude of the deficit (Cadieux & Shore, 2013). External-based responses increase conflict, and produce a larger deficit. The present study used this manipulation to test a Bayesian model that estimates the relative weighting of the internal and external reference frame during a crossed-hands TOJ task (Badde, Heed, & Röder, 2015). The model provides a better understanding of the tactile TOJ task, and how various manipulations, like response demands, change reliance on the two reference frames. Participant responses were provided in an internal reference frame, an external reference frame, or using button presses (a hybrid of internal and external). Preliminary results showed an increased external reference frame weight when responses were made using the external reference frame response demand.

6-07 **Neural BEAGLE: An analogue to the BEAGLE algorithm implemented in the Semantic Pointer Architecture** Eilene Tomkins-Flanagan, Queen's University, Douglas Mewhort, Queen's University.

We present an implementation of the BEAGLE algorithm (Jones & Mewhort, 2007) using the Semantic Pointer Architecture (SPA; Eliasmith, 2012). BEAGLE generates a semantically rich lexicon of words from text corpora. Lexica generated using BEAGLE have been employed in models of semantic memory tasks that closely fit human performance. We take BEAGLE as a process model for word learning, making specific claims about information encoding. The SPA is applied as a constraint on the algorithm, forcing it to conform to the practical limitations of a biologically plausible neural

substrate. The constraint thus grounds and reshapes BEAGLE's modelling claims. Our method, conversely, gauges the SPA's performance on a human-scale semantic learning task, where prior, the SPA has only been employed on small-scale problems. We evaluate our implementation's performance with respect to the original BEAGLE algorithm and a version modified according to the constraints of the SPA. Mutually constraining psychological and neural models answers directly Hebb's (1958) call to integrate lines of evidence in the neurobiological and psychological sciences. Furthermore, it enables us to discuss concrete problems of implementation and scaling for process models that may describe; and so that they may better describe; mechanisms of cognition actually present in the brain.

6-08 **Representations in a deep-network model of visual cortex** Bryan Tripp, University of Waterloo.

Computational models can be useful for understanding how neural mechanisms relate to brain function. However, computational neural models are usually only capable of simple behaviour. Deep networks, in contrast, make sophisticated decisions based on naturalistic stimuli, so they may be a good starting point for brain models with more realistic function. I recently developed a deep-network architecture that closely matches the architecture of primate visual cortex. The model has over 100 layers, corresponding to different cortical layers within 31 different visual areas. I will show preliminary results on deep representations that are formed by training the network to perform complex tasks. The model can accept as input the same stimuli that are shown to humans in visual psychophysics tasks, and it can be probed in detail to understand how it makes decisions. In the future, the model's anatomical grounding should allow ablations that model specific strokes, as well as allowing comparison of specific layers' activity with fMRI and EEG data. Future work will incorporate additional neural mechanisms, to expand the scope of visual phenomena that the model can reproduce.

6-09 **Topographic Organization in Artificial Neural Networks For Application in AI and Human Brain Studies** Abdolreza Joghataie, University of British Columbia, Goldin Joghataie, University of Toronto.

In this paper, an artificially intelligent processing system is considered to behave similar to a minicolumn or ganglion in the natural brain, with input (afferent), interconnecting, and output (efferent) layers of neurons. The aim is to study the gradual formation of specialization within neural pathways, the allocation of information, and correlation between the stimulus to afferent neurons and the corresponding response from each efferent neuron. For illustration, a 3-layered feedforward neural network is used. The study is expected to have application in modelling the human brain, quality control, and monitoring information processing within the AI systems of autonomous robots.

**6-10 Reducing the Number of Nonnaïve Participants in your Mechanical Turk Samples Ethan Meyers**, University of Waterloo, Alexander Walker, University of Waterloo, Jonathan Fugelsang, University of Waterloo, Derek Koehler, University of Waterloo.

Using participants who have been previously exposed to experimental stimuli (referred to as nonnaïveté) can reduce effect sizes. The workforce of Amazon's Mechanical Turk is particularly vulnerable to this problem and solutions are usually cost and time inefficient. Furthermore, previous attempts at solving the problem of nonnaïveté on Mechanical Turk have shown only mixed effectiveness. In response to this problem and its currently underwhelming solutions, we developed a novel participant recruitment strategy for conducting research on Mechanical Turk designed to recruit participants naïve to frequently-used experimental stimuli. We accomplished this by setting a maximum number of HITs participants can have completed on Mechanical Turk in order to be eligible for our study, in this case 50 HITs. To assess the effectiveness of our novel method, we recruited two samples simultaneously, one "naïve" using our recruitment strategy and one "experienced" using standard Mechanical Turk recruitment restrictions (i.e., 95% HIT approval rating). On tasks where using nonnaïve (vs. naïve) participants have been shown to reduce effect sizes (e.g., the Cognitive Reflection Test) we replicate these findings when comparing our samples. We will discuss the pragmatics of our easy to implement and costless recruitment strategy and its present and future limitations.

**6-11 Autonomic sensitivity to anticipation: Observing heart rate deceleration within the dual mechanisms for control framework Michelle A. Dollois**, University of Guelph, Mark J. Fenske, University of Guelph, Christopher M. Fiacconi, University of Guelph.

The dual mechanisms for control (DMC) framework posits that cognitive control can be separated into two distinct modes – proactive and reactive control. Proactive control is characterised by the active maintenance of behavioural goals and involves processes related to anticipation and preparation. In contrast, reactive control is characterized by late engagement of attentional resources and as-needed corrections to behaviour in the presence of conflict. We reasoned that the different temporal profiles of effort investment associated with these two forms of control may be reflected in different patterns of autonomic nervous system engagement. To examine this issue, we measured changes in heart rate during performance of the AX-continuous performance test (AX-CPT) allowing us to disentangle the contributions of each form of control. Across two experiments we replicated the behavioural patterns associated with each control mode and found that subsequent inhibition of a prepared response was associated with greater HR deceleration. Interestingly, changes in HR were not sensitive to conflict in the absence of a prepared response. These results provide new insight into how autonomic activity is related to cognitive control processes.

**6-12 Examining the antecedents to boredom Jhotisha Mugon**, Psychology (Cognitive Neuroscience), University of Waterloo, James Danckert, University of Waterloo.

Boredom is a state of wanting but failing to engage with the world. The contingencies that lead to such a failure include a diminished sense of agency, poor skill-challenge fit, and deficient effort regulation. The following studies report how each of these contingencies influence the experience of boredom. Study 1 operationalised agency in terms of choice and investigated whether having choice led to increases or decreases in boredom. Results suggest that the act of choosing in itself has no consequence on boredom when available options are all equally boring. Study 2 investigated how control over the challenge levels of a task affects boredom with results suggesting that when given control over challenge,

participants are able to modulate their boredom levels. Study 3 looked at the relationship between boredom proneness and willingness to exert effort with results suggesting that boredom prone individuals are less willing to engage in tasks when they perceive them to be more boring. Study 4 used an effort discounting paradigm with results showing that both high and low boredom prone individuals were less likely to choose effortful tasks. Taken together, this work highlights a key role for effort regulation and skill-challenge fit in the experience of boredom.

**6-13 Escaping the woes through flow?: Exploring the relationship between gaming to escape, depression and flow in problematic video-game play**

**Chanel Larche**, University of Waterloo, Peter Tran, University of Waterloo, Mike Dixon, University of Waterloo.

Retrospective self-reports suggest that flow, depression and “gaming to escape” are related to excessive, problematic video-game play (Hull, 2013; Király et al., 2017). Here we seek to ascertain whether players who report gaming to escape are more prone to experiencing flow during gameplay, compared to players who are motivated to game for more primary forms of reinforcement (e.g., arousal-thrill). We also aimed to determine whether this escapism is related to stress, depression and anxiety in everyday life. In an ‘ABBA’ (A = control condition, B = game condition) design, we had 56 gamers play Skyrim, and had them complete ratings of arousal, flow, and positive affect after each condition. Results showed that those who reported gaming to escape had higher ratings of flow and positive affect during gameplay compared to arousal-thrill gamers. Similarly, in a multiple regression analysis, the degree to which players endorsed gaming to escape was a unique predictor of flow in both game (B) conditions, whereas arousal-thrill gaming was not. Importantly, gaming to escape was positively correlated with depression and stress. Findings converge to suggest that flow may play a crucial role in problematic video-game play, particularly among players who game to escape.

**6-14 Measuring Mind-Wandering, Meta-Awareness, and Intentionality: Replicating the Metronome Response Task** Thomas Anderson, University of Toronto, Rotem Petranker, Hause Lin, Norman A.S. Farb.

Meta-awareness (MA) is the process of attending to and appraising the contents of consciousness. MA is critical for certain higher-order attentional

resources, but a research gap exists in how to practically detect MA in time-sensitive contexts. Validation of continuous MA measurements would allow us to better understand its temporal dynamics. We will present data from a large (N=300) multi-site pre-registered replication of the recently-developed Metronome Response Task (MRT). The MRT is a behavioural continuous performance task wherein response variability serves as an implicit indicator of mind-wandering. On random trials, participants are probed to see if they are (i) on-task, (ii) mind-wandering unintentionally, or (iii) mind-wandering intentionally. Results indicate successful replication that increased response variability does track mind-wandering above and beyond control variables. This studies informs the time-course of the sustained-attention cycle (focus/mind-wandering/meta-awareness/shift). Future development and validation of behaviour-free feedback models for MA would have practical application catching inattention in the lab. Modelling meta-awareness is also inherently useful for understanding the neural correlates of consciousness.

**6-15 Moving forward on the search for the neural correlates of consciousness(NCC).** Lukasz Kurowski, Centennial College and York University.

One of the main problems in locating the neural correlates of consciousness rests on distinguishing the neural correlates of contents of consciousness from the neural correlates of state of consciousness. A state of consciousness comes in different modes, such as wakefulness or alertness, drowsiness, dreaming and various altered states of consciousness induced by drugs or other substances. However, each state is filled in with specific contents of consciousness, such as sensorimotor, interoceptive, exteroceptive, affective and cognitive representations. Thus, the NCC for contents and the NCC for state are lumped together. To move forward, my proposal is to first empirically and conceptually isolate the neural correlates for state from contents of consciousness. This could be done by focusing on brain structures that are responsible for generating a state of consciousness, such as the hypothalamus, brainstem and thalamus, based on neurological and anesthesiological research. Second, focus on specific frontal and parietal cortical areas that seem to be responsible for filling in or representing various contents of consciousness within each state of consciousness. Third, focus on the thalamus, which seems to be one of

the pivotal brain structures that links, structurally and functionally, subcortical and cortical structures and cortico-cortical connections.

## **Speaker Session #7: Sunday June 9, 11:30am – 12:30pm**

7-01 **More than a hit: Examining concussion-induced cognitive deficits using event-related potentials** Nathalee Ewers, McMaster University, Courtney Tidd, McMaster University, John Connolly, McMaster University.

Concussions represent both a diagnostic problem and a symptom assessment challenge. These difficulties arise from a lack of reliability in behaviourally-based clinical measures. This study sought to determine whether event-related potentials (ERPs) associated with attention and memory could be used as markers of cognitive deficits induced by concussion. Three paradigms were meant to measure different cognitive functions during an EEG recording. In the continuous visual memory task (CVMT), it was expected that recently-concussed participants would have difficulty allocating resources as demonstrated by a reduction in P300 amplitude and/or a delay in latency. A response-based auditory oddball task was expected to produce similar results; while a response-independent auditory oddball task was expected to reveal problematic automatic attentive processing in the concussed group, demonstrated by deficits in the mismatch negativity (MMN). Abnormalities detected by the oddball task have been observed in this population previously, however prior research on the CVMT showed sensitivity to deficits in participants with moderate to severe traumatic brain injury. The purpose of this study was to demonstrate these same effects in a concussed population. ERP results showed deficits in both attention and visual working memory, suggesting decreased mental efficiency in this population, and may provide evidence of concussion-induced cognitive deficits.

7-02 **Dopamine agonism restores reward responsiveness following chronic stress** \* Steven Lamontagne, Queen's University, Sarah Wash, Queen's University, Savannah Lightfoot, Queen's University, Mary Olmstead, Queen's University.

Anhedonia, “a loss of interest or pleasure” (DSM-5, 2013), is an endophenotype of major depressive disorder (MDD). Chronic stress often

precedes the onset of anhedonia in MDD patients (Hamen, 2005); however, some individuals are resilient to its effects (Southwick et al., 2005). Using the rat-based probabilistic reward task (PRT), I investigated whether chronic mild stress (CMS)-induced reward dysfunction could be restored through enhanced dopamine (DA) signalling, targeting either D1 (SKF) or D2/D3 (amisulpride; AMI) receptors. Thirty-six rats were exposed to Willner's (1992) CMS regime and 24 rats were left undisturbed (no-stress control). Prior to testing in the PRT, animals received systemic injections of saline (1ml/kg; n=12 CMS, n=12 no-stress), low dose AMI (0.5mg/kg; n=12 CMS, n=12 no stress) or SKF (1mg/kg; n=12 CMS). We found a strong inverse correlation between adrenal weight and reward learning following CMS, suggesting that some animals (~40%) are resilient to chronic stress whereas others (~60%) are susceptible. Importantly, this effect was eliminated when CMS animals were treated with AMI or SKF. This is the first study to demonstrate that D2/3 or D1 agonism restores reward responsiveness in animals that are susceptible to chronic stress, pointing to a potential role for DA in treating anhedonia.

7-03 **Synthetic Estrogen and Cognition: Do Time of Oral Contraceptive Ingestion and the COMT Val158Met Polymorphism Affect Working Memory?** \* Laura Gravelins, University of Toronto, Ava Ma De Sousa, University of Toronto, Clara McNamee, University of Toronto, Karla Machlab, University of Toronto, Pascale Tsai, University of Toronto, Leah Velikonja, University of Toronto, Brittany Demircan, University of Toronto, Katherine Duncan, University of Toronto, Gillian Einstein, University of Toronto; Rotman Research Institute, Baycrest Health Sciences, Canada; Tema Genus, Linköping University, Sweden.

The main estrogen produced by the ovaries, 17-beta estradiol (E2), plays a key role in memory. Whether synthetic estrogens in oral contraceptives (OCs) play the same role is largely unknown. One major difference between ethinylestradiol (EE), the main synthetic estrogen in OCs, and endogenous E2 is that plasma concentrations of EE are highly variable throughout a 24-hour period due to its pharmacokinetic properties. We asked how the pharmacokinetics of EE might affect working memory (WM) by testing OC users at a peak EE state 1-2 hours after pill ingestion, and at a low EE state just before pill ingestion, and comparing their performance to normally cycling (NC) controls tested at low and high E2 menstrual cycle phases.

Participants were also genotyped for the catechol-o-methyltransferase (COMT) Val158Met polymorphism. Previous research has shown E2 interacts with different DA availabilities due to this polymorphism to modulate WM, so we wondered if EE does the same. Our results showed that time since pill ingestion, COMT genotype, and their interaction did not affect WM. Despite the concentration variability of EE in OC users within a 24-hour period and the variability of DA breakdown, women on OCs have stable WM.

**7-04 Hippocampal activation and spatial memory performance on a virtual maze in schizophrenia depend on spatial strategy use, cognitive abilities, and medication dose** Todd Girard, Ryerson University, Leanne Wilkins, Ryerson University, Katherine Herdman, York University, Bruce Christensen, Australian National University, Jelena King, McMaster University, Michael Kiang, University of Toronto, Veronique Bohbot, McGill University, Canada.

The 4-on-8 virtual maze task, a human analog of the rodent radial-arm maze, is amenable to both spatial (cognitive mapping) and response-based (body-centered or landmark-based) strategies to remember and navigate to target objects. These strategies are associated with dissociable brain systems: the hippocampus and caudate play key roles in spatial- and response-strategy use, respectively. The current study replicates our previous finding of a differential deficit among individuals with schizophrenia spectrum disorders (SSDs) who spontaneously adopt a spatial strategy, whereas SSD participants using a response strategy were not impaired. Moreover, fMRI results revealed lower right-hippocampal activation in the SSD-spatial group during test trials, compared to healthy comparison participants using either strategy as well as SSD participants using a response strategy. Importantly, the SSD and healthy samples using response strategies did not differ in terms of caudate activation. Interestingly, patients' spatial strategy use and memory performance correlated negatively with premorbid intelligence and antipsychotic dose. This study highlights the importance of strategy use in relation to spatial cognitive functioning in SSD. Future research will investigate the underlying mechanisms associated with individual differences in spontaneous strategy selection and the development of protocols to train impaired hippocampal-dependent abilities or harness compensatory intact abilities.

**7-05 Culture, self-concept and event memory: A cross-cultural study of Chinese and Canadian children** Andrea D'Alessandro, Wilfrid Laurier University, Andrew Tkatchyk, Wilfrid Laurier University, Hua Huo, Wilfrid Laurier University, Hongyuan Qi, Wilfrid Laurier University, Kim P. Roberts, Wilfrid Laurier University.

Cross-cultural studies have demonstrated the influence of cultural values on self-concept and autobiographical memories (Wang, 2004, 2006). The present study investigated the influence of culture and self-concept on children's event memory. Sixty 7-to 10-year-old Chinese and European Canadian children viewed a story of a girl experiencing both social and individual-focused events. Participants were interviewed to recall the story after a delay period of 5 to 7 days. All interviews were audio recorded and transcribed verbatim. Recalled details of the target events were coded as either correct or incorrect. The revised Twenty Statements Test was used to measure children's self-concept, which required children to complete 10 "I..." statements to introduce the self. Children's self-descriptions were categorized as either social- or individual-oriented. Preliminary analyses demonstrated that Chinese children had greater accuracy in recalling social-focused than individual-focused details compared to Canadian children. Chinese children also expressed more social- as opposed to individual-oriented self-descriptions than Canadian children. The results demonstrate that Chinese children, who hold a social-oriented self-concept, accurately remember more social- than individual-focused events compared to Canadian children, who hold an individual-oriented self-concept. Findings of this research may inform social workers and educators as they interact with children from different cultural backgrounds.

**7-06 Perceived credibility of children's use of a timeline in recalling a repeated event** Huan-Huan Zhang, Wilfrid Laurier University, Kim Roberts, Wilfrid Laurier University.

Children's testimonies are often the key to successful prosecutions. Continuous efforts in developing age-appropriate interview techniques suggest that the addition of aids is often not helpful and exposes children to the risk of false reports. The timeline, a graphical depiction of time, was recently found to have no positive effect for children's episodic recall.

Despite empirical evidence suggesting that these aids should be used with caution, no research has examined how potential jurors would perceive them. In forensic contexts, adults' perception of children's accuracy is as important as the actual accuracy of their reports. The present study investigated how adults perceive 6- to 9-year-olds' event recall with and without the timeline (verbal-only). Adults watched children recall temporal details about a target event and rated on their cognitive competence, interview performance, perceptions about the timeline, and general perceptions. Preliminary findings suggest participants did not view the timeline and verbal-only interviews differently. However, when compared between the two interview conditions, children who experienced a verbal-only interview after the timeline interview were perceived much more negatively than those who experienced the reverse order. This suggests that adults may perceive the timeline to be more helpful for children when in fact it was not.

**7-07 Investigating the effects of task duration and cognitive load on time estimation \* Jesika Walker**, Carleton University, Mohammed Aswad, Carleton University, Calvin Findlay, Carleton University, Guy Lacroix, Carleton University.

The goal of this experiment was to examine participants' ability to keep track of time during a visual and memory search task where task difficulty and duration were manipulated. Two hundred and ninety-two participants performed the task for eight or 58 minutes. Participants in the prospective time judgment condition were forewarned of an impending time estimate whereas those in the retrospective condition were not. Most importantly, cognitive load was manipulated and assessed by assigning participants to either a consistent or a varied mapping condition. The results revealed significant overestimation and higher variability of responses in the prospective condition compared to the retrospective one in the eight-minute task only. Moreover, participants significantly overestimated the duration of the eight-minute task and underestimated the 58-minute task on average. Finally, cognitive load had no effect on participants' time estimates. Thus, the well-known cross-over interaction between cognitive load and time judgment condition for short durations (typically less than two minutes; Block et al. 2010) does not seem to extend to longer durations.

**7-08 Pre-diabetes accelerates neurocognitive decline in older adults Joyla Furlano**, Western University, Lindsay Nagamatsu, Western University.

Type II diabetes (T2D) is associated with neurocognitive decline beyond normative aging, and thus older adults with T2D are at high risk for developing dementia. However, the extent to which similar deficits may occur in prediabetic older adults is not well understood. While few studies have shown that prediabetic older adults experience some cognitive decline, further research is needed to determine the specific cognitive domains affected and the degree to which this decline occurs. Moreover, structural and functional brain changes that may occur with these deficits is currently unknown in this population. Therefore, the aim of this study was to assess cognitive function and brain health in prediabetic older adults. We conducted a cross-sectional analysis of older adults (aged 60-80) with prediabetes (FPG 6.1-7.0 mmol/L) and healthy aged-matched controls, examining 1) cognitive performance, 2) functional brain activation as measured by fMRI, and 3) structural measures (e.g., volume of the hippocampus). Based on our cross-sectional analysis, prediabetic older adults show impaired cognition (e.g., memory), as well as decreased hippocampal volume and activation. Therefore, we conclude that older adults with prediabetes experience brain decline, and could benefit from lifestyle interventions to prevent or delay the onset of such decline.

**7-09 Voice pitch-based size and dominance perceptions are linked Marie Armstrong**, McMaster University, Chengyang Han, Zhejiang University, China, Jessica Ostrega, McMaster University, David R. Feinberg, McMaster University.

Voice pitch is thought to have evolved to be a reliable indicator of male formidability. However, perceptions of formidability indicators such as size and dominance from the voice are not accurate and likely stem from a heuristic that larger objects emit lower-pitched sounds. To further test this bias, we averaged the voices of people who were perceived to be tall and short and a separate pair of prototypes for people who were objectively tall and short. The averages based on perceived height varied less in height than those averages based on measured height. Perceptions of the perceived height averages altered height ratings more than measured height averages,

even though they varied less in measured height. We also created averages for physical dominance, which were rated nearly identically to the perceived height averages. Together these results support the hypothesis that judgements of size and dominance are based on a perceptual bias, rather than an ability to accurately assess these characteristics from voice pitch. We also tested perception of voice averages based on social dominance and attractiveness ratings to investigate whether attitudes towards these perceptual categories follow a similar pattern as the height and physical dominance averages. These results were more nuanced.

**7-10 I've got the music in me: An indirect measurement of pitch perception Lauren Vomberg**, University of Lethbridge, John Vokey, University of Lethbridge, Scott Allen, University of Lethbridge.

Musicians are better able to judge whether a test tone (presented second) is higher or lower than a reference tone (presented first) compared to non-musicians, particularly when they are judging tones constructed without the fundamental frequency. Understanding how musicians complete this task may allow non-musicians to obtain musician-level accuracy. We previously found that musicians are likely to spontaneously hum while completing this task, and their performance is more accurate when asked to hum out loud. To investigate what aspects of humming are important, we tested musicians and non-musicians across four conditions, three designed to directly control humming; no specific instructions (they could hum if they chose to), specifically asked to hum, and speeded response (no time to hum). The fourth condition attempts to replicate the subtle muscular feedback obtained from humming in an embodied manner. Rather than simply pressing one button for up and another for down (as in the other conditions), participants responded by moving a vertical slider up or down on the computer screen to the extent which they thought the tones differed. Results indicated similar responses regardless of condition, with musician accuracy being significantly higher than non-musician accuracy in identifying the direction of the tones.

**7-11 What is the role of the motor system in the perception of music (and emotional speech prosody)? Frank Russo**, Ryerson University.

The motor theory of speech perception suggests that people perceive speech by identifying vocal tract gestures rather than speech sounds. The original and strongest version of this theory, as developed at Haskins Laboratories in the 1950s, claimed that this was achieved through an innate neural mechanism that was speech specific. Although this strong version was refuted by the turn of the century, many of the ideas found new life due to intense interest in mirror system phenomena. On the basis of the accumulated evidence over the last two decades, it would appear that the motor system has a limited but important role to play in supporting (a) perception of speech, especially in degraded or noisy conditions, and (b) supporting speech language acquisition. In this talk, I will consider the extent to which the motor theory may be applied to understanding perception of music and emotional speech prosody. By comparison, both of these domains are relatively non-symbolic in the sense that pitch sequences do not tend to have shared cultural meanings. This lack of symbolism may predispose an observer to rely on input from the motor system during perception as it may provide an important window into the producer's internal state and/or social-emotional intentions. In this talk, I will consider the available evidence for the role of the motor system in perception of music and emotional speech. Evidence will be drawn from behavioral, electrophysiological, and neuroimaging studies. I will also consider the perceptual consequences of neuromotor stimulation and degeneration.

**7-12 The multimodal enhancement of beat perception in rhythms we hear and feel Sean Gilmore**, Ryerson University, Frank Russo, Ryerson University.

Perceiving the beat is an integral part of our ability to experience music. Research has investigated beat perception using sensorimotor synchronization (SMS) performance, and the entrainment of neural oscillations in the brain. SMS has been shown to be superior in auditory compared to visual modalities, however a small number of studies have found that performance in sensorimotor synchronization (SMS) is equivalent for vibrotactile and auditory rhythms given the right conditions. Further, some research suggests that SMS is enhanced for multimodal (auditory-tactile) rhythms. Currently no research has examined the entrainment of neural oscillations to vibrotactile or multimodal rhythms. The current study examined SMS and neural entrainment to rhythms that varied in modality (auditory, vibrotactile and multimodal) and complexity

(metronome, simple). Results revealed an enhancement in SMS for multimodal compared to unimodal rhythms (vibrotactile, auditory) rhythms. SMS was comparable between auditory and vibrotactile rhythms. These modality effects were moderated by rhythmic complexity. In the case of metronomic rhythms, auditory SMS was comparable to vibrotactile SMS, but in the case of simple rhythms, auditory SMS was superior to vibrotactile SMS. Trends in neural entrainment mapped onto the trends in the SMS data.

**7-14 Compound words are more vulnerable to lexical decomposition in simple span than in complex span** Elisabet Service, McMaster University, Zoë Wälchli, McMaster University.

It is commonly assumed that immediate serial verbal recall (simple span) is mostly a measure of short-term memory, or phonological loop capacity, whereas tasks combining processing and storage (complex span) combine short-term storage, long-term memory and attention. We compared memory for compound words in three tasks: simple span, complex sentence reading span encouraging verbal rehearsal and complex span when opportunity for rehearsal was minimized. Each of our lists included at least one legal recombination possibility of the two constituents of different items (CANDLELIGHT + DRUMSTICK = CANDLESTICK). We found better recall in simple span and complex span with rehearsal compared to complex span with no rehearsal. Error analysis revealed that order errors were more frequent in complex span when verbal rehearsal was minimized than the two other tasks. However, error types reflecting decomposition of the compound words to their two constituents were more common in simple than either complex span task. Lexical variables only affected error categories in simple span. These results suggest that phonological coding supports order memory in both simple and complex span. Both STM and LTM activation caused greater lexical competition in simple span. Cumulative episodic encoding in complex span appears to protect from lexical competition.

**7-15 Resources allocation in visual working memory** Chaoxiong Ye, University of Jyväskylä, Finland, Hong-Jin Sun, McMaster University, Canada, Qianru Xu, University of Jyväskylä, Finland, Qiang Liu, Liaoning Normal University, China.

How resources in visual working memory (VWM) is allocated is one of the most important questions in the research on VWM. We proposed earlier (Ye et al. 2017) a two-phase allocation model which suggests that the resources could be allocated by an early and late consolidation phase. In the early phase, individuals automatically allocate VWM resources and create a low-precision representation for each item in the scope of attention. Allocation can then enter a late consolidation phase, where it can be flexibly controlled according to task demands. Through a series of experiments, we tested the two-phase model. In three experiments, we systematically manipulated memory set size and exposure duration. We did not find an effect of task demands when the set size was high and the exposure duration was short. However, when we either decreased the set size or increased the exposure duration, we found a trade-off between the number and precision of VWM representations. In another two experiments, we found a positive correlation between the VWM capacity and trade-off ability when the exposure duration was long, but a lack of such correlation when the exposure duration was short. These results are consistent with the predictions of the two-phase model.

**7-16 Recognition-induced-memory-alteration (RIMA) in visual working memory** April Pereira, University of Toronto, Mississauga, Keisuke Fukuda, University of Toronto, Mississauga, Ontario.

Memories can be manipulated long after they are encoded by biasing the context in which they are retrieved (e.g., Frenda, Nichols, & Loftus, 2011; Jonker, Seli, & MacLeod, 2013). However, it is not clear whether memories that are just encoded and actively held in mind is also modifiable by biasing the context in which they are accessed. To test this, we had young adults perform a visual working memory task in which they remembered one simple object (e.g., a colored circle) over a 5-second retention interval. The precision and confidence of their memory were assessed immediately after the retention interval. During the retention interval in the critical condition, participants performed two-alternative-forced-choice (2AFC) recognition tests in which they judged which of the two alternatives were similar to the original memory item. The results showed that this simple recognition judgment was enough to bias the immediate recall of the original stimulus toward the similar alternative. Interestingly, this recognition test did not

change their confidence in the final recall. Our finding of the recognition-induced-memory-alteration (RIMA) demonstrates that memory alteration is not specific to long-term memories and it can be induced without affecting the confidence of memory retrieval.

**7-17 Tests of the Role of the Generation Heuristic on Duration Judgments**

\* **Erin Dowling**, University of Manitoba, Sandra Hunter, University of Manitoba, J. P. Leboe-McGowan, University of Manitoba, L. C. Leboe-McGowan, University of Manitoba.

Human perception for time is an inherent and integral part of people's lives. However, the quest to understand the elementary mechanisms that might influence recollection for the temporal features of events has historically brought forward several misconceptions. Theories proposing innate time-keeping mechanisms (e.g., "internal clocks") are problematic as they fail to address how human recollection of temporal features—such as an event's duration—is easily manipulated by cues that are unrelated to time. This study explored how a heuristic framework for memory, focusing specifically on the generation heuristic, guides people's retrospective judgments about the duration of past events. We have found that people are more likely to judge the duration that an image was presented as longer if they had previously labelled it so in an earlier task. A subsequent study revealed that the frequency of change experienced during an encounter with an image also biases judgments about its duration. Both of these results occurred irrespective of the objective duration of the image's presentation. These results provide insights that could be useful for developing strategies to improve the experiences of those enduring long wait-times and helping people avoid error in situations for which inaccuracies in time judgment could be devastating.

**7-18 The impact of verbal and nonverbal auditory distractor on developing object representations**

**Genevieve Desmarais**, Mount Allison University, Sarah MacEwan, Mount Allison University.

Presenting a verbal distractor during encoding can interfere with learning to recognize objects by touch, suggesting that we use verbal encoding when exploring objects by touch. This verbal encoding seems to create a representation that is accessible to both vision and touch, leading to similar identification performance in both modalities (and violating encoding

specificity). It is however possible that it was the auditory nature of the distractor and not its verbal nature that interfered with performance. We investigated this possibility by asking participants to learn to recognize novel objects by sight or by touch while presenting either verbal auditory distractors, nonverbal auditory distractors, or no distractors. Once all objects could be recognized, participants completed an experimental task where they were presented with two of the objects and were asked to identify either the haptically-presented object or the visually presented object. On half the trials, two copies of the same objects were presented (congruent trials) while on the other half, two different objects were presented (incongruent trials). Our results replicated past findings that violate encoding specificity, and showed that the impact of interference presented during learning depends on both the learning modality and the identification modality.

**7-19 The costs and benefits of producing the items in short-term ordered recall** **Jean Saint-Aubin**, Université de Moncton, Véronique Cyr, Université de Moncton, Dominic Guitard, Université de Moncton.

The production effect refers to the memory advantage for words read aloud during encoding over those read silently. This effect has been observed in free recall with mixed lists, that is lists where some words are spoken aloud and others are read silently and with pure lists where all words are read aloud or silently. Here, we extended this effect to immediate serial recall with lists of 6 words. In Experiment 1, results revealed a large production effect with mixed-lists, but not with pure lists. Furthermore, in mixed-lists, sawtooth serial position curves were obtained with an advantage restricted to the produced items. In pure lists, produced items showed a form of crossover effect: For the first half of the list, produced items were less well recalled than words read silently; however, items read aloud later in the list were better recalled. We attributed the disadvantage of produced items at the first serial positions to articulatory suppression: Producing the items would interfere with rehearsal. In Experiment 2, in the silent condition, participants were required to say aloud the word "mathématiques" after reading each item. As predicted, in pure lists, a large production effect was observed at all serial positions.

**7-20 Independence of text explicitness and implicitness: Impact on text recognition Murray Singer, University of Manitoba.**

The inferences that either reliably or optionally accompany text comprehension have been extensively studied. However, the explicitness and implicitness of text ideas might be viewed as independent. In this regard, investigators sometimes refer to "explicit inferences:" the implications of text that are also directly stated. Conversely, many explicit ideas are incongruent with their text gist. This suggests a 2 x 2 classification of text ideas as (a) stated or not, and (b) implied or not. In three experiments that explored this conceptualization, inferences were respectively defined as (a) highly probable verb-case-filling concepts, (b) highly consistent with the story context, or (c) congruent with text causal antecedents. Certain target ideas were (a) stated or not and (b) implied or not by their texts. In post-reading recognition testing, stated versus unstated ideas were uniformly more discriminable when they were unimplied than implied in their texts. The ramifications of the results regarding multi-level text representation theories are considered.

**Speaker Session #8: Sunday June 9, 1:15pm – 2:15pm**

**8-01 Auditory P3 indices of attention in adolescents with acute suicidal behaviour: an event-related potential study Paniz Tavakoli, Children's Hospital of Eastern Ontario, Addo Boafu, Children's Hospital of Eastern Ontario, Emily Jerome, Carleton University, Kenneth Campbell, University of Ottawa.**

In adolescence, suicidal behaviour is associated with cognitive impairments which have debilitating impacts on psycho-social functioning. Attention is one of the most impaired functions in suicidality. Very little research has focused on the neurophysiology of suicidality in adolescents. The present study uses event-related potentials (ERPs) to investigate attentional dysfunctions associated with suicidality. Eighteen adolescents with suicidal behaviour and 18 healthy controls performed an auditory novelty oddball task. The task consisted of standard (80%), target (10%), and novel (10%) stimuli. The participants were instructed to press a button upon presentation of the target. ERPs indexing the different stages of attention processes were collected (N2 and P3). Adolescents with suicidal behaviour

showed enhanced N2 amplitudes to target and novel stimuli. They also showed reduced target P3 amplitudes compared to healthy controls. There were no differences in the amplitude of the novel P3 across groups. These findings suggest that more resources may be required for stimulus detection and classification processes in adolescents with suicidal behaviour. Processes associated with attentional resource allocation or working memory may, however, be impaired. The N2 and P3 may be useful biomarkers to aid in developing a clinical risk profile of suicide in adolescence.

**8-02 The neural correlates of a modified emotional Stroop task in adolescents with acute suicidal behaviour. Boafu Addo, Children's Hospital of Eastern Ontario, Paniz Tavakoli, Children's Hospital of Eastern Ontario, Kenneth Campbell, University of Ottawa.**

There is increasing evidence that, in adolescence, deficits in attentional control play a critical role in the vulnerability for suicidal behaviour. Very few studies have investigated the neurophysiological correlates of suicidality in adolescents. The present study uses event-related potentials (ERPs) to investigate attentional control and interference in adolescents with suicidal behaviour during an emotional Stroop task. Subjects are asked to name the ink-color of words varying in emotion (positive, negative, neutral, suicide-related). Suicidal individuals are hypothesized to be more preoccupied by the context of the suicide-related stimuli, which may interfere with their ability to perform the colour naming task. Seventeen adolescents with suicidal behaviour and 17 healthy controls performed an emotional Stroop task while ERPs were recorded. Adolescents with suicidal behaviour showed reduced P3 amplitudes, irrespective of emotional value, compared to healthy controls. There were no differences in the amplitude of the N2 across emotions or groups. Suicidal adolescents also showed increased reaction times to suicide-related stimuli compared to neutral stimuli. These findings suggest that adolescents with suicidal behaviour may have deficits in overall attentional control and resource allocation compared to healthy controls. Reduced P3 amplitudes may also suggest an inability to sustain attention on the task compared to controls.

**8-03 Investigating how the brain represents abstract concepts: God in body and space, Susie MacRae, University of Northern British Columbia, Alexander LePage, University of Northern British Columbia, Brian Duffels,**

University of Northern British Columbia, Annie Duchesne, University of Northern British Columbia, Paul Siakaluk, University of Northern British Columbia, & Heath Matheson, University of Northern British Columbia.

We use concepts to understand the world around us. Concepts are partially represented by reactivations of the sensorimotor regions activated during physical experiences with objects. However, god cannot be experienced directly through the modalities. Perhaps we use metaphors to map sensory experience into this abstract domain. In the present experiments (N = 52), we investigated whether supplication and word position interact to support understanding of abstract concepts. We used linear mixed effects models and a model selection procedure to determine whether interactions between body posture and word position help explain reaction times. In one experiment using the Implicit Associations Task, we showed that kneeling marginally increased the association of god with up and devil with down. In a simple categorization task, we showed that kneeling improves the categorization of god and devil words more than words referring to sky/sea or the socially powerful/powerless. Though Bayesian ANOVAs suggest these posture interaction effects are weak, these results are consistent with the theoretical conclusion that space and posture are metaphorically mapped into the abstract domain of religious concepts.

**8-04 Patients with lesions in the left prefrontal cortex (BA 9 & 10) have less entrenched beliefs and are more skeptical reasoners \* Vinod Goel,** York University, Miriam Marling, York University, Vanessa Raymount, Johns Hopkins University, USA; Imperial College, London, UK, Frank Krueger, George Mason University, USA; Department of Psychology, University of Mannheim, Germany, Jordan Grafman, Northwestern University Medical School, Cognitive Neurology and Psychiatry and Behavioral Sciences and Physical Medicine and Rehabilitation, Chicago, Illinois, USA.

The effect of prior beliefs on reasoning and decision making is a poorly understood phenomenon, exhibiting considerable individual variation. Neuroimaging studies have established the involvement of the left prefrontal cortex in reasoning involving beliefs, but there is a scarcity of patient studies addressing the necessity of the left PFC in belief-based inference. To address this gap, we tested 102 patients with unilateral focal penetrating traumatic brain injuries, and 49 matched controls. Participants

rated simple inductive arguments and independently rated the believability of each argument's conclusion. A Voxel-Based Lesion Symptom Mapping analysis identified patients with lesions to the left PFC who were significantly less swayed by highly believable conclusions compared to all other patients, in addition to their right PFC counterparts and controls. These results seem to indicate that lesions to left PFC act as a buffer against the influence of beliefs and make these patients more skeptical reasoners. Another explanation is that unilateral left PFC lesions disrupt hemispheric equilibrium and allow for the increased inhibitory role of the right PFC towards beliefs. We speculate that individual differences in left and right PFC interactional dynamics may contribute to differences in how beliefs influence reasoning in the general population.

**8-05 Members of the public see less advancement of knowledge than do scientists from studies with conflicting results Derek Koehler,** University of Waterloo, Gordon Pennycook, University of Regina.

Science often advances through disagreement among scientists and the studies they produce. For members of the public, however, conflicting results from scientific studies may produce a sense that nothing new has been learned. Participants read about pairs of studies with results that either agreed or disagreed, and were asked, "When we take the results of these two studies together, do we now know more, less, or the same as we did before about [the study topic]?" We find that the majority of participants do not feel that "we know more" as the result of the two new studies when the second study fails to replicate the first. When the two study results strongly conflict, a non-trivial proportion of participants actually say that "we know less" than we did before. Such a sentiment violates normative principles of statistical and scientific inference positing that new study findings can never reduce our level of knowledge (and that only completely uninformative studies can leave our level of knowledge unchanged). Scientist members of the American Academy of Arts and Sciences, when presented with the same scenarios, were less inclined to say that nothing new is learned from conflicting study results.

**8-06 Why do we give? Testing a two-stage model of donation behaviour Michelle Ashburner,** University of Waterloo, Jonathan Fugelsang, University of Waterloo, Evan Risko, University of Waterloo.

Several theoretical models of donation behaviour have been proposed to increase our understanding of why people give. According to one such model, the two-stage model of donation behaviour (Dickert, Sagara, & Slovic, 2011), the decision of whether to donate is governed by a separate mechanism than is the decision of how much to donate. Particularly, mood management (i.e., guilt avoidance) is held to predict the decision to donate whereas empathic feelings are held to predict the decision of amount donated. The present research tests this two-stage model of donation behaviour and demonstrates that mood management is the predominant factor in both the decision to donate and the amount donated. Implications of the current results for the two-stage model of donation behaviour are discussed.

**8-07 Debt repayment and anchoring effects: Disclosure of payment options to increase credit card monthly repayment**

**Jeronimo Soro**, Faculdade de Psicologia da Universidade de Lisboa, Portugal, Mário Ferreira, Faculdade de Psicologia da Universidade de Lisboa, Portugal, Catarina Nunes, Faculdade de Psicologia da Universidade de Lisboa, Portugal.

Difficulty in calculating compound interests, hyperbolic discounting and anchoring of minimum payment required are related to credit card debt repayments that are often smaller than possible (and advisable). The USA 2009 CARD act introduced a disclosure in credit cards' statement informing the pay-off time and total amount paid for minimum monthly payments as well as presenting an option of payment with debt pay-off in 36 months. Research testing the impact of this disclosure confirmed an increase in monthly payments, however there is also evidence that it creates a new point of anchoring (Salisbury, 2014). We propose and test new disclosure options with presentation of more payment options based on percentage of the total debt (as is the minimum payment) either in table or graph format to avoid anchoring and promote a more abstract comprehension of the long-term consequences of payment decision. The new options were compared to credit card statements with and without the CARD act disclosure in scenarios emulating credit card repayment. Preliminary results show a tendency for higher payments under the new disclosure options, attenuating new points of anchoring, and higher estimates of pay-off time in different fixed payments scenarios, closer to the objective answer.

**8-08 Inducing feelings of ignorance makes people more receptive to expert (economist) opinion** \* **Ethan Meyers**, University of Waterloo, Martin Turpin, University of Waterloo, Michal Bialek, University of Waterloo, Jonathan Fugelsang, University of Waterloo, Derek Koehler, University of Waterloo.

People don't respond more to experts (economists) than to fellow lay people (Johnston & Ballard, 2016). We sought to better understand the factors that make it more likely that people will revise their beliefs in response to expert vs. public opinion. We hypothesized that exposing an illusion of explanatory depth would lead to more belief revision to experts. We found that after exposure, expert opinion was more influential than public opinion. Our results suggest that experts (economists) may not be afforded privilege of opinion in their own domains over the public because people think they know more than they do.

**8-09 Recognition of voices in a foreign language: Data from infants and adults** **Mathieu Grenier**, Université du Québec à Montréal, Rushen Shi, Université du Québec à Montréal.

Infants as young as 7 months old can distinguish voices of different speakers, but are only capable of doing so in their own language (Johnson et al., 2011). This observation suggests that the experience of a language is a determining factor in this ability. However, these studies used adult-directed speech as auditive stimuli. Given that babies are more attentive to infant-directed speech, the present study inquired whether infant-directed speech help infants recognition voices in a foreign language. In a visual preference task, francophone babies (n=40) aged 4-13 months were familiarized with infant-directed voices of Swiss-German mothers, each paired with a cartoon character. Each test trial displayed two characters side by side, while the voice of one was presented. Eye-fixation time on the target character was the dependent variable. Results revealed that infants did not perform better than chance in identifying the speakers. In Experiment 2, adults (n=40) were presented with the same trials. Results of their identification responses showed that their performance was significantly higher than chance, suggesting that they recognized the foreign voices. Taken together, our results show that infant-directed speech is not salient enough to allow babies to identify speakers in a foreign language.

**8-10 Infants' understanding of reflexive and transitive actions Emeryse Emond**, Université du Québec à Montréal, Rushen Shi, Université du Québec à Montréal.

During language development, children must distinguish grammatical structures that are similar in surface but denote different conceptual relations. For example, reflexive and transitive structures show a similar word order in certain languages (English: "He is washing himself" versus "He is washing him"; French: "Il se lave" versus "Il le lave"). The case of French is particularly interesting since reflexive pronouns and transitive pronouns are highly similar phonetically. In an eye-tracker experiment we tested French-learning 30-month-olds. Each trial presented two images simultaneously side by side, one depicting a transitive action and the other a reflexive action, while a pre-recorded sentence described one of the two scenes (e.g., Il se lave. 'he reflexive-pronoun wash'). Eye gaze data were collected by the eye-tracker. Results (n=36) showed that upon hearing the sentence (from the offset of the main verb in each trial), infants looked at the target image significantly above chance. They also showed a significant looking increase to the target image in the post-sentence time period relative to the pre-sentence period when only the images were displayed. Our results demonstrate that shortly after two years of age infants understand the difference between reflexive and transitive actions and their corresponding syntactic structures.

**8-11 The effects of elderspeak on real-time language comprehension Raheleh Saryazdi**, University of Toronto, Tamara Mostarac, University of Toronto, Craig Chambers, University of Toronto.

When talking to older adults, speakers sometimes engage in "elderspeak"-an adaptation characterized by slower speech, exaggerated intonation, repetition, and elaborations. However, research to date has suggested the benefits of elderspeak for listeners arise primarily from repetition/elaboration and not the acoustic adaptations. Further, little is known about how elderspeak might benefit real-time aspects of language processing. The current study used spoken language eye-tracking to examine how acoustic features of elderspeak influence the on-line resolution of linguistic indeterminacy. Specifically, we explored their effects

on listeners' ability to use sentence context to resolve grammatical-category ambiguities (e.g., saw[past tense verb] vs. saw[noun]). On critical trials, gaze was recorded as participants viewed a set of images, some of which were related to words in an accompanying recorded sentence ("George saw a car crash yesterday"), produced either normally or slowly with expanded intonation. Along with a target image (car crash), the display contained a competitor object reflecting the grammatically-incorrect noun interpretation of the verb word (i.e., "saw" the tool). The results revealed a benefit of elderspeak for older adults as the critical verb was encountered, with fewer fixations to the competitor object occurring when elderspeak was used. Younger adults, however, did not show any benefit.

**8-12 Parent language and children's inductive reasoning about snakes Denée Buchko**, University of Regina, Jeff Loucks, University of Regina.

Snakes are frequently vilified in North America, despite their low threat to humans overall. How do parents talk to their children about snakes, and how do young children conceptualize these atypical animals? Carey (1984) argued that children initially reason about all non-human animals using humans as an inductive base. More recent evidence indicates that this anthropocentric stance is not present at age 3 but is by age 5 (Herrmann, Waxman, & Medin, 2010). That study, however, compared the inductive bases of human and dog (which children are highly familiar with). In the present experiment we examined patterns of induction in 3- and 5-year-old children when snakes served as the inductive base in comparison to humans. We simultaneously examined how parents talk to their children about snakes vs. squirrels, and whether this affects their induction. Results indicated that even the 3-year-olds showed an anthropocentric pattern, which was then magnified in the 5-year-olds. Parents also used different language when talking about snakes vs. squirrels (pronouns and psychological references), which related to children's reasoning. This study has implications for how young children's reasoning about non-human animals develops, and how parents may subtly shape how children think, and potentially feel, about atypical animals.

**8-13 Affective forecasting in older adults Julia Halilova**, York University, Shayna Rosenbaum, York University; Rotman Research Institute, Baycrest, Canada.

Recent research shows that at least some future-thinking abilities are preserved in individuals with lesions of the medial temporal lobes (MTL). The purpose of this study was to investigate whether the role of the MTL extends to another form of future thinking, affective forecasting (i.e., predicting one's own future emotions). Young adults tend to overestimate the impact of future events on their future emotional states, a phenomenon known as the impact bias. In the current study, we investigated whether an impact bias of similar magnitude would be found in older adults. During the first session, participants were asked to predict the intensity of a range of positive and negative emotions that they would experience in response to winning or losing a computerized word search game on a scale from 1 (not at all) to 7 (extremely). Participants returned to the lab a week later to play the game, which was rigged so that participants lost. Participants were then asked to rate the intensity of their experienced emotions on the same scale. Older adults were found to be more accurate than young adults in predicting their negative (but not positive) emotions in response to losing the game.

**8-14 The effect of exercise on multisensory integration in younger and older adults Aysha Basharat**, University of Waterloo, Michael Barnett-Cowan, University of Waterloo.

Everyday events give rise to sensations that span all of our senses; for example, watching someone speak gives rise to both auditory and visual information, which must be bound together in order to form a meaningful representation of the event. Multisensory integration represents the central nervous system's (CNS) ability to integrate information from multiple senses. However, determining the temporal coincidence of events is difficult for the CNS as it must deal with differences in signal intensity, transmission time, and transduction latencies. Previous studies have found that multisensory integration becomes more difficult with aging, which has been related to decreased speech comprehension, increased susceptibility to falls, and poor decision making while driving. Here, we explore whether a single bout of aerobic exercise improves response time, accuracy, and precision obtained from audiovisual temporal order perception tasks typically used to assess multisensory integration. In order to ensure that the effects observed are not due to task repetition, all participants are asked to

complete tasks related to audiovisual multisensory integration before and after a cognitively demanding task as well as a rest condition. The anticipated results from this study will help to inform interventions that target brain health improvement in older adults.

**8-15 Does familiar face recognition survive distortion to configuration and surface properties? Skylar Rego**, University of Guelph-Humber, Adam Sandford, University of Guelph-Humber.

Familiar face recognition is said to utilize configuration. However, this has been challenged in recent studies, while other studies point toward a more important role for surface properties such as pigmentation in recognition of familiar faces. The extent to which familiar face recognition survives distortions to configuration and surface properties was tested across three experiments. Famous (n=16) and non-famous (n=16) faces were distorted by global or non-global linear stretching and by presenting faces as photographic positives or negatives. Participants categorized faces as familiar or unfamiliar across eight stimulus conditions in a within-subjects design. Results showed recognition of familiar faces was robust to configurational distortions with no decrements in accuracy or response times, except when faces were contrast negated (experiments 1 and 2). Faces were better recognized when the whole configuration was viewable. However, recognition was still well above chance when participants were presented only the top or bottom half of faces following categorization of the configurationally distorted images (Experiment 3). The results corroborate studies that limit the explanatory power of configuration, extend previous results with non-global linear stretching, and further suggest a role for surface properties in familiar face recognition.

**8-16 Emotional vocal bursts associated to different elicitors of pathogen disgust Mathieu Gagnon**, Royal Military College of Canada.

According to the psycho-evolutionary approach, disgust is a fundamental human emotion rooted in an evolved pathogen-avoidance mechanism (Curtis, 2013). To date, much research has explored its behavioral output, especially in terms of facial expressions. However, authors have often neglected to study its other expressive modalities, such as the voice. Moreover, recent theoretical advances have highlighted the need to

account for a wide array of disgust elicitors and likely co-occurring emotions. In mind of such issues, we presented 35 undergraduate participants with scenarios of seven empirically validated elicitors of pathogen-disgust (animals, dead bodies, lack of bodily hygiene, food, sexual behaviors, bodily products and body envelop violation) and five non-verbal vocal sounds typically associated to disgust, anger, fear, sadness and surprise (Haidt, McCauley & Rozin, 1994; Cordaro et al., 2016). Participants read each scenario and rated how likely each sound was in response to the events in the scenario. Globally, the results show that participants' ratings vary based on the specific type of elicitor and that some emotions (namely fear and anger) are likely to co-occur with disgust. Overall, this research strengthens our understanding of how humans respond to different pathogen threats in their environment.

**8-17 Anxiety-Provoking Context Scenes Can Reduce the Context Reinstatement Effect Christopher Lee**, University of Waterloo, Ryan Yeung, University of Waterloo, Myra Fernandes, University of Waterloo.

Reinstating the same context during retrieval, as at encoding, has been shown to benefit memory for targets associated with that context. In two experiments, we investigated whether anxiety-provoking context scenes lessened the context reinstatement (CR) benefit. During encoding, participants viewed target faces paired with scenes pre-rated as either highly anxiety-provoking or not, half of which contained other faces embedded within the scene. At retrieval, target faces were re-presented with either the same or a new context scene. In Experiment 1, the expected CR benefit occurred when contexts consisted of low-anxiety scenes, or high-anxiety scenes without embedded faces. In contrast, the CR benefit was reduced when contexts were high-anxiety scenes containing embedded faces. In Experiment 2, to determine whether the presence of embedded faces, or anxiety level of scenes drove the reduced CR effect, we included contexts consisting of low-anxiety scenes with embedded faces. Once again, the CR effect was shown to be reduced, only when the context scene was highly anxiety-provoking with embedded faces; that is, reinstating the same, versus new, anxiety-provoking context failed to benefit target memory. Results suggest that the benefit of reinstating a context, on target memory, depends critically on the characteristics of the reinstated context.

**8-18 Assessing the impact of word valence on short and long term memory in an AB task Ellen MacLellan**, McMaster University, Mitchel LaPointe, McMaster University, Marta Maslej, McMaster University, Victoria Bednarek, McMaster University, David Shore, McMaster University.

Valence impacts attention allocation—negative valence can constrain the breadth of focus, in both time and space, and positive valence can broaden that focus. Valence also impacts memory with typically superior memory for negative valence stimuli. We combined a two-word attentional blink (AB) procedure with a recognition memory task to explore the combined influence of selective attention and valence on short and long term memory. Participants completed the AB procedure with either all positive, all negative, or mixed valence words. They then completed a recognition memory task for T1 and T2 words. Interestingly, we observed an AB-like pattern of performance in long-term memory. Critically, the impact of valence on short-term memory was only evident when valence was blocked. Based on this, we argue that the impact of valence on short-term memory is mediated by overall mood and not transient valence of the individual words. In contrast, the impact of valence on long-term memory was only evident when the positive and negative words were mixed. Based on this, we argue that the impact of valence on long-term memory is mediated by the transient shifts in attention produced by the positive and negative words.

**8-19 The effects of self-guided meditation and napping on non-declarative and declarative memory consolidation Mohammad Dastgheib**, Queen's University, Asvini Kulanayagam, Queen's University, Liza Legro, Queen's University, Matthew Stewart, Queen's University, Hans Dringenberg, Queen's University.

Numerous studies have reported that, compared to an equivalent period of wakefulness, post-training sleep (overnight or brief daytime naps) benefits memory consolidation. However, most investigations have employed various forms of "active waking" (e.g., videos, computer games, physical exercise, regular daily activities) as a comparison condition for sleep, while few studies have examined the role of "quiet waking" in memory consolidation, even though some of the EEG oscillations during quiet waking resemble those present in sleep (e.g.,  $\theta$  activity). Here, we compared the consolidation of declarative (word pair-associates) and non-declarative

(marble maze visuo-motor task) learning over a 60-min time interval (with continuous EEG monitoring) filled with either (A) napping; (B) active-waking (watching a video); or (C) quiet-waking (self-guided meditation). Preliminary analyses indicate better recall performance following quiet-waking and napping in the declarative task compared to active waking. For non-declarative learning, recall performance after quiet-waking and napping without entering slow-wave sleep (SWS) was better than that after active waking or napping with SWS. Together, these results provide evidence that some forms of quiet waking (here: self-guided meditation) can exert beneficial effects on memory consolidation that are similar to those seen with sleep (supported by NSERC).

**8-20 On balance, does variability influence face familiarization? \* Rebekah Corpuz, University of Regina, Chris Oriet, University of Regina.**

We investigated whether the ratio of target:distractor images used to test for learning of an unfamiliar face influences responses in a card sorting task. Previous research suggests that increasing variability during learning has no effect on memory for a target presented a few minutes or five days later with a 1:1 target:distractor test set (i.e., 16 target cards and 16 cards of 4 distractor identities). However, participants may have been able to circumvent the use of memory altogether with these “balanced” sets, mitigating any effect of variability by guessing the target from the identity that appeared most often. To test this, subjects were randomly assigned to one of three conditions: a) no variability (still image), b) low variability video (little change in target’s appearance and context), c) high variability video (several changes in the target’s appearance and context). Subjects then completed a sorting task with an “unbalanced” 1:4 target:distractor test set (i.e., 4 target cards and 16 cards of 4 distractor identities). The results suggest that subjects likely circumvented the use of memory in previous versions of the task. Nevertheless, a memory advantage was observed with exposure to a high variability video that persisted over a five day delay.

**Speaker Session #9: Sunday June 9, 2:15pm – 3:15pm**

**9-01 Neurofunctional impact of chronic cannabis use on emotion Zhongjie Bao, Nipissing University, Darren Campbell, Department of Psychology, Nipissing University.**

Blunted emotion is a side effect of cannabis use reported by chronic users. Past studies have established a link between heavy cannabis use and deficits in emotional face processing. However, changes in neurofunction underlying such deficits remain unknown. We selected 64 cannabis users who reported severe life problems from cannabis use (abusers), 64 cannabis users who did not report cannabis-related problems (Users), and 64 non-users from the Human Connectome Project (HCP). The 3 groups of participants were matched on age, gender, and educational attainment. We examined the functional MRI data of an emotional processing task which required participants to match one of two faces to a presented target face that displayed either anger or fear. We downloaded the pre-analysed task-fMRI data processed by the HCP pipeline, followed by a group contrast based on threshold-free cluster enhancement. Our key finding is that abusers and users differ from the non-users in amygdala activity but not between each other. The next step is to investigate the difference between user and abusers with other factors such as age of onset and intensity of use. Our study provides neurological evidence that chronic cannabis use may alter how users respond to negative social signals.

**9-03 Theoretical foundations of association and dissociation between performance, neurophysiology and subjective reports of workload Ofir Yakobi, University of Waterloo.**

Assessment of mental workload is required in many circumstances. Human factor engineers assess workload in order to design better user interfaces. Operators evaluate the workload they experience while performing tasks in order to make informed decisions (e.g., to efficiently allocate resources to tasks). Researchers assess workload in order to understand performance limitations and how the cognitive system is organized. Consequently, different classes of workload measures have been developed over the years, including performance, neurophysiological, and subjective indices. These measures are often used interchangeably without theory driven considerations, although they may lead to different conclusions. In a series of four experiments (N=62), performance and subjective reports of workload were recorded, as well as the P300 event-related potential, while participants performed tracking and oddball tasks. As expected, the results suggest that different measures could lead to different conclusions. There is, however, a systematic pattern of agreement and disagreement between

these measures that depends on the type of processing involved in the task. Overall, workload measures tend to associate in response to controlled efforts, but not to automatic, effortless processing. Theories of metacognition, performance and the P300 were recruited to account for the pattern of associations and dissociations between workload measures.

9-04 **The influence of object affordances on perception of objects presented near hand** **Adriana Paoletti**, Trent University, Liana Brown, Trent University.

People display enhanced perception of visual targets when presented near hand. Research suggests that the near-hand effect relies on the same mechanisms that process visual information for action. According to the theory of affordances every object is associated with a specific action, and simply viewing the object leads to the automatic generation of potential motor responses. Its possible that this process is enhanced when the target object appears near the hand. To assess whether action potentiation drives the near hand effect, we asked participants to respond to targets that appeared either near or far from a single hand placed in the display. The target was preceded by a cue composed of images of handled objects. Handle orientation was manipulated to determine whether the action potentiated by the target appearing near hand interacted with the action potentiated by handle orientation. In experiment 2 only one handled object was presented. A consistent near-hand effect was discovered in both experiments, but there was no effect of handle orientation and no interaction. The results so far do not support or rule out the action potentiation explanation for near-hand effects, and they also cast doubt on the use of 2-D handled images for action potentiation.

9-05 **Gender bias at scale: Evidence from the usage of personal names** **Brendan Johns**, University at Buffalo, Melody Dye, University of California, Berkeley.

Recent research within the computational social sciences has shown that when computational models of lexical semantics are trained on standard natural language corpora they embody many of the implicit biases that are seen in human behavior (Caliskan, Bryson, & Narayanan, 2017). The current study aims to build on this work and demonstrate that there is a large and

systematic bias in the use of personal names in the natural language environment such that male names are much more prevalent than female names. It will be shown that this bias holds over an analysis of billions of words of text, subcategorized into different genres within fiction and non-fiction novels, and subtitles from television and film. Additionally, it will be shown that this bias holds across time, with more recent work holding the same patterns as work published tens or hundreds of years previously. Finally, the main cause of this bias will be shown to be from male authors perpetuating the bias towards male names, with female authors showing a much smaller bias. This work demonstrates the potential of big data analyses to shed light on large-scale trends in human behavior and elucidate their causes.

9-06 **Humour from familiar and unfamiliar puns: Tell me one I haven't heard before?** **James Boylan**, University of Waterloo, Albert Katz, University of Western Ontario.

The cognitive processes involved in humour appreciation have been an ongoing topic of debate. We show that humour in written puns depends on familiarity. Participants ratings of humour from unfamiliar puns were associated with fluency of interpretation (that is, the time necessary to “get” the pun), and with either semantic incongruity or aggressive content. In contrast, humour from familiar puns was associated with the quantity of elaboration on associated content and longer durations of time spent engaging with an item. Counter-intuitively, participants found familiar puns to be more humorous than unfamiliar (novel) puns. Prior theories of humour appreciation, which have emphasized the importance of comprehending novel incongruities, may therefore underestimate the full range of how we engage with humorous stimuli. Implications for relevant theory will be discussed.

9-07 **The conceptual metaphor false memory effect** \* **Nick Reid**, Western University, Albert Katz, Western University.

Conceptual metaphors are broad mappings in which information from one domain (the “source”) is mapped onto another, dissimilar domain (the “target”). For instance, TIME is often talked about in terms of MONEY, with expressions such as “that cost me a day” and “budget your hours.” In two

experiments, we found that conceptual metaphors could induce false recognition. Using a variant of the DRM procedure, we presented participants with lists of expressions in which all of the expressions instantiated the same conceptual metaphor (e.g., TIME IS MONEY). On a following recognition test, participants were presented with critical lures that also instantiated the same conceptual metaphor (e.g., “lend me a few minutes”). We also included control lures that shared one domain in common with the study list conceptual metaphor, but did not instantiate the same source to target mapping. Across both experiments, the critical lures were falsely recognized significantly more often than control lures. In experiment 2, we also asked participants to report any strategies they used to remember the study list expressions. Very few participants reported consciously attending to the metaphorical mapping, which suggests conceptual metaphors may influence memory without requiring conscious awareness.

9-08 **The effects of language on object perception: Evidence from a visual oddball task with ERP** Xuan Pan, Western University, Debra Jared, Western University.

Lupyan’s (2012) Label-feedback Hypothesis proposes that linguistic labels affect our conceptual and perceptual representations through top-down feedback. We tested this hypothesis by investigating the effect of Chinese word structure on picture perception. In Chinese, some nouns provide explicit category information (like sunflower in English), while some nouns do not. A visual oddball detection task with ERP was used. Pictures of four birds (robin, ostrich, pigeon, and penguin) were used as standards and deviants. The robin-ostrich pair share a category clue in their Chinese names, and the pigeon-penguin pair do not. Each pair consists of a typical bird (robin and pigeon) and one atypical bird (ostrich and penguin). In Chinese-English bilinguals that have lived in Canada for a short period of time, the visual mismatch negativity (vMMN) elicited by deviant stimuli was significantly larger for pairs without category clues (pigeon-penguin) than pairs with clues (robin-ostrich), but in long-stay bilinguals and English monolinguals, the vMMN was similar for the two pairs. These results demonstrate that linguistic information embedded in object names affects people’s object perception. The influences of L1 word structure on object perception diminish as bilinguals live in the L2 country for a longer time.

9-09 **Uncrossing crossed hands with visual imagery** Lisa Lorentz, McMaster University, Raluca T. Petria, McMaster University, Kaian Unwalla, McMaster University, David I. Shore, McMaster University.

Crossing the hands over the body midline produces a profound deficit in a tactile temporal order judgement (TOJ) task—the crossed hands deficit (CHD). The conflict resolution theory of this effect (Shore, Spry, & Spence, 2002) proposes that coordinates from two reference frames (internal somatotopic and external visual) must be integrated to localize tactile stimuli, and that conflict between information in these reference frames when the hands are crossed leads to impaired TOJ performance. Congenitally blind individuals do not show the CHD (Roder, Rosler & Spence, 2004) and blindfolding sighted participants decreases the magnitude of the deficit (Cadieux & Shore, 2013), suggesting that removing conflicting visual information from the external reference frame reduces conflict. In the present work, we reduced conflict by bringing the internal and external frames into alignment: participants simply visually imagined their crossed arms as uncrossed. This led to a significant decrease in the magnitude of the CHD. In addition, we introduced a second measure of individuals’ representation of space by presenting auditory probes requiring a localization response. Finally, we explored a measure of individual differences in imagery ability (VVIQ; Marks, 1973).

9-10 **Altered large-scale organization of shape processing in visual agnosia** Erez Freud, York University, Marlene Behrmann, Carnegie Mellon University.

Shape processing is a cornerstone for various perceptual behaviors such as object recognition and face perception. Even though both dorsal and ventral pathways process shape information, a lesion to the ventral pathway alone often results in an impairment in shape perception, known as visual agnosia. This might imply that the dorsal pathway does not functionally contribute to object perception. Alternatively, it is plausible that a lesion to the ventral pathway also alters shape processing in distal regions of the dorsal pathway. To disentangle between these alternatives, in a study of a patient with object agnosia following a lesion to the right ventral pathway, we utilized a recent manipulation that has been used successfully in healthy individuals to map shape processing mechanisms (Freud, Culham, Plaut & Behrmann,

2017). As expected, shape sensitivity along the patient's right ventral pathway was markedly reduced and, as reported previously (Konen et al., 2011), a similar reduction was detected in the contralesional left ventral pathway. Of most interest, posterior parts of the dorsal pathway in both hemispheres also evinced a reduction in shape sensitivity. Finally, we identified regions in the posterior ventral pathway and anterior dorsal pathway that exhibited greater shape sensitivity in the patient compared with the controls, possibly reflecting compensatory mechanisms. Together, these findings demonstrate that a focal cortical lesion can lead to a large-scale reorganization of the visual cortex. These large-scale alternations are consistent with the idea that a distributed network of regions, along the two pathways, promotes shape perception.

9-11 **The impact of stimulus complexity on the disparity gradient limit**  
**Arleen Aksay**, York University, Laurie M. Wilcox, York University.

The horizontal separation of two points, with a fixed relative disparity, determines whether they can be fused or are seen as diplopic. The ratio of the threshold disparity to separation is referred to as the disparity gradient limit. This limit is violated repeatedly in the real world. Here we measure the vertical gradient limit to assess the impact of increased complexity on diplopia thresholds. In Experiment 1 observers (n=20) viewed a vertically aligned pair of dots separated in depth by 25 arcmin in a stereoscope. One element was fixated, and the other was presented at a range of distances above or below fixation. Observers reported whether the more distant element was fused or diplopic. In Experiment 2 we connected elements to form objects using thin lines, either within or across depth. Our results show that the gradient limit is much lower than reported previously, with

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## Abstracts for Symposia

**Saturday June 8<sup>th</sup> 10:45am – noon**

**Symposium #1-1      Boredom: Beyond a search for meaning.**

Boredom is a ubiquitous human experience in which we feel dissatisfied with whatever we are doing now. Past work has cast the experience in the

low inter-observer variability. Connecting lines to form objects in Experiment 2 significantly elevated thresholds. It is clear that sensitivity to diplopia is high when viewing isolated elements, a result that may not generalize to more complex stimuli. This may partially explain why diplopia is rarely experienced when the gradient limit is exceeded in natural environments.

9-12 **Near, far, wherever you are: Differing impacts of scene foreground and background on visual search.** **Louisa Man**, Queen's University, Monica Castelhana, Queen's University.

In real world scenes, we are guided by numerous factors to locate a target efficiently. The semantic congruency between an object and scene context as well as the spatial likelihood of an object impacts how efficiently search occurs (Biederman, 1982; Castelhana & Henderson, 2007). To date, there is little research into how changes in target position across scene depth impacts visual search performance. In the current study, we were interested in whether the target's spatial location (foreground vs. background) as well as scene context would impacted search performance. Participants performed a visual search task in scenes with either matched or mismatched foregrounds and backgrounds (Chimera scenes, Castelhana et al., 2018). Additionally, targets could appear in the foreground or background. In Experiment 1, individuals found foreground objects faster (Foreground Bias). In Experiment 2 when a scene preview was added, the Foreground Bias persisted, but was slightly moderated in the Chimera scenes. The results are consistent with previous findings and suggest a Foreground Bias in search towards processing the space closer to the observer.

context of a search for meaning – and ultimately a sense that what we are doing lacks meaning. But is this all there is to boredom? This symposium will present ideas from interdisciplinary speakers ranging from animal behavior

(R. Meagher; Reading, UK), cognitive psychology (A. Hunter; York, Canada), self-regulatory and motivation science (E. Britton UW, Canada) and social psychology (A. Moynihan) to explore the antecedents and consequences of boredom. The symposium will be chaired by James Danckert (University of Waterloo) and John Eastwood (York University).

*Bored in Animals: Signs and Possible Solutions.* Rebecca Meagher (University of Reading)

*A motivational account of boredom: How chronic and transient motivational orientations influence boredom experience.* Emily Britton (University of Waterloo)

*Boredom and the Existential Escape Hypothesis.* Andrew Moynihan (University of Limerick)

*Idle Hands, Listless Minds: Unpacking the Dynamics of Boredom and Attention.* Andrew Hunter (York University)

**Symposium #1-2      On the capacity and resolution of visual cognition: Using neural and behavioural evidence to examine the limits of information processing.**

Seminal models of attention (Broadbent, 1958; Attneave, 1960) and memory (Sperling, 1960; Atkinson & Shiffrin, 1968; Baddeley, 1986) are sensitive to capacity limits. More modern and nuanced models of these general cognitive processes—for example, visual selection (Itti & Koch, 2001) and visual working memory (Zhang & Luck, 2008; Bays & Husain, 2008)—make computationally explicit the mechanisms by which these limitations are manifest. In this symposium, a variety of approaches will converge on the topic of information processing limits; in particular delineating capacity and resolution boundary conditions. Feltmate will report on a modified attentional blink task used to determine whether blink-induced report failures are due to the probability or resolution of T2 encoding. Lockhart will describe results across several experiments exploring the ability to flexibly allocate visual working memory according to fixed and variable priority rules. Using EEG, Sheldon will demonstrate how pre-stimulus alpha is correlated with guess rate, but not precision, in a

perceptual judgment task. Dube will discuss behavioural and modelling evidence showing that visual working memory representations cannot be flexibly prioritized post-encoding. In general this symposium will reinforce the benefits of a multidisciplinary approach to understanding the limits of visual cognition, while specifically providing converging insights into the computational and neural mechanisms that reflect these limits.

*The probability and fidelity of encoding during the attentional blink.* Brett T. Feltmate, Ralph S. Redden & Raymond M. Klein (Dalhousie University)

*Limitations to goal-directed flexible allocation of visual memory resources.* Holly A. Lockhart & Stephen M. Emrich (Brock University)

*Effects of random fluctuations in alpha oscillations on orientation detection: An EEG study.* Sarah S. Sheldon & Kyle E. Mathewson (University of Alberta)

*Limits to the re-distribution of resources in visual working memory.* Blaire Dube, Stephanie Rak & Naseem Al-Aidroos (University of Guelph)

**Symposium 1-3      Memory in the Wild**

Most of our current scientific understanding of human memory relies on research that has probed memory for study materials encountered in the laboratory. While there are many advantages to investigating memory under such controlled conditions, there are also inherent limitations that are increasingly being recognized in cognitive psychology and in cognitive neuroscience. This recognition has fuelled many new research initiatives explicitly concerned with probing memory for events in everyday life, and for stimuli encountered in naturalistic settings. In the current symposium, we plan to review recent developments in this flourishing field, aiming to illustrate how it can shed light on cognitive processes as well as on neural mechanisms that govern *memory in the wild*. Dr. Rosenbaum will present studies in patients with brain lesions that address the role of the hippocampus in memory processing and in other cognitive domains. Dr. Robin will discuss evidence for how spatial contexts differentially cue autobiographical and other types of memories based on their lifetime familiarity. Dr. Sheldon will consider how the presence of stress or emotion can act as a “retrieval context” that influences how episodic memory

processes contribute to remembering personal events. Finally, Dr. Köhler will review neuropsychological and functional neuroimaging findings that highlight mechanisms involved in assessing the familiarity of objects accrued over a lifetime.

*A real-world, patient-based approach to understanding hippocampal contributions to memory.* Shayna Rosenbaum (York University)

*Familiar spatial contexts as autobiographical memory cues.* Jessica Robin (Rotman Research Institute, Baycrest Centre)

*Modifying autobiographical memories: The effects of stress and emotion on remembering the past.* Signy Sheldon, PhD (McGill University)

*Mechanisms involved in assessing cumulative lifetime familiarity with object concepts.* Stefan Köhler (Brain & Mind Institute; Western University)

## **Saturday June 8<sup>th</sup> 4:05pm-5:20pm**

### **Symposium 5-1 Encoding our world: Exploring the nature and flexibility of representations**

Throughout development, our neurocognitive system takes in massive quantities of information from our environment, and creates representations that are critical for adaptive memory and perception of the world. These representations must strike a balance between stability and flexibility. That is, when faced with new information in our environment, representations must be sufficiently stable so that we can discern commonalities and make inferences. Depending on the circumstances, these representations must also readily integrate with, or differentiate from that new information, even forming entirely new memories. How does this tug-of-war play out both behaviorally and in the brain? In this symposium, the speakers address this fundamental question by (1) employing computational models to predict when new memories will be created and when old memories will be updated, (2) using fMRI to delineate how initial overlap or competition between memories predicts representational change, (3) investigating how developmental differences in the way we learn impacts the nature of our memory representations, and (4) measuring

the impact of task-set on the relative flexibility and stability of representations. Together, these talks utilize a diverse set of approaches, to provide a cross-sectional perspective of our current understanding of the nature of representations and representational change.

*What is represented in memory after statistical learning: Evidence from adults and children.* Tess Forest (University of Toronto)

*Hippocampal encoding supports flexible representations of newly-learned visual categories.* Michael Mack (University of Toronto)

*Balancing stability and flexibility: Effects of task context on object representations across the cortical hierarchy.* Marieke Mur (Brain and Mind Institute, Western University)

*Competition between overlapping stimuli predicts learning-induced representational change.* Jeff Wammes (Yale University)

### **Symposium 5-2 Reasoning and Metareasoning: What Makes Us Think Analytically**

Many current models of reasoning assume that intuitive thinking is a default mode of thinking that can lead to reasoning biases. It is assumed that (at least some people) are capable of an analytic form of thinking that would overcome this bias. Four papers discuss the interplay of intuitive and analytic thinking. Pennycook examines the role of metacognitive processes in susceptibility to conspiracy theories and pseudo-profound bullshit (e.g., "Wholeness quiets infinite phenomena"). In a series of studies, he observed conspiracy believers and bullshit-receptive individuals are exceptionally overconfident, even on a genuinely difficult task where participants can do naught but guess. Brisson presents evidence that susceptibility to pseudo-profound bullshit may be attributed to a general problem-solving strategy. Importantly, this problem-solving strategy predicted variance in susceptibility even after controlling for another potent predictor, the Cognitive Reflection Test. Newman examines the accuracy of participants' judgments of solvability, whether they are sensitive to valid cues to difficulty, and their relationship to giving up on a traditional problem-solving task. Thompson challenges the notion that cognitive capacity supports

efficacious reasoning because it enables high-capacity reasoners to think analytically. Instead, their advantage may rest in use of intuitive, heuristic strategies that mimic analytic thought.

*Exceptional overconfidence: Implications for conspiracy belief and bullshit receptivity.* Gordon Pennycook (University of Regina)

*Judgments of solvability are insensitive to water jug problem difficulty.* Ian R. Newman (University of Saskatchewan)

*Dual strategy model and bullshit: Statistical reasoners are more receptive to pseudo-profound statements.* Janie Brisson (Université du Québec à Montréal)

*Explaining logical intuitions: The role of cognitive capacity and heuristic strategies.* Valerie A. Thompson (University of Saskatchewan)

## **Sunday June 9<sup>th</sup> 10:15am-11:30am**

### **Symposium 6-1 Now is the time for cognitive psychologists to work on education, training and policy**

Teachers are slowly beginning to overcome educational myths, including the belief that matching teaching to preferred learning styles leads to improved academic performance. Although much work remains, we are entering an exciting phase where educators, cognitive scientists and policy makers are coming together to explore how cognitive science can be applied to educational policy and instructional design. For more than 150 years, cognitive scientists have been systemically studying processes such as attention, memory, and learning in controlled lab settings. Emerging findings on spread of (in)attention, spacing to-be-learned concepts, and the interaction between physical activity and learning have transferred from the lab to class-based studies with motivated learners in authentic learning conditions. This rich resource of knowledge can be applied to developing evidence-based interventions in education. The speakers in this symposium will explore how cognitive principles can inform instructional design and critical issues in education to bridge the gap between the lab and classroom.

*The path to durable learning is guided by cognitive psychology.* Joe Kim (McMaster University)

*Attention contagion in an undergraduate lecture setting.* Noah Forrin (University of Waterloo/McMaster University)

*Moving Spacing Effect Research from the Laboratory to the Classroom.* Vanessa Foot-Seymour (York University & York Region District School Board) & Melody Wiseheart (York University)

*The mind-body approach: incorporating physical activity into instruction to promote attention and learning.* Barb Fenesi (Western University)

### **Symposium 6-2 Second-Language Influences on First-Language Processing Across the Lifespan**

An important question for the study of bilingualism is how knowledge and use of two languages influence second-language (L2), and, more interestingly, first-language (L1) processes. An equally important follow-up question is how bilingualism influences L1 and L2 processes across the lifespan, from infancy to late adulthood. While greater levels of L2 experience should improve L2 processes, it is unclear whether: (1) L1 processes should also be affected (as the L1 typically represents the dominant, more entrenched language) and (2) whether L1 processes should be differentially affected across different age groups (given their varying amounts of absolute L1 and L2 experience). This symposium includes four talks that investigate these issues. Specific topics include examining how bilingualism impacts infants' L1 audio-visual speech processing; how bilingualism impacts young adults' L1 novel word learning; how bilingualism impacts children's and young adults' L1 reading and text comprehension strategies; and how bilingualism impacts children's, young adults', and older adults' L1 eye movement reading behaviour. Collectively, this symposium will help clarify how the L1 and L2 systems are represented and accessed during online processing across the lifespan, which may reflect age-related differences in neuroplasticity.

*Monolingual and bilingual preverbal infants' face scanning patterns during audio-visual speech processing.* Monika Molnar (University of Toronto),

Jovana Pejovic (Basque Center on Cognition), & Eiling Yee (University of Connecticut)

*Long-term memory of novel words in an L1 is impacted by knowledge of an L2.* Pauline Palma (McGill University), Marie-France Marin (Université du Québec à Montréal), Kris Onishi, & Debra Titone (McGill University)

*How L2 reading strategies predict L1 reading comprehension in bilingual children and adults.* Deanna Friesen & Bailey Frid (Western University)

*Bilingual experience influences L1 reading patterns across the lifespan: Evidence from eye movement recordings.* Veronica Whitford (University of New Brunswick), Marc Joanisse (Western University), & Debra Titone (McGill University)

## **Sunday June 9<sup>th</sup> 2:15am-3:15pm**

### **Symposium 9-1 Reasoning and belief revision in development**

Individuals are often required to weigh different, and potentially contrasting, forms of evidence in order to arrive at appropriate inferences. In many cases, evidence may be at odds with a currently held belief. Researchers studying development have increasingly asked about the processes by which children confront this task. In the face of different types of evidence, when do children revise their beliefs, and when do they hold onto them? This symposium brings together work investigating developmental and contextual differences in children's ability to seek and evaluate different forms of evidence. Together, these findings have implications for our understanding of reasoning and belief-revision across the lifespan.

*Developmental changes in information integration and base rate neglect.* Samantha Gualtieri & Stephanie Denison (University of Waterloo)

*Supporting children's hypothesis-testing and belief revision during scientific inquiry.* Vaunam Venkadasalam, Nicole Larsen, Angela Nyhout, Alana Iannuzziello, & Patricia Ganea (University of Toronto)

*Does providing an explanation for a counterintuitive claim influence children's testing of that claim?* Samuel Ronfard (University of Toronto-

Mississauga), Eva E. Chen (Hong Kong University of Science and Technology), Deborah Kelemen (Boston University)

### **Symposium 9-2 Approaches to teaching cognitive psychology: On-line experiments, computation, and active learning**

Student understanding of cognitive psychology benefits from firsthand experience and experiential learning. Course instructors who incorporate such components must decide which to include and how to implement them, while balancing other course content. Effective decision making can profit from dialogue about the experience and ideas of other educators. Hence, the proposed symposium will present three different approaches to designing cognitive psychology courses that aim toward best practices for including research experience and experiential learning in this course. Dana Murphy will highlight weekly in-class experiments using CogLab a well-known web-based software that is packaged with a textbook. He also designs opportunities for students to engage in a leadership role. Bradley Harding uses in-class demos and out-of-class labs to illustrate classic cognitive concepts; he also incorporates computational elements and data generators, employed once students understand the experience of participating in experiments. Aimee Skye and Eric Legge have created active learning classes with activities that bridge text content, lectures and real world applications (e.g., a distracted driving analogue and an eye-witness memory experience). Myra Fernandes, who uses E-Prime software tools and is co-author of a cognitive-psychology textbook, will serve as discussant, with her observations on and questions of the three presentations. Subsequently, the audience will be invited to ask questions, comment, and share information about other approaches.

*Using weekly laboratory experiments to develop student understanding of cognitive psychology and student leadership skills.* Dana Murphy (Nipissing University)

*Do not (just) teach, do: Using real data and "random" dataset generators as a tool for teaching undergraduate cognition courses.* Bradley Harding (Memorial University of Newfoundland)

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## Abstracts for Poster Session #1

### Friday June 7<sup>th</sup>, 5:30pm – 7pm, Federation Hall, Columbia Room; Welcome Reception

P1-01 **Not by the same token: A female orangutan (*Pongo pygmaeus*) is selectively prosocial**, Jordyn Truax, Oakland University, Rochester, USA, Hope Emigh, Eckerd College, St. Petersburg, USA, Lauren Highfill, Eckerd College, St. Petersburg, USA, Jennifer Vonk, Oakland University, Rochester, USA.

Prosociality has been a topic of extreme interest in comparative psychology in recent years. The majority of this research has focused on highly social animals, such as chimpanzees, which have not consistently shown a preference toward prosocial behaviors. In contrast, less is known about the prosocial tendencies of orangutans, a non-group living great ape species. Although orangutans have behaved prosocially in some previous studies, they have not previously been assessed for responses to close kin in a task where different tokens represented different outcomes. We gave female orangutan opportunities to provide rewards to herself as well as her mother, sister, or both. She was more likely to choose the option that benefitted another as well as herself (as opposed to benefitting only herself) when her sister rather than her mother served as recipient. However, she chose the prosocial option equally between her mother and sister when both served as possible recipients. When benefits could be offered to all three orangutans, she chose a prosocial option on every trial. Despite the limitations associated with a single case-study, this is the first to show that orangutans may benefit kin differentially in a token task.

P1-02 **Cognitive freezing in zoo-housed gorillas in response to images of self and group-mates**, Amity Jordan, Oakland University, Rochester, USA, Jennifer Vonk, Oakland University, Rochester, USA, Molly McGuire, Oakland University, Rochester, USA .

Bethell and colleagues (2016) introduced a speeded response procedure to assess “cognitive freezing” in nonhuman primates, which may indicate negative affective states. We applied a version of the procedure to three silverback gorillas who responded by touching images of grey squares (baseline), conspecifics in threat displays (threat) or conspecifics in neutral poses (neutral) on a touch-screen. Slower responses to threat faces compared to neutral and baseline stimuli indicated negative affect. Affect was assessed on days where gorillas had spent the night in individual stalls versus together in a dayroom, and after days where they had access to outdoor and indoor habitats, outdoor habitat alone or indoor habitat alone. In a previous study, we found that gorillas habituated to images of other gorillas after repeated presentations so, in the current study, three sets of photos utilizing the group’s own images were presented randomly over a period of several months. This procedure has an advantage over other tests of cognitive bias in that it requires no training and only a small number of test sessions should be presented.

P1-03 **Live to tell the tail: Testing Bayesian Models of Socially-Driven Decisions in Zebrafish**, Kevin Kadak, Wilfrid Laurier University, Noam Miller, Wilfrid Laurier University.

The rules by which members of social species make collective decisions are a major topic of research. A well-known model of optimal decision-making has two versions: one in which only the size of the majority for one option is considered, and another in which the sequence of choices is also valued. For example, a dissenting choice early in a sequence (e.g.: left, right, right, right) should be less influential than one made later in the sequence (e.g.: right, right, right, left). It is also possible that animals use a simpler rule, such as copying the last choice they observed. To test these models, we trained two

groups of zebrafish to consistently swim to one of two arms of a Y-maze. We sequentially released 4 trained fish into the maze and noted the sequence of choices they made. We then released an experimentally-naïve test fish that had the opportunity to observe the previous choices. We compared the probability with which test fish followed the majority of the group for each decision sequence to the predictions of each model. Our findings imply that fish use a simple heuristic to make social decisions – most often following the last fish that chose before them.

**P1-04 Attentional control settings are not accomplished through activated long-term memory, Lindsay Plater**, University of Guelph, Maria Giammarco, University of Guelph, Chris Fiacconi, University of Guelph, Naseem Al-Aidroos, University of Guelph.

Humans are able to adopt an attentional control setting (ACS) which influences which objects in our complex visual environments capture our attention. Recent research has demonstrated that it is possible for long-term memory (LTM) to maintain ACSs; but what determines which LTM are capable of biasing attentional capture? One enticing possibility is that they are represented in activated LTM, and can interface with perception. However, our previous research has demonstrated that representing complex visual objects in activated LTM is not sufficient for those same objects to form an attentional control setting. Here, we tested whether representation in activated LTM is necessary for ACSs; does inducing participants to adopt an ACS for complex visual objects result in those objects being represented in activated LTM? Results demonstrated that, while participants successfully adopted an ACS, those same objects did not produce intrusion effects like other objects that were represented in activated LTM. Thus, we conclude that activated LTM is neither necessary nor sufficient for humans to adopt an ACS. Either something other than activated LTM is the reason that LTM ACSs are capable of biasing attentional capture, or a new methodology is needed to measure representation in activated LTM.

**P1-05 The interplay between attention, mood, and vulnerability for depression, Dana Hayward**, University of Alberta, Stephanie Tremblay, Concordia University, Linda Booij, Concordia University.

Previous research supports the notion that attention can be modulated by mood. In the current study, we aimed to systematically investigate how attention may be affected by two facets of mood, namely (a) current mood state via mood induction (positive or negative), and (b) vulnerability to mood via history of depression (present or absent). 75 healthy individuals, varying in past history of depression, performed spatial cueing tasks with (i) abrupt onsets, (ii) negative scenes, and (iii) positive scenes acting as peripheral cues. Additionally, mood was experimentally induced to be positive or negative through sustained listening to music. The classic Posner cueing task was administered to measure stimulus-driven attention, and modified cueing tasks with positively-, or negatively-valenced images as cues were administered to measure emotional attention. Repeated-measures ANOVAs indicated that, overall, mood condition affected attention to the classic and positively-valenced, but not the negatively-valenced cues. For individuals with a history of depression, however, mood condition differentially modulated attention to the different cues, in that those in the positive mood induction condition showed the largest inhibition of attention for positively-valenced scenes. Together, depression history and current mood appear to differentially modulate attention for various classes of stimuli.

**P1-06 Note-taking for the win: Doodling does not reduce boredom or improve retention of lecture material., E. Krysten Spencer-Mueller**, University of Guelph, Mark J. Fenske, University of Guelph.

Doodling and fidgeting—traditionally viewed in educational contexts as markers of inattention and poor classroom behaviour—have more recently been considered as possible routes to improve performance by reducing boredom and its negative impact on memory. However, there is a surprising lack of well-controlled studies examining this possibility, despite fairly widespread adoption of fidget toys and doodling exercises within classroom settings. Here we report two experiments (total N = 150) that assess the impact of doodling on boredom, attention, mindwandering, and subsequent recall of auditory information. In Experiment 1, participants first listened to a 15-minute section of a lecture known to induce boredom. Immediately afterwards, they were asked to jot down important information from a short voicemail while either doodling (add shading to shapes) or doing nothing in between note taking. In Experiment 2, participants listened to the

same lecture for 45 minutes under one of four conditions: structured doodling (i.e., shade in shapes), unstructured doodling, note-taking, or listen-only. Thought probes assessed levels of boredom, attention, and mindwandering throughout the lecture. Across studies, doodling neither reduced boredom nor increased retention of information compared to other conditions. In contrast, test performance was highest (and mindwandering lowest) for those focused on note-taking.

**P1-07 Impact of Perceptual Load on Long-Term Memory Retrieval, Michelle Blumberg**, Queen's University, Geoff Harrison, Queen's University, Jacob Wilde, University of Guelph, Pelin Tan, Queen's University, Daryl Wilson, Queen's University.

Classically, priming studies have investigated how recently attended information impacts subsequent behaviour and argue that priming is a mechanism guided by a short-term implicit memory system. However, comparatively little research has examined long-term memory (LTM) priming systems. The present study investigated whether learned associations stored in LTM can influence behaviour and whether LTM priming is influenced by task demands. Participants learned stimulus-stimulus (Experiment 1) or stimulus-response (Experiment 2) associations between coloured rings (red or green) and either a letter (E1) or a response (E2). During a subsequent visual search task, trials were either incongruent with the learned association (i.e., search task ring-target pairing was different from the learned pairing) or congruent (search task pairing was the same as learned pairing). Differences in response times between incongruent and congruent search task trials served as the index of LTM priming. LTM priming was observed in both experiments, but task demands were only relevant in the response modality, where higher task demands increased reliance on LTM. We believe this novel approach has exciting potential for investigating the mechanisms of LTM priming.

**P1-08 Initiation and execution of physical and imagined movements, Desiree Magotiaux**, University of Alberta, Peter Dixon, University of Alberta, Scott Glover, Royal Holloway University of London.

Motor imagery has often been found to produce temporal patterns that mirror those of physical movements. In the present research, we examined

the time to make “pro” movements towards a visual target and “anti” movements away from that target. In addition, we asked participants to distinguish between the time to prepare and initiate a movement and the time to carry out the movement. Consistent with a parallel between physical and imagined movements, both physical and imagined movements increased in duration with movement distance; initiation time was relatively unaffected by distance. As well, the direction of movement affected both initiation and movement time for both imagined and physical movements. The results support the view that motor imagery entails the construction and monitoring of motor plans.

**P1-09 Resolving the issue of poor reliability in the differential study of attentional capacity, Kaylynn M. Brant**, Queen's University, Canada, Geoffrey W. Harrison, Queen's University, Canada, Daryl E. Wilson, Queen's University, Canada.

Despite being one of the most commonly studied constructs in cognitive psychology, our ability to measure individual differences in attentional capacity is surprisingly limited. Two of the most prominent obstacles in the differential study of attentional capacity is that our measurement tools lack strong psychometric properties (e.g. test-retest reliability), and a lack of consistent operational definitions. This study aimed to resolve these issues by selecting a set of tasks with high test-retest reliability, share largely overlapping operational definitions for the contributions of attention to task performance, and to collect data from several different response modalities (memory accuracy, response times, and eye tracking measures). Despite our steps to resolve issues of reliability (test-retest  $r_s > .7$ ) and construct validity, the between task correlations ranged from negligible to small. Notably, several small correlations were observed between measures from distinct response modalities (e.g., accuracy and eye-tracking) which supports attention as a construct that transcends response modality. These results provide further support for attentional capacity as a multifaceted construct, such that performance on very simple tasks likely share contributions from several attentional mechanisms.

**P1-10 Does inversion disrupt averaging of emotional expressions?, Sarah Schimmel**, University of Regina, Chris Oriet, University of Regina.

Previous research suggests subjects compute statistical summary representations (SSRs) to represent the average emotion of a set of faces without representing the individual faces comprising the set. Evidence for this claim relies on the finding that subjects can identify changes to average expression even when they cannot localize any face that changed. However, previous work in our lab suggests subjects must perceive changes to individual faces to infer changes in average expression. Thus, it is unclear whether subjects can compute average expression without encoding individual faces. Inverting faces impairs recognition of some individual facial expressions (sadness, disgust) more than others (fear, neutral). Subjects judged which of two consecutive arrays of upright or inverted faces displayed more sadness or disgust, or were more fearful or neutral. Finding that 1) inversion interferes with recognition of fear/neutral in ensembles of faces and 2) inversion has no effect on recognition of average sadness/disgust in ensembles would demonstrate a double dissociation between the processing of individual items and ensembles, and provide strong support for the claim that computing the average expression of a set of faces does not rely on individual exemplars. Results are discussed in the context of current understanding of SSRs for faces.

**P1-11 Psychopathic personality traits, stress, and moral decision making, Abeera Attiq**, Department of Psychology, University of Regina.

Research suggests that stress has pro-social effects, increasing altruistic decisions in males. Because psychopathic personality traits are associated with blunted stress responses, the present study examined whether these traits moderate the relationship between stress and altruistic decisions. University students completed the Levenson Psychopathy Scale (LPS) and then stress was manipulated using the Trier Social Stress Test or its low stress equivalent; cortisol, heart rate (HR), blood pressure (BPS, BPD), and subjective stress were measured and the impact of stress on altruistic decisions was examined using the Everyday Moral Reasoning Task (EMRT). Results showed that the stress groups significantly differed on the stress measures, but not the EMRT. LPS and EMRT were significantly negatively correlated and  $\Delta$ cortisol and EMRT demonstrated a nonsignificant negative correlation—both of which appeared to be driven by the high stress group. Only the moderated regression model involving cortisol was significant, collapsed across stress conditions. While our sample was predominantly

female, significant negative correlations between EMRT and LPS,  $\Delta$ cortisol,  $\Delta$ HR, and  $\Delta$ BPD were found only in males. The finding that psychopathy is associated with fewer altruistic decisions was expected, but the finding that larger increases in stress were associated with fewer altruistic decisions contradicts the extant literature.

**P1-12 Inhibitory abilities moderate the relationship between nucleus accumbens reward sensitivity and measures of wellbeing, Diana Galarraga**, University of Toronto, Tong Liu, University of Toronto, Anthony Romyn, University of Toronto, Xiangrui Li, Ohio State University, Mark Steyvers, University of California, Irvine, Zhong-Lin Lu, Ohio State University, William Cunningham, University of Toronto.

Curiously, elevated striatal sensitivity to rewards is associated with both greater subjective happiness and clinical populations surviving with mania and bipolar disorders. How can elevated striatal sensitivity lead to such divergent life outcomes? The current study investigated whether elevated nucleus accumbens (NAcc) sensitivity to rewards was associated with either subjective happiness or subclinical mania depending on individual differences in executive functioning. Participants ( $n = 49$ ) completed tasks including the fMRI Monetary Incentive Delay (MID) and Go/No-go, and personality questionnaires including the Subjective Happiness (SHS) and Hypomanic Personality (HPS) scales. Linear regression analyses revealed that MID NAcc sensitivity was associated with both greater subjective happiness and subclinical mania. However, when accounting for Go/No-go inhibitory performance, divergent relationships emerged. Increased NAcc sensitivity positively predicted subjective happiness when the incidence of inhibition errors were low, but with increasing errors this relationship turned negative. Meanwhile, heightened NAcc sensitivity positively predicted subclinical mania when the incidence of inhibition errors were high, but with decreasing errors this relationship turned negative. Together, these results suggest that the relationship between reward system sensitivity and wellbeing should be conceptualized within a broader framework including moderating variables such as individual differences in inhibitory abilities.

**P1-13 Socio-Cognitive Processing of Referent and Valence Information in Childhood\*, Anna Hudson**, University of Waterloo, Emma Green,

University of Waterloo, McLennon Wilson, University of Waterloo, Roxane Itier, University of Waterloo, Heather Henderson, University of Waterloo.

The self-referencing bias prioritizes self-relevant information processing. Critically, the valence of this information can protect against, or foster, the development of internalizing disorders. To examine the role of item valence on referent processing, the Self Referential Encoding Task (SRET) can be employed. The SRET asks participants whether trait adjectives (positive and negative) describe themselves (yes or no; Self-Relevant) or someone else (yes or no; Other-Relevant). Our recent work in healthy adults demonstrated enhanced memory and Event Related Potential (ERP) amplitudes for self-referential items on the P1 ERP component, and the Late Positive Potential (LPP). Separately, positive (relative to negative) items were also better remembered, eliciting enhanced amplitudes on the LPP. Referent and valence processing at the ERP level have yet to be examined in children. To determine the developmental trajectory of prioritized information processing, the present study administered the SRET to a group of 9-11 year old children while EEG was recorded. Deeper encoding was found for self-relevant items, reflected in enhanced memory and LPP amplitude in our preliminary sample (N=18; target N=60). This work is critical in identifying what information children prioritize in socio-cognitive processing, which has implications for the protection against forming internalizing disorders in later adolescence.

**P1-14 Feeling bored in a media-rich world: Does state boredom lead to media multitasking?** Allison Drody, University of Waterloo, Brandon C.W. Ralph, University of Waterloo, James Danckert, University of Waterloo, Daniel Smilek, University of Waterloo.

Media multitasking involves engaging with multiple streams of information when at least one of these streams includes media. Past research supports the notion that there is a relation between media multitasking the experience of boredom. In the present study, we manipulated participants' state levels of boredom in order to determine whether state boredom increases the likelihood that participants will media-multitask. Participants watched videos intended to induce either boredom or interest. Next, participants completed an attention demanding 2-back task. On each trial of the 2-back, a letter appeared in the center of the screen and participants

were asked to indicate whether the current letter matched the letter presented two trials back. Importantly, while completing the 2-back, participants had the option of playing a video alongside the task (the video would appear above the 2-back stimuli). Our measure of media multitasking was the number of 2-back trials during which a participant had the video playing. We found no difference in media multitasking between participants who were exposed to the boring video and those who were exposed to the interesting video. Thus, we found no evidence to support the notion that variations in state boredom influence people's level of media multitasking.

**P1-15 Lifting the disguise: Negative sounds cause multiline slots players to react to "losses disguised as wins" as the losses they are rather than the wins they seem.** Molly Scarfe, University of Waterloo, Madison Stange, University of Waterloo, Dr. Michael Dixon, University of Waterloo.

Losses disguised as wins (LDWs) are slot machine outcomes where players gain fewer credits than they wager. Despite being losses, the machine celebrates these outcomes with positive sounds and animations. Consequently, players behaviourally and psychologically respond to them as if they are wins. However, when LDWs are paired with a negative sound, players more accurately estimate their number of winning spins, but it is unknown how such a manipulation may influence reward reactivity. Participants played 200 spins each on two slot machines where LDWs were paired with either a positive or negative sound. We measured how long participants waited between spins, the amount of force they used to press the spin button (indices of reward reactivity), as well as subjective game experience. We hypothesized that both wait time between spins, and the force that participants used to press the spin button would be reduced in the negative sound condition. Preliminary results based on a sample of 20 indicate support for the first hypothesis. If the hypotheses are supported, it would suggest that pairing LDWs with negative sounds aids players in responding to them as losses. Data collection is ongoing, and the complete results and implications will be discussed.

**P1-16 Learning and categorization of objects through haptic exploration,** Kyle Gauder, McMaster University, Daniel Goldreich, McMaster University, Canada.

With haptic exploration—the active manipulation of objects to gather information through touch—the brain can seamlessly integrate features into whole percepts, learning the categorical and statistical structures of the world. The information processing that underlies this ability is poorly understood. One way to understand this process is through Bayesian inference—a probability framework for comparing hypotheses as information is gathered. This approach has seen success in vision and audition but has rarely been extended into haptics. Here we compare human performance against that of an optimal Bayesian observer. Participants attempted to categorize a set of 3D-printed polygons from which we defined two novel categories with overlapping feature distributions. 45 participants completed nine blocks of forty trials in one of three training regimens: 1) single-category exposure followed by testing with corrective feedback, 2) single-category exposure followed by testing without feedback, and 3) no prior exposure, testing with corrective feedback. Each trial, participants gave their best guess for object category and their confidence. All participants demonstrated category learning. Group (3) achieved the best performance. Intriguingly, performance did not asymptote, suggesting that further improvement with additional training is possible. Future studies will test this prediction.

**P1-17 Are video-game loot boxes gambling?: Examining the subjective, physiological and behavioural experience of loot box openings in Overwatch**, Chanel Larche, University of Waterloo, Katrina Chini, University of Waterloo, Christopher Lee, University of Waterloo, Mike Dixon, University of Waterloo, Myra Fernandes, University of Waterloo.

There is current debate as to whether videogame loot boxes (buyable virtual boxes comprised of virtual, randomly determined in-game items) constitute a form of gambling. Such items range in objective value, from common (less valuable) to rare (more valuable) items. Here we aim to assess whether players psychologically, physiologically and behaviourally respond to the rarity/value of these items. If so, participants should treat boxes of greater value as more arousing, rewarding, and more inducing of the urge-to-open another box (much like slots players respond to wins of different sizes). In Study 1 we recruited 60 avid players of the game Overwatch, and exposed them to 49 videos depicting loot boxes openings where the items varied in

(Overwatch) rarity. We showed that how much players valued the loot boxes corresponded to their rarity. Additionally, for more valuable loot boxes, players showed increased ratings of subjective arousal, positive affect and urge. In an ongoing study, we are collecting measures of physiological arousal (skin conductance) and behavioural reward-tracking measures (post reinforcement pauses). By adding these physiological and behavioural measures we seek to bolster our claim that there are clear parallels between players reactions to loot boxes and gamblers' reactions to slot machine outcomes.

**P1-18 Mental rotation task performance dependent on menstrual cycle phase in a gender expansive Thai population**, Lindsey Thurston, University of Toronto, Lindsay Coome, University of Toronto, Malvina Skorska, University of Toronto, Diana Peragine, University of Toronto, Doug VanderLaan, University of Toronto Mississauga.

Sex differences in visuospatial cognition have been reported in cisgender individuals with an advantage for cismen; mental rotation task (MRT) performance exhibits this robust difference. It has also been reported that MRT performance varies by circulating hormone concentration, with high-estrogen phases of the menstrual cycle associated with lower performance in naturally cycling ciswomen. However, current literature fails to corroborate this association across sexual orientation and gender identity which could undermine the expected sex difference due to the hypothesis that identity is influenced by the direction of masculinization/feminization of neurodevelopment.

Here, MRT performance was assessed in Thai participants (N=599). Individuals assigned female at birth (AFAB) were categorized by gender identity and sexual orientation based on Thai norms and grouped by menstrual cycle phase (low estrogen versus high estrogen). We replicated the male advantage, such that cismen outperformed AFAB participants; moreover, this difference was reduced during the low estrogen phase as expected. Across AFAB groups, performance was not significantly differentiated by sexual orientation or gender identity but did replicate the expected estrogen trend. This work demonstrates sex differences in visuospatial performance in a non-Western sample and is a starting point for establishing cognitive performance across sexual orientation and gender identity.

**P1-19 Hello from the right side: Turning biases in emotional contexts at arrivals and departures, Sierra Kyliuk, University of Saskatchewan, Lorin Elias, University of Saskatchewan.**

Previous studies of lateral biases in embraces at airport arrival gates have noted a rightward bias (Turnbull et al., 1995), but this finding has never been compared to the potentially emotional negative circumstance experienced at departure gates. The right hemisphere hypothesis (RHH) attests that the right hemisphere dominates all emotional processing (Borod et al., 1988). In contrast, according to the valence hypothesis, (Davidson, 1995), negative emotions are dominated by the right hemisphere, whereas positive emotions are dominated by the left hemisphere. Examining emotionally positive and negative embracing biases at airports allows us to contrast these two hypotheses. Over 450 images were coded for embracing bias and we found a consistent and significant left-turning bias at both the arrivals and departures gate. These results suggest that the processing of emotions in the right hemisphere induce a leftward shift in the consistent right turning bias. The results add further support for the RHH. Future research could examine videos to see the full embrace interaction, and replicating the current study in a laboratory study could examine this phenomenon in more depth.

**P1-20 The effects of individual language differences on the bilingual advantage in working memory, Cassandra Morrison, University of Ottawa and Bruyere Research Institute, Ottawa, Canada, Farooq Kamal, University of Ottawa and Bruyere Research Institute, Ottawa, Canada, Vanessa Taler, University of Ottawa and Bruyere Research Institute, Ottawa, Canada.**

Several studies have suggested a bilingual advantage in working memory (WM) compared to monolinguals. However, there are also many studies showing no such bilingual advantage. These conflicting results may be because of limitations in the grouping of bilingual participants. We will investigate the effects of age of acquisition of second language (L2), years of education in L2, and amount of L2 use to examine whether differences between bilinguals are observed based on individual differences in language usage. Participants completed a delayed matching to sample task while reaction time, accuracy, and electroencephalography were recorded. A

linear mixed effects regression will be done to examine the individual differences in L2 usage on reaction time, accuracy, and event-related potentials (P200, N2, and P3b). It is expected that bilinguals with a younger age of acquisition of L2, more years of education in L2, and higher daily usage of L2 will exhibit more advantages in WM performance. The WM advantage will be supported by larger P200 and P3b amplitudes and smaller N200 amplitudes. These results will help uncover some of the confounding variables that contribute to the controversial findings as to whether bilinguals have a cognitive advantage over monolinguals.

**P1-21 Semantic richness effects and abstract verb representation, Emiko Muraki, University of Calgary, David Sidhu, University of Calgary, Penny Pexman, University of Calgary.**

The average adult knows the meanings of thousands of abstract words (e.g., realize). Explaining how this knowledge is acquired and stored has been a challenge for grounded cognition theories, wherein semantic knowledge is grounded in sensorimotor representations (Barsalou, 1999). Multiple representation theories, drawing from both grounded cognition and amodal representation theories, propose that abstract words may rely on simulation of a variety of systems to access word meaning, such as systems dedicated to processing emotional, introspective and linguistic experience (Barsalou, 2008; Borghi & Binkofski, 2014). Thus far, abstract words have been treated as a homogenous group, limiting our ability to investigate the influence of different underlying representational systems. In the present study we examined lexical-semantic processing of abstract verbs, separating them into cognitive, emotional and non-bodily word types. We used a syntactic classification task and a recognition task to investigate behavioural differences amongst the word types. Semantic richness effects were then investigated at an item level to determine the influence of semantic dimensions and contextual information on variability in response times and recognition accuracy. The results provide support for the proposal that abstract concepts are heterogeneous and engage complex multimodal representations.

**P1-22 Neuroplasticity in lexical processing: An exploration of training-related neural changes in younger adults, Kelsey Cnudde, University of Calgary, Sophia van Hees, University of Calgary, Sage Brown, University of**

Calgary, Gwen van der Wijk, University of Calgary, Penny M. Pexman, University of Calgary, Andrea B. Protzner, University of Calgary.

Lexical processing is a complex and essential skill that remains relatively stable throughout adulthood. Despite this stability, recent research suggests that with specific training, lexical processing can be altered. For example, the British Lexicon Project (BLP; Keuleers, Lacey, Rastle, & Brysbaert, 2012) showed that extensive LDT practice results in decreased reliance on word meaning, and decreased reaction time. Research on expertise suggests that the extensive lexical training undertaken by competitive Scrabble players results in improved LDT performance, as well as altered neural networks involved in lexical processing (e.g., Protzner et al., 2016). Together, these studies suggest that lexical processing shows signs of plasticity. In the current study, we replicated the BLP with the addition of EEG to investigate the neural changes associated with training-induced behavioural changes in lexical processing. Response time on LDT trials decreased within the first half of training and stabilized thereafter, replicating the behavioural findings of the BLP. Measures of brain function (event-related potentials and brain signal variability, which is a measure of neural flexibility) also showed changes over time, and aligned with changes in response time. Our results provide insight about the neural underpinnings of behavioural changes brought about by training in lexical processing.

**P1-23 Indirect Articles and the Electrophysiological Correlates Associated with Integrating and Updating Situation Models, Deanna Hall**, Wilfrid Laurier University, Todd Ferretti, Wilfrid Laurier University, Murray Singer, University of Manitoba.

This research used ERP methodology to examine the impact of indefinite articles (a/an) on situation model updating. We compared the current research with a previous study in which a definite article (the) was implemented. Two sentence passages were examined that contained discourse concepts that were either previously mentioned (match), mentioned with a general term (general match), unmentioned in lieu of another concept (mismatch), or completely unmentioned (null). N400 amplitudes showed that the null condition was the most difficult to semantically integrate, followed by the general match and mismatch and then the match condition. Late positivity amplitudes showed the mismatch

and general match conditions were the most difficult to update in the situation model. An online sentence completion study provided information as to exactly how individuals were integrating the target concepts. Overall, these results differed from previous research that used a definite article by showing the mismatch condition was the most difficult to update into the situation model, despite being relatively easy to integrate semantically.

**P1-24 Recall and maintenance of autobiographical memories from different visual perspectives, Jeffrey Hong**, Wilfrid Laurier University, Todd Ferretti, Wilfrid Laurier University, Dominique Skubnik, Wilfrid Laurier University.

Any autobiographical event can be reconstructed from a first- or third-person visual perspective. The current study explored the cognitive load associated with recalling personal events and holding them in mind, based on sentence cues (e.g., I was packing the suitcase), from each of these perspectives. Slow cortical potentials were examined as an index of cognitive load as they have been shown to be associated with the difficulty of recalling and maintaining memories in mind. This index showed that the cognitive load associated with holding events in mind was greater when participants adopted a third- than first-person visual perspective. This result is consistent with previous work that has shown a similar pattern of results when individuals are instructed to generate novel, imagined events. Participants in the current study also rated first-person memories as more vivid and third-person memories as older. These results provide novel insight on the cognitive load associated with autobiographical memory retrieval and maintenance.

**P1-25 Investigating the function of peripheral vision in early scene processing, Jatheesh Srikantharajah**, University of Waterloo, Colin Ellard, University of Waterloo .

Prior research (i.e. Larson & Loschky, 2009) has shown that peripheral vision is sufficient to identify the gist of a briefly (< 250 ms) presented scene. In two experiments, we investigate whether people rely more on peripheral or central vision for identifying scene gist, and whether information from peripheral vision suffices to form affective impressions about scenes. In the first experiment, 25 participants viewed simultaneous images of different

scenes in the central and peripheral visual fields for 66 ms. Scenes were housing interiors, forests, lakes, and urban streets. Participants were tasked to identify the gist of the overall scene and were given a choice between the peripheral and central scene. Participants were significantly more likely to indicate that the gist of the scene was the information in the periphery. In the second experiment, 50 participants viewed 52 urban and natural scenes presented to the peripheral visual field for 216 ms, and then rated the pleasantness and interestingness of those scenes. Natural scenes were rated as significantly more pleasant and interesting than urban scenes. These results indicate that peripheral vision is not only advantaged in processing gist, it also provides sufficient information for forming affective judgments about scenes.

**P1-26 Resistance to proactive interference and splitting in interpersonal stress: An experimental study, Gasser Saleh**, University of Montreal, Pierre McDuff, University of Montreal, Jean Gagnon, University of Montreal.

Resistance to proactive interference (RPI) is the ability to resist memory intrusions from irrelevant previously learned information. Despite the fact that a decrease of RPI is associated with more intrusions of self-referential negative thoughts such as traumatic memories, little is known about self-concept components associated with RPI. Splitting is a defense linked to self-concept used under interpersonal stress by which the positive and negative representations of self are separated in order to protect oneself from anxiety. Splitting could be understood as a difficulty to use RPI in order to resist intrusion from negative self-representations. Relationship between splitting and RPI as a function of interpersonal stress was investigated in 131 individuals. Participants completed a questionnaire measuring splitting and were randomly assigned to either the rejection or the exclusion condition of the Cyberball task (Williams and Jarvis, 2006) followed by a measure of their perception of inclusion during the task. Finally, they performed a RPI task. Interaction between splitting and experimental conditions was not significant, but interaction between splitting and perception of inclusion was. High splitting usage with a perception of low inclusion predicted a decreased performance in the RPI task. Splitting seems to be a self-concept component associated with the RPI.

**P1-27 How Gender Pronouns Impact the Cognitive Processes of Reading, Hudson Blue**, Laurentian University, Emalie Hendel, Laurentian University, Denis Vaillancourt, Laurentian University, Joel Dickinson, Laurentian University, Annie Roy-Charland, University of Moncton.

Schemas are representations of individuals, objects or events that allow information to be categorized and organized in way that makes the understanding of this information easier. While schemas are useful cognitive tools, when violated with inconsistent information they can also be problematic. The current study was examining if a change of gender pronouns when describing the same individuals, such as in the case of people who are transgender, will violate the schema for the initial gender presented and impact cognitive processes. Since the Attentional-Disengagement Model predicts that words that draw more attention have more omissions in a letter detection task, the missing letter effect phenomenon was used to test for cognitive impacts of schema violations. Results revealed an unexpected interaction between gender and sex, which is discussed in terms of stereotype entrenchment. Better understanding of relevant cognitive processes to the perception of transgender people will help guide in ways in which discrimination against these people can be reduced.

**P1-28 Circadian contributions to individual differences in performance rates, Shannon E Wright**, McGill University, Sebastian Andric, McGill University, Caroline Palmer, McGill University.

Individuals display spontaneous rates of motor production in a variety of tasks including walking, speaking, and music performance. Spontaneous motor production rates differ between individuals; factors that contribute to these individual differences have not yet been identified. This study investigates physiological markers of spontaneous motor production rates.

Circadian fluctuations in production rates were measured with physiological markers while trained pianists performed melodies at four times in a single day (09h, 13h, 17h, 21h). Heart rate was measured before and during piano performance; body temperature and alertness were also measured. Pianists performed familiar and novel musical melodies at a comfortable spontaneous rate and completed a chronotype questionnaire.

Heart rate variability was significantly greater before than during music performance of both familiar and novel melodies. Music performance rates were slowest at 9am (the initial recordings) and unchanged at other times of day; timing variability of performance was consistent across times of day. Performance rates and timing variability were stable within individual across sessions. Slower production rates at 9 am may have been related to chronotype; the majority of pianists' sleep patterns indicated a late chronotype. In sum, musicians' performance rates as well as physiological measures appeared to be stable across the day.

**P1-29 Cross-linguistic Effects of Intention Recognition in Malay-English bilinguals, Maziyah Mohamed**, University of Western Ontario, Debra Jared, University of Western Ontario.

Research has shown that grammatical markers in a language can influence the way we think. In Malay, accidental actions are marked with a prefix. Conversely, Malay speakers are more likely to assume a deliberate intent when the prefix is absent. The goal of this research was to determine whether this way of interpreting the intentions of others extends to English for Malay-English bilinguals. In Study 1, I demonstrated that Malay speakers have accurate memory for the intentions of characters in text. In Study 2, I used a cross-modal priming task to investigate whether there were differences between Malay-English bilinguals and English monolinguals in their interpretation of intentions. Participants heard scenarios in which the action of the character was clearly unintentional or was ambiguous, and then they saw a word that was either consistent with an unintended-action interpretation or was unrelated. Malay-English bilinguals performed differently than English monolinguals only in the ambiguous condition; they showed a smaller priming effect suggesting that they were more likely to have interpreted ambiguous actions as deliberate. These findings demonstrate that the grammatical intention marker in Malay influenced speakers' perception of intentions even when listening to English. These results inform our understanding of cross-cultural communication differences.

**P1-30 Influence of semantic information on morphological parsing of masked compound words., Alexander Taikh**, University of Alberta, Christina Gagne, University of Alberta, Thomas Spalding, University of Alberta.

In studying the role of morphology in visual word recognition, a question of interest is whether the individual constituents of a compound become automatically activated during its processing due to the morphological segmentation of the compound. Gagne et al. (2018) found that a masked compound word prime (highlight) facilitated the recognition of its constituent (high), suggesting that compound segmentation occurs automatically, resulting in the constituents becoming activated even when the compound is very briefly presented.

The present experiment examined whether pre-activating the meaning of the compound, and thus facilitating access to its lexical representation, could prevent its morphological segmentation. Visible semantic primes related to the compound were presented, followed by the masked compound word primes and the constituents (flag - highlight - high) in a lexical decision task. Importantly, the constituents did not retain the meaning of the compounds. Recognition of the constituent targets was faster when the semantic prime was related (vs. unrelated) to the compound, suggesting that activating the meaning of the compound facilitated its recognition and its morphological segmentation. Our findings suggest that decomposition of compound words is obligatory and the individual constituents become automatically activated.

**P1-31 Concreteness with auditory versus visual presentations, \* Simritpal Malhi**, University of Windsor, Lori Buchanan, University of Windsor.

Previous research (Malhi & Buchanan, 2018) revealed a reverse concreteness effect (i.e., concrete words were processed slower than abstract words) in an iconicity judgment task. Participants were shown word pairs and were asked to decide if the position of the words on the computer screen matched how their referents appeared, either in everyday objects (for concrete words; e.g., monitor – keyboard) or in relationships (for abstract words; e.g., happy – sad). We proposed that with concrete word pairs, the first step was visualization and the second step was mental manipulation. In contrast, because the abstract word pairs could not be

visualized, there was only the single step of mental manipulation. Thus, this two-step process for concrete words involving visualization placed time-based demands that slowed down processing. The present study sought to investigate the role of sensory presentation by having participants listen to the words instead. Results showed a similar pattern such that the reverse concreteness effect was observed again. However, the reaction time results revealed that, when participants heard the words, concrete words were processed even slower than abstract words, suggesting that seeing the concrete words makes it easier to visualize them whereas hearing the words places additional time-based demands on visualization.

**P1-32 The Flexibility of Radical Position Coding in Chinese Character Recognition: Evidence From Transposed Radical Priming Effects.**, Zian Chi, Western University, Xuan Pan, Western University, Stephen Lupker, Western University, Canada.

In the hierarchical processing framework of Chinese, the radical and the character have different levels of representation. A key research question is whether radical representations are position-sensitive or position-general. In the present research, Experiment 1 involved a masked priming lexical decision task, whereas Experiment 2 involved a masked priming same-different task, both with ERP measurements investigating this issue. “Related” primes involved characters in which the two radicals were transposed. In Experiment 1, we found a transposed radical (TR) priming effect in response time and in N170 amplitude, indicating that TR priming effects are not limited to low-level processing tasks. In Experiment 2, the results on same trials showed a TR priming effect in both response time and P3 latency. These results imply that the representations of Chinese radicals are position-general, at least if the radicals are free radicals.

**P1-33 Statistical learning and how it relates to language and reading abilities: An event-related potential study.** Christine Moreau, Western University, Marc Joanisse, Western University, Laura Batterink, Western University.

Our ability to learn language relies on our sensitivity to structural patterns in speech, a process known as statistical learning (SL). SL has been found to be impaired in children with reading and language disorders; however,

research on SL abilities in children with a broad range of language and reading abilities is largely unexplored. Studies looking at SL have mostly used offline behavioural measures, which do not capture SL as it occurs and excludes important information, such as the time course of learning. In this study, electroencephalography (EEG) and behavioural measures are used to investigate SL in English monolingual 8- to 12-year-old children with a range of reading and language abilities. The goal of the study is to explore how SL predicts patterns of deficit in multiple language modalities to provide a more complete picture of how SL influences language and reading development. The hypothesis is that children who have poor language profiles will also have poor SL abilities. Results are pending, but we anticipate that participants who have poor language and reading abilities will also have poor SL abilities. This would demonstrate that SL is associated with the emergence of language disorders.

**P1-34 Punny and funny: Semantic association in pun reading.** Taylor Gooding, University of Windsor, Vincent Porretta, University of Windsor, Lori Buchanan, University of Windsor.

Puns rely on ambiguity to evoke disparate meanings, producing a humorous effect shown to affect reading (Jared & Bainbridge, 2017, Canadian Journal of Experimental Psychology). Here, we investigated the role of semantic priming on comprehending the meaning associated with puns. In an eye-tracking experiment, 30 native English-speaking participants read 90 puns (e.g., During branding, cowboys have sore calves often). Each pun sentence was preceded by a prime varying in semantic association: high (i.e., thigh), low (i.e., horse), or unrelated (i.e., court). After reading, participants rated the humour of the sentence on a six-point scale. The results showed that highly semantically related primes facilitated total reading time of the critical pun word (calves) relative to unrelated primes. This effect persisted for the total reading time as measured by summed fixations. Further, sentences that were judged to be funny had significantly faster reading reaction times (button press to end trial). However, humour ratings did not influence gaze behavior, nor were humour ratings influenced by priming condition. The results indicate that priming with semantically related words reduces ambiguity in late measures of processing but that reduced ambiguity does not impact humour ratings.

**P1-35 Differences between explicit and implicit memory processes during language learning: Evidence from fNIRS, Leah Brainin, The University of Western Ontario, Marc Joanisse, The University of Western Ontario.**

Compared to young children, the language learning process is much more difficult and less successful in adulthood. However, little is known about how domain-general non-linguistic cognitive processes contribute to these age-dependent differences. We argue that language learning involves both explicit declarative memory processes to acquire a vocabulary of words and implicit procedural memory processes to learn grammatical patterns. Using functional Near-Infrared Spectroscopy (fNIRS), we aimed to quantify the relative contribution of declarative versus procedural learning in young adults via an artificial language learning task involving both vocabulary semantic items and grammatical patterns. Preliminary results revealed that adults performed significantly better on vocabulary test items compared to grammar test items. We predict these differences are due to differences in memory engagement during language learning. Through ongoing fNIRS analyses, we expect a positive correlation between frontal neural engagement during training and grammar accuracy during testing. This suggests that adult's diminished engagement in procedural mechanisms may result in less effective grammar learning. Moreover, an enhanced reliance on declarative memory may be interfering with optimal implicit grammar learning. Overall, the current study sheds light on whether declarative and procedural memory differences result in adults' specific difficulty with grammatical language learning in a domain-general manner.

**P1-36 Spatial probability learning, voluntary attention, and gaze, Sean Griffin, University of Waterloo, Britt Anderson, University of Waterloo.**

Evidence suggests that the set of neural mechanisms responsible for spatial probability learning (PL) might intersect with those which mediate the voluntary expression of spatial attention. For this reason, we investigated a potential cross-task influence of spatial PL on voluntarily expressed patterns of spatial attention. We used a behavioural task based on the Tse Illusion to measure voluntary shifts in spatial attention (Illusion Task; Tse, Caplovitz, & Hsieh, 2006). To induce spatial PL, we used a feature discrimination task (PL Task) derived from Druker and Anderson (2010). In three studies, we combined the Illusion Task with the PL Task in a pre-test/post-test design.

Our third study included eye tracking which allowed us to investigate mechanistic hypotheses about the dependence of spatial PL on spatial biases in gaze adaptation and perceptual processing. Our three studies replicated past work on spatial PL and produced robust estimates of the impact of spatial PL on the feature discrimination task. We found the effect to be largely driven by changes in eye-movement generation and consequently speed of target acquisition. Finally, we discovered that spatial PL did not influence the expression of voluntary attention in a subsequent task.

**P1-37 A novel false recognition effect: The impact of congruency on illusory memory, Ben C. Sclochnik, McMaster University, Tamara M. Rosner, McMaster University, Bruce Milliken, McMaster University.**

Rosner, D'Angelo, MacLellan and Milliken (2015) demonstrated a false recognition effect using interleaved word pair stimuli, wherein each stimulus contained two words that either matched in identity (congruent), or differed in identity (incongruent). False alarms were higher for new congruent items than for new incongruent items. This effect is reminiscent of the Jacoby-Whitehouse effect (JWE; Jacoby & Whitehouse, 1989), wherein brief duration masked primes during a recognition task produce false recognition effects. We examined whether the Rosner et al. effect and the JWE effect are indeed related. Our research strategy was to manipulate the relative proportions of congruent and incongruent items at test (.20/.80 vs .80/.20) using the Rosner et al. procedure, and the relative proportions of repeated and non-repeated items using the JWE procedure. Westerman (2008) showed that the JWE is larger when proportion of repeated items is relatively low. In Experiment 1, we replicated this effect successfully. In Experiment 2, we found no corresponding effect of the relative proportions of congruent and incongruent items in the Rosner et al. procedure. Our results demonstrate that the Rosner et al. effect is replicable, and offer preliminary support for the view that it is distinct from the JWE.

**P1-38 Hooked on a feeling: how emotional mood and cues bias autobiographical memory recall, Stephanie Simpson, University of Toronto, Signy Sheldon, McGill University.**

Human memory is malleable. This means that the factors present in our current context can affect the way we recall past personal experiences – autobiographical memories. One such factor, emotion, can be felt internally (e.g., through mood) or expressed externally (e.g., through a retrieval cue). Here, we examined two issues pertaining to the influence of these two emotional sources (mood and cue) on autobiographical memory retrieval. First, to what degree do mood and emotional retrieval cues reliably impact the content of recalled events? Second, what role do the dimensions of emotion (valence and arousal) play in memory retrieval? Under two mood states (happy, sad), 32 young adults described specific autobiographical experiences in response to cues that systematically varied in emotional arousal (high, low) and valence (positive, negative). The content of these descriptions was scored to assess the number of episodic (internal) and non-episodic (external) details as well as the overarching emotional tone. We observed that the emotional characteristics of a cue, not mood, more reliably influenced these variables. Moreover, valence and arousal contributed uniquely to autobiographical memory retrieval: cue valence determined the emotional tone while highly arousing cues biased memory specificity. This investigation has implications on models of memory organization.

**P1-39 Controlling confounds in the list-length effect in cued recall, Tyler M. Ensor**, Memorial University of Newfoundland, Dominic Guitard, Université de Moncton, Tamra J. Bireta, The College of New Jersey, William E. Hockley, Wilfrid Laurier University, Aimee M. Surprenant, Memorial University of Newfoundland.

An ongoing debate in the memory literature concerns whether the list-length effect (better memory for short lists compared to long lists) exists in item recognition (Annis, Lenes, Westfall, Criss, & Malmberg, 2015; Dennis, Lee, & Kinnell, 2008). This debate was initiated when Dennis and Humphreys (2001) showed that, when confounds present in earlier list-length experiments were controlled, the list-length effect disappeared. The issue has yet to be settled. Interestingly, the same confounds present in recognition experiments exist in cued-recall experiments. Here, we implemented Dennis and Humphreys' methodological controls to test for the list-length effect in cued recall. In Experiment 1, we found a robust list-length effect when start-of-study items from the long list were tested.

However, no list-length effect was found in Experiments 2 and 3 when end-of-study items from the long list were tested. These results are consistent with the view that cued recall is susceptible to retroactive interference but not proactive interference, a position supported by early interference work (e.g., Lindauer, 1968; Melton & von Lackum, 1941).

**P1-40 Forward and Backward recall for visuospatial information are functionally equivalent, Dominic Guitard**, Université de Moncton, Jean Saint-Aubin, Université de Moncton.

Backward recall has been studied for over a century. However, the processes highlighted by backward recall remain to be elucidated. It has been suggested that, at retrieval, visuospatial representations are more involved in backward than forward recall. We systematically investigated this hypothesis for visuospatial information. More specifically, we used a visuospatial dot task combined with manual-spatial tapping. In Experiment 1, the interference task was introduced at presentation and in Experiment 2, it was introduced at recall. Results revealed that participants recalled fewer dots when they performed manual tapping than in the control condition. However, the detrimental effect was of similar magnitude in both recall directions. In Experiment 3, participants performed the interference task during both presentation and recall. Furthermore, articulatory suppression was performed during all trials to prevent the use of verbal representations. Again, the performance was lower with manual tapping, but importantly, the magnitude of the detrimental effect was the same in forward and backward recall. Overall, results do not lend support to the visuospatial hypothesis.

**P1-41 Assessing Story Recall in Patients with Mild-Cognitive Impairment (MCI), Tammy Bui**, University of Ottawa and Bruyère Research Institute, Christine Sheppard, Bruyère Research Institute, Vanessa Taler, University of Ottawa and Bruyère Research Institute .

The Logical memory (LM) test of the Weschler Memory Scale (WSM) is a frequently used clinical test for episodic memory assessment. However, the lack of alternative forms and reliance on verbatim scoring limit its longitudinal application and clinical utility. The aim of the present study was: (1) to develop twelve psychometrically equivalent alternate story recall

forms matched in terms of length, units, and propositions; and (2) to assess immediate and delayed unit and propositional responses of older adults (n=14) and MCI patients (n=14) using veridical, gist, and distortion scoring criteria. Older adults performance on immediate and delayed recall was superior to that of MCI patients. There were higher veridical scores in the immediate recall, but higher gist scores in the delayed recall overall. Older adults displayed higher distortion-level recall than MCI patients. The availability of alternative forms will be a major advantage in clinical practice and the proposed scoring protocol will allow for a more sensitive detection for cognitive decline. The newly developed forms will be used for neuropsychological assessment and early detection of Alzheimer's Disease (AD), providing guidance for clinicians in developing pharmaceutical and social interventions.

P1-42

P1-43 **Only the weak survive: Semantic effects in retrieval-induced forgetting**, Tara McAuley, University of Windsor, Daniela Wong-Gonzalez, University of Windsor, Chelsea Reaume, University of Windsor, Lori Buchanan, University of Windsor.

Retrieval-induced forgetting (RIF) is a phenomenon whereby the retrieval of a memory causes forgetting of related memories (Anderson et al., 1994). This phenomenon is investigated using the retrieval practice paradigm in which category-exemplar pairs are either practiced (rp+) or unpracticed (rp-) exemplars from practiced categories or unpracticed categories (nrp). The RIF effect is observed when rp+ items are recalled better than nrp items, which are recalled better than rp- items. In the inhibitory account for this phenomenon, competing exemplars must be inhibited to retrieve the target exemplar, and the strength of the RIF effect reflects the amount of competition created by this inhibition. To test this account, we manipulated the semantic distance of the exemplar pairs. This semantic feature was used as a proxy for the strength of the competitors. Results support the inhibitory account; recall was more accurate for rp- items that were weak competitors (distant neighbours) than strong competitors (close neighbours). These results demonstrate that item-specific semantic features can be uniquely applied to provide further insight into a memory phenomenon.

P1-44 **The role of napping in consolidating clinically-relevant information in healthy and depressed participants**, Edwyn Lo, Queen's University.

The hypothesis that overnight sleep or daytime naps have beneficial effects on memory consolidation has been widely supported for many years. Given the comorbidity of memory impairment and depressive symptoms, the present study compared the effects of napping on memory consolidation of clinically-relevant information in healthy and depressed individuals. A new memory test was developed, consisting of a psychoeducational video that presented information regarding cognitive symptoms of depression and strategies to help alleviate these symptoms. Memory for the video was assessed by free-recall and a paired-associates test. Participants were randomly assigned to a 60-minute wake or nap condition with continuous EEG monitoring. Preliminary results show that retention is similar following the nap compared to wakefulness in both healthy and depressed participants. Interestingly, regardless of condition, depressed participants exhibited better recall performance than healthy individuals. These findings suggest that napping may not benefit the consolidation of explicit, clinically relevant information. However, recall performance, as assessed here, was superior in depressed individuals, perhaps due to the personal relevance of the information presented in the video (supported by NSERC).

P1-45 **Memory for temporal order in action comes last**, Taline Blakley, University of Regina, Jeff Loucks, University of Regina.

Learning a multistep action sequence requires encoding 1) which items are being used, 2) which sub-actions are being performed with each item, and 3) what order the sub-actions are executed in. We hypothesize that processing order is the least prioritized element, such that 1) and 2) must be processed before 3). In the present experiment participants learned a 4-step action sequence involving 4 items via multiple demonstrations. Following distractor tasks, they were then asked to imitate the sequence that they had observed previously with a new set of items. Participants in different conditions learned the sequence with either easy or difficult to process items, with respect to the category that bound the objects across each demonstration. Each group was further subdivided such that one experienced a deviant order for the 2nd demonstration, while the other viewed 4 consistent orders. Results indicated a significant interaction

between item difficulty and deviancy on imitation of order. Specifically, in the easy condition, the deviant order did not affect imitation of order, whereas in the deviant condition the deviant drastically reduced imitation of order. These results have implications for the conceptualization of working memory processes in regards to learning, and the mechanisms of temporal processing.

P1-46 **Memory for Pairs of Cheers and Tears: Individual Differences in Associative Memory**, Nada Alaifan, University of British Columbia, Peter Graf, University of British Columbia.

Emotional events tend to be better remembered than emotionally neutral events, and this memory difference tends to be larger in women than men. However, convincing evidence for this claim is available mainly from research on autobiographical memory. The present study was designed to find such evidence in episodic memory. The subjects were undergraduate student volunteers. They studied a long series of picture pairs, with each pair consisting either of two emotionally positive pictures, two negative pictures or two neutral pictures. After a brief delay, memory was assessed with an associative recognition test. For this test, we displayed pairs of pictures, with each pair consisting either of two pictures which had also been displayed together in the study phase of the experiment (an intact item), or with two pictures which had been displayed at study but as part of two different pairs (a repaired item), or consisting of one previously displayed picture plus a new picture (an old-new item). The participants' task was to identify the intact items. Preliminary findings show lower Associative recognition of valenced items, but not influence due to sex.

P1-47 **Feeling positive or negative? The role of positive and negative framing in metacognitive judgements in reasoning.**, Daniel Geary, University of Saskatchewan, Valerie Thompson, University of Saskatchewan.

Meta-Reasoning constitutes the processes that monitor and control reasoning and problem-solving actions. The framework proposed by Ackerman and Thompson (2017) proposes that one's monitoring judgments are mediated by cues that are not always well calibrated with accuracy. This claim is now challenged by new studies examining the feeling of error (FOE) which have demonstrated that FOE is well calibrated, and this incongruence

of findings may be largely driven by a framing effect arising from the positive and negative valency in how the metacognitive question is asked (Cruz, Arango-Muñoz, & Volz, 2016). Our goal was to test this claim by comparing the positively-framed (feelings of rightness or FOR) and negatively-framed (FOE) metacognitive assessments in reasoning.

P1-48 **The impact of emotion on memory predictions: A psychophysiological approach**, Evan E. Mitton, University of Guelph, Michelle A. Dollois, University of Guelph, Christopher M. Fiacconi, University of Guelph.

Judgments of learning (JOLs) are predictions regarding the likelihood of remembering recently acquired information on a later test of memory. Past literature has shown that such predictions are inferential in nature and can be informed by a variety of cues. The current project investigates the role of one such cue, namely emotion, in guiding JOLs. Preliminary research suggests that negatively-valenced information is perceived as more memorable than neutral information. However, current measures of valence and arousal rely on subjective ratings rather than direct physiological measures of these constructs. Therefore, the current project utilizes a novel psychophysiological approach to assess the impact of emotion on JOLs. Specifically, facial electromyography (fEMG) and skin conductance responses (SCR) are used to measure changes in valence and arousal, respectively, as participants make JOLs to neutral and negative images. Critically, this approach allows us to correlate on a trial-by-trial basis the physiological response to a stimulus with its corresponding JOL. Moreover, inclusion of multiple physiological measures affords the opportunity to examine whether generalized physiological arousal (SCR) predicts JOLs independently of the valence of the image (fEMG). These results are discussed in relation to experience- vs. theory-based contributions to meta-memory judgments.

P1-49 **Is responding with your eyes a more valid measure of number line estimation than responding with a mouse?**, Kelsey J. MacKay, Centre for Instructional Psychology and Technology, KU Leuven, Belgium, Filip Germeys, Research Centre for Work and Organisation Studies, KU Leuven (Brussels Campus), Belgium, Lieven Verschaffel, Centre for Instructional Psychology and Technology, KU Leuven, Belgium, Wim Van Dooren, Centre

for Instructional Psychology and Technology, KU Leuven, Belgium, Koen Luwel, Research Centre for Mathematics, Education, Econometrics, and Statistics, KU Leuven (Brussels Campus), Belgium.

In number line estimation (NLE), participants respond with either a pencil (paper-and-pencil variant), or a mouse (computerized variant). However, using a pencil/mouse might allow participants to hold the pencil/mouse at the midpoint, thus creating an external benchmark. Problematically, external benchmarks on the NLE task improve estimates (Peeters, Verschaffel, & Luwel, 2017). Our aim was to determine if answering with the eyes can be a less biased estimation method, by comparing answering with the mouse and answering with the eyes (using eye-tracking). Adults (N = 33) positioned 54 numbers on a 0-1000 number line in a mouse condition (i.e., respond with the mouse) and an eye condition (i.e., fixate on the number line). Results showed moderate and strong significant correlations in participants' accuracy and reaction times, respectively, between the two conditions. Also, participants were significantly slower and more accurate in the mouse than in the eye condition. For the eye-tracking data, 5 equal-sized interest areas were made across the number line to investigate benchmarking on the number line. Eye-tracking data will be presented across these interest areas for both conditions. Future research using paper-and-pencil or mouse-and-computer NLE tasks should consider the potential additional external benchmark.

**P1-50 Explicit counting for discriminating temporal intervals, Esteban Mendoza-Duran**, Université Laval, Vincent Laflamme, Université Laval, Simon Grondin, Université Laval, Juan-Carlos Forigua-Vargas, Fundación Universitaria Konrad Lorenz, Colombia.

The aim of the present study was to compare the benefits of using explicit counting in a temporal discrimination task under various marker-type conditions. In this experiment, conditions with and without counting were compared for three implicit standard durations, .6, .8 and 1.0s, in connection with three marker-type conditions, which were intervals marked by: 1) two brief visual signals (visual-visual); 2) one auditory signal followed by a visual signal (auditory-visual); and 3) one visual signal followed by an auditory signal (visual-auditory). Results show no evidence that explicit counting leads to better accuracy. There is evidence, however, that accuracy

was worse with the visual-auditory markers than the visual-visual markers condition and that accuracy decreased for briefer implicit standard duration. The results agree with previous research that has shown that at 1.6s, explicit counting provides improvements of performance in a temporal discrimination task in all marker-type conditions.

**P1-51 Psychology-specific education strengthens students' implicit understanding of psychology as a science, Lindsay Morgan**, Carleton University, Demi Plagianakos, Carleton University, Guy Lacroix, Carleton University.

Even though psychology is a science, its status has been met with skepticism from both the lay public and those educated in other scientific disciplines. The goal of this research was to determine if an education in psychology impacts students' implicit perception of their discipline as a science. It was expected that more senior undergraduate students would display stronger associations between psychology and scientific terminology. To this end, first- and upper-year students completed a lexical decision task (LDT) that comprised common academic disciplines and related words. In Experiment 1, students took part in a go/no-go version of the task. Upper-year students demonstrated a stronger implicit association between psychology and science compared to their first-year counterparts. However, an alternate explanation was possible: upper-year students could have been quicker to respond to the word psychology because of a familiarity effect. Experiment 2 was conducted to rule out this possibility. As such, students took part in a yes/no LDT. Preliminary analyses suggest that upper-year students implicitly associated psychology and science, regardless of familiarity.

**P1-52 Expectation's Expansive Effect on Subjective Duration Reflects Low-Level Processes, Corinna D. McFeaters**, University of New Brunswick, Daniel Voyer, University of New Brunswick.

Subjective duration for novel stimuli is typically longer than for repeated stimuli, but expectations of repetition moderate this effect (Matthews, 2015). Matthews posed these findings in terms of opposing effects of repetition and expectation, with repetition contracting duration and expectation expanding it. McFeaters and Voyer (2018) replicated Matthews' experimental paradigm, observing longer subjective durations for expected

repetitions than unexpected repetitions but also a corresponding shortening of subjective duration for unexpected novel stimuli compared to expected novel stimuli. Overall, their results suggested a context-based effect of expectation, rather than the mitigation of stimulus-based repetition contraction. The current study therefore aimed to examine whether the effect generalized to higher-order contextual expectations. Sixty participants completed a judgment task in which two words were serially presented and participants indicated whether the duration of the 375-ms. or 625-ms. comparison stimulus was longer or shorter than a 500-ms standard stimulus presented immediately prior. In half of the blocks, repetition was verbatim; in the other half, it was semantic. For verbatim repetitions, results replicated those of McFeaters and Voyer (2018); however, no effect was observed for semantic repetition. Overall, results suggested that the expansive effect of expectation was limited to low-level stimulus expectations, rather than originating from higher-order context effects.

**P1-53 Speed perception is enhanced for familiar human motion, Jeff Loucks**, University of Regina, Denée Buchko, University of Regina.

Evidence indicates that observers' speed perception is enhanced for the motion of any biological agents (e.g., both human and dog; Loucks & Nagel, 2018). However, processing human versus non-human motion results in the activation of distinct neural patterns (Papeo et al., 2017). In the present experiments we sought to clarify the role of category and familiarity in speed perception. In Experiment 1 we compared speed discrimination for point-light human walking, human infant crawling, cat walking, and chicken walking. Results indicated greater sensitivity for human walking in comparison to all other entities, especially in comparison to human infant crawling and chicken walking, for which sensitivity was at chance. In Experiment 2 we investigated whether human walking was enhanced relative to cat walking even when spatially scrambled, to rule out enhancements due to local motion. Results demonstrated that speed perception was only enhanced for human walking when global configuration was maintained. These results reveal that speed perception is enhanced for highly familiar and typical human motion in comparison to typical and relatively familiar non-human motion, but that motion familiarity also plays

a significant role (e.g., human infant crawling). It is not yet known whether this enhancement reflects ancestral priorities or visual expertise.

**P1-54 A fully transparent replication study of precognitive detection of reinforcement using an expert consensus design, Alyssa LeGuerrier**, University of Ottawa.

The most recent crisis in psychology has been fuelled by the inability to replicate a majority of published findings. A contributing factor to this crisis was the controversial publication of significant findings in Bem (2011) implying the existence of psi abilities. The nature of these results was believed to be a by-product of questionable research practices (QRPs) and the file drawer problem. The purpose of this study was to conduct a fully-transparent replication of one experiment published by Bem (2011) testing precognitive reinforcement with the presentation of erotic and non-erotic stimuli. The study design was reviewed by a panel of experts, both believers and skeptics of extrasensory perception, to improve the integrity and validity of experimental research in psychological science. 143 participants participated in this replication. Results from binomial testing and standard t-tests failed to indicate a significant effect for precognitive abilities. Further statistical equivalence testing supported the presence of a null effect for precognition. Although these findings do not support the existence of parapsychological abilities, contradictory to the conclusion drawn by Bem in his original study, this research acts as a demonstration of the level of transparency that should be included in future replications and innovative studies.

**P1-55 The role of individual differences in judging the authenticity of smiles including traces of negative emotions, Weldie Joseph**, Université de Moncton, Adele Gallant, Université de Moncton, Annie Roy-Charland, Université de Moncton.

Smiles can display happiness but, their voluntary production may also be used to mask other emotions. However, a masking smile is not always a perfect replication of an authentic enjoyment smile and traces of the real emotion may leak. Research showed that humans are good at detecting an authentic smile from a masking smile but not at identifying which emotion is being hidden. Previous results are not explained by attention to the location

of cues of the felt emotion being masked. The goal of the current study was to explore the role of individual differences in emotional contagion, intelligence and regulation on smile judgement and recognition as a possible explanation. 80 participants judged the authenticity of smiles containing traces of fear, anger, sadness and disgust and enjoyment smiles. When the smile was deemed non-authentic, participants indicated if there was another emotion masked and, if so, which one. Eye movements were also recorded. Participants completed questionnaires to measure emotional contagion, intelligence and regulation. Results revealed that participants are sensitive to enjoyment and masking smiles. However, results are not easily explained by attentional processes, nor individual differences. Results are discussed as a function of the explicit knowledge hypothesis of facial expression recognition.

**P1-56 Dissociating the effect of autobiographical memory retrieval on the cognitive and affective components of empathy, Can Fenerci, McGill University, Signy Sheldon, McGill University.**

Contemporary research has documented overlap in recruiting episodic memory processes for remembering past personal experiences (i.e., autobiographical memories) and empathy. However, empathy is a multi-faceted construct that encompasses a cognitive (inferring mental states) and affective (feeling concern for another person) component, which leaves open questions about which component is supported by episodic memory. To address these questions, we tested how recruiting episodic processes during autobiographical memory retrieval affected performance on a subsequent empathy task. In a within-subjects design, young healthy adults described in detail, autobiographical memories similar in content or emotion to an upcoming empathic event or performed a control task. These descriptions were scored for episodic or non-episodic content. During the subsequent empathy task, participants viewed videos of people describing negative life events and rated how they thought the target was feeling as they described the scenario, measuring cognitive empathy, and then rated their willingness to help and level of concern for that person, measuring affective empathy. For both autobiographical memory conditions, recalling episodic content improved affective but not cognitive empathy. This finding provides new insight into how autobiographical memory and empathy are

linked by indicating that episodic memory processes selectively improve the affective component of empathy.

**P1-57 The impact of acute cardiovascular exercise on cognitive performance in university students, Hanna Bowers, Mount Allison University, Geneviève Desmarais, Mount Allison University.**

Cardiovascular exercise has beneficial effects for older adults: it helps protect individuals against cognitive decline and helps to improve cognitive functioning. This benefit has also been demonstrated in school-aged children but this research often focuses on special groups (e.g., children with weight issues). Furthermore, whether this benefit also impacts young adults is less clear. Our goal was therefore to examine the impact of acute cardiovascular exercise on cognitive performance in young adults. Healthy undergraduate students completed a set of attention and memory tasks before and after a bout of exercise: cardiovascular exercise or stretching (control). Generally, we did not observe differences in performance after exercising between individuals who completed cardiovascular exercise and individuals who stretched.

For tests of sustained attention and memory, exercising did not impact performance. However, for our executive function task, all participants improved their reaction time performance (but not their accuracy) at post-exercise testing compared to pre-exercise testing, regardless of exercise type. The results are consistent with the notion that reaction time measures are more sensitive to the impact of exercise than accuracy measures. Also, it is possible that different types of exercise impact performance, and future studies will need to rule out this possibility.

**P1-58 Chronic early-life social isolation and hippocampal-dependent learning and memory in male and female rats., Saeideh Davari, University of Waterloo, Nicole D'Costa, University of Waterloo, John G. Mielke, University of Waterloo.**

Objective: Chronic early-life social isolation (CELSI) has been reported to affect learning and memory, however, few studies have examined whether such a developmental stressor similarly affects male and female animals.

Methods: Upon weaning, male and female siblings from 10 Sprague-Dawley rat litters were stratified by sex and then randomly assigned to either the group housed (3 animals/cage), or the social isolation (1 animal/cage) condition for 7 weeks. Spatial learning and memory were then tested over 4 days using the Morris water maze. Next, the animals were euthanised, and a variety of biometrics, such as plasma corticosterone levels, were gathered. Finally, to determine whether CELSI affected neural cell density, the expression of key neuronal and glial proteins were assessed in isolated hippocampal tissue using Western blotting.

Results: Socially isolated female rats displayed reduced retroperitoneal fat pad weight. In addition, female animals exhibited a deficit in spatial memory acquisition on days 1 and 2; however, male rats demonstrated enhanced acquisition on day 2. As well, male rats exhibited an increased expression of a key neuronal cell marker (PSD-95).

Conclusions: Taken together, the results suggest a sexually dimorphic effect of CELSI, particularly with regards to some aspects of hippocampal-dependent behaviour.

P1-59 **Dual-task interference as a function of task load**, Anna Michelle McPhee, , University of Toronto Scarborough, Theodore C.K. Cheung, University of Toronto Scarborough, Mark A. Schmuckler, University of Toronto Scarborough.

This experiment examined the impact of various dual-task manipulations (involving motor and cognitive tasks) on motor behaviour. Motor difficulty was manipulated by having adults (N = 22) walk in forward or backward directions (easy versus hard motor tasks, respectively). Cognitive difficulty was manipulated by having participants count while walking, varying the difficulty of counting (counting by 2s versus 3s) and counting direction (counting forwards versus backwards). Gait parameters were assessed for all possible combinations of motor and cognitive variables, along with baseline gait during forward and backward walking with no concurrent counting tasks. Relative to baseline, dual-task interference was observed for

cognitive tasks during forward and backward walking, with differences in temporal (e.g., stride time), spatial (e.g., stride length), and spatiotemporal (e.g., gait velocity) gait parameters. Comparisons within the dual-task conditions themselves generally revealed main effects for walking direction, counting direction, and counting difficulty, although there was some variation across temporal, spatial, and spatiotemporal factors in these main effects. Interestingly, there was no evidence for any form of cumulative or interactive influence of these factors on gait, suggesting that although dual-task interference effects do occur between motor and cognitive factors, these influences do not combine in any systematic fashion.

P1-60 **Does motor system engagement contribute to the memory advantage for vocal melodies?**, Emily Wood, Ryerson University, Joseph Rovetti, Ryerson University, Frank A. Russo, Ryerson University.

Several studies have demonstrated a memory advantage for vocal melodies over those produced by instruments. In the current study, we investigate whether the source of this advantage is preferential engagement of the motor system during the perception of vocal melodies relative to instrumental melodies.

In this experiment, participants listened to 24 unfamiliar folk melodies presented in a vocal or piano timbre. These were encoded during a listen-only condition or during an articulatory suppression condition, in which participants isochronously produced a task-irrelevant syllable to interfere with motor engagement. Afterwards, participants heard the original 24 melodies presented among 24 foils and judged whether melodies were old or new. We predicted that the vocal memory advantage should be found in the listen-only condition but not in the articulatory suppression condition. Our preliminary results have replicated the vocal memory advantage in the listen-only condition. Additionally, we find that the vocal memory advantage is eliminated in the articulatory suppression condition. Future work will include an active control condition (tapping isochronously) to account for the cognitive demand associated with articulatory suppression. The results of this study will have implications for the development of theory concerning sensorimotor integration in the representation of music.

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## Abstracts for Poster Session #2

Saturday June 8<sup>th</sup>, 12:45pm- 2:15pm, Science Teaching Complex, Atrium

**P2-01 The role of external limb perturbation in visually-guided**

**locomotion,\*** **Anneesa Singh**, University of Toronto, Mark Schmuckler, University of Toronto.

Visually-guided locomotion research shows that certain gait parameters are influenced by environmental conditions and external perturbances in the form of a limb load (Schmuckler, 1993). However, no research to date has examined a full range of gait parameters in such conditions from a developmental perspective. This poster presents the adult data from a larger developmental study that includes adult participants as well as children aged 14 and 24 months. In the current study, adults proceed through conditions requiring varying degrees of visual guidance with and without a load on their limb. Results indicate that navigation through environments requiring more visual guidance decreases both spatial and temporal parameters of gait as evidenced by decreases in step length, step time, stride length, and stride velocity. Furthermore, the presence of ankle loads decreases spatial and temporal gait parameters. The presence of ankle loads interacts with guidance conditions such that the negative effects of increasing guidance are more dramatic in the presence of ankle weights. Analyses of the adult data provide an important means of comparison for determining when in development children display gait characteristics similar to that of an adult, i.e., when particular aspects of gait are fully developed.

**P2-02 The effect of background context on production,\*** **Victoria**

**Kavanagh**, Memorial University of Newfoundland, William Hockley, Wilfred Laurier University, Kathleen Hourihan, Memorial University of Newfoundland.

The production effect is the finding that memory for verbally produced information is better than memory for non-verbally produced information. Production has been shown to improve memory for words, non-words, pictures, and text material. What has yet to be examined, however, is whether production influences memory for the context in which an item is

produced. It is well-established that memory at test is better when the test context matches the study context as opposed to when the context at test is mismatched with the study context. In the current study, participants studied a list of words presented on background images. Half of the words were read aloud and half were read silently. At test, half of the studied items were tested on their same background context image and half were presented on a new image. Results are discussed in terms of how context change influences the production effect in recognition.

**P2-03 The Redundancy Effect on Mind Wandering in Online Video**

**Lectures,\*** **Laura Bianchi**, University of Waterloo, Kristin E. Wilson, University of Waterloo, Evan F. Risko, University of Waterloo.

Given the rise in use of online classes, there is an increasing interest in determining the most effective (i.e., the most conducive for learning) way to present online lecture information. The cognitive load model of multimedia learning suggests that learners are capacity limited and as such when identical information is presented simultaneously across different formats (e.g., audio and accompanying text), it could lead to impaired learning outcomes (Mayer, 2008). Impaired learning due to the presentation of redundant information is referred to as the redundancy effect. Most research examining the redundancy effect uses short (i.e., under 10 min) multimedia presentations and focused on comprehension. We examine this effect in a 25-minute online video lecture and examine both comprehension (i.e., memory for lecture material) and mind wandering. We found no differences across presentation conditions (i.e., audio only, text only, audio with full text, and audio with abridged text) in overall comprehension and limited differences in mind wandering behaviour. With respect to the latter, there was some evidence that the text only lecture showed the largest time-on-task effect on mind wandering. Implications for the design of recorded lectures is discussed.

**P2-04 Identifying youth at highest risk for avoidant coping,\*** **Annabel**

**Sibalis**, Ryerson University, Leah Sack, Ryerson University, Natalie Besharat, Ryerson University, Karen Milligan, Ryerson University.

Youth with learning disabilities and co-occurring mental health difficulties (LDMH) frequently face challenges in academic, social, and behavioural domains, often experiencing failure or setbacks. In order to buffer against the effect of these negative events and cope with the resulting negative affect, many youth develop an overly inflated estimation of their self-competence, termed ‘positive illusory bias’. While such a strategy is initially adaptive and self-protective, this pattern of coping ultimately impairs one’s ability to face and overcome challenge as well as maintain an accurate world view.

Given that PIB is particularly prevalent in neurodevelopmental populations, including in those with LDMH, it is important to understand if information processing challenges (such as inattention and impulsivity) common to these disorders contribute to PIB. This study investigates a sample of 35 youth ages 11-16 with LDMH, exploring the relative contributions of inattention and impulsivity to PIB in academic, social, and behavioural contexts.

The contributions of these abilities to presence of PIB, as well as the implications of these findings, including their ability to help tailor interventions to the needs of youth with LDMH, will be discussed.

**P2-05 Drawing and memory: Using visual production to alleviate concreteness effects,\* Brady Roberts**, University of Waterloo, Jeffrey Wammes, Yale University.

Recent work has demonstrated improved memory for information that was drawn at encoding, relative to several other control tasks. This ‘drawing effect’ has been observed in both young and older adult populations, and is robust to a wide array of experimental perturbations. It has been proposed that drawing improves memory via the encoding of contextual information from multiple distinct codes - motor, generative, and visual - which together produce a rich multi-sensory memory. However, research in this arena has primarily tested concrete words, raising an interesting question: Will the beneficial effects of drawing evaporate when the link between a word and its multisensory referent is not clear? In the current study, we investigated this idea. Participants were asked to encode words either through drawing

them or writing them out repeatedly. Critically, the to-be-remembered words were sampled along a continuum of concreteness: from low (i.e., very abstract) to high. Results indicated that the benefit of drawing is remarkably invariant to changes in concreteness. This suggests that even for highly abstract concepts without a clear link to a semantic or visual referent, memory is reliably improved through drawing. Investigations on the role of the drawings’ visual content in this relationship are underway.

**P2-06 Better the Devil you Know Than the Devil you Don’t: Predictability Influences Moral Judgments,\* Alexander Walker**, University of Waterloo, Martin Turpin, University of Waterloo, Michal Bialek, University of Waterloo, Jonathan Fugelsang, University of Waterloo.

People have a strong desire to understand the world around them. Could this desire to feel that we understand our environment bias our moral judgments? That is, could having a reason for committing an immoral act (e.g., physically assault) make that act more acceptable? What if this reason is immoral in nature (e.g., needing to escape a bank you had just robbed)? Across two experiments (N = 400), we assess how the intelligibility of an immoral act influences participants’ moral judgments. We find that participants judge immoral acts (e.g., braking someone’s jaw with a punch) performed for immoral reasons (e.g., escaping after robbing a bank) more positively compared to immoral acts performed for no reason and that this effect is mediated by judgments of actors’ predictability. Furthermore, we find that participants judge actors acting for no reason as causing more harm despite the fact that they caused objectively less harm than that caused by actors acting for immoral reasons (e.g., broken jaw vs. broken jaw and \$50,000 stolen). Overall, the results suggest that peoples’ moral judgments are influenced by the predictability and intelligibility of an immoral actor, with more predictable actors being judged as more moral and less harmful.

**P2-07 Influence of physical self-motion cues on route learning while driving,\* Yasaman Jabbari**, McMaster University, Michelle Sharma, McMaster University, Martin Mohrenschildt, McMaster University, Judith Shedden, McMaster University.

When navigating to a destination in an unfamiliar environment, drivers often use knowledge about landmarks (Tim Hortons) and routes (turn left at

Tim Hortons). Correct route navigation is influenced by the nature of the landmarks. For example, proximal landmarks provide excellent local cues and distal landmarks, which can be seen from long distances, provide excellent spatial mapping cues. Self-motion cues are also important. For example, as the vehicle moves forward and turns, visual objects in the environment flow across the visual field and enhance route memory. Another strong cue to self-motion is physical, including both vestibular and proprioceptive signals. Relatively no research has examined the contribution of physical motion cues to specific route knowledge. We used a motion simulator to examine the contribution of physical self-motion cues on memory under three landmark conditions: proximal, distal, and no landmarks. Physical motion affected acceleration and intensity of pressing the gas and brake pedals. Route memory was improved in presence of landmarks, and physical motion further boosted route memory when proximal landmarks were present. One hypothesis is that physical cues to self-motion are integrated by associating the physical movement with nearby landmarks.

**P2-08 Music training improves neural processing of second language reading with enhanced top-down attentional modulation,\* Cuicui Wang,** Western University, Peixin Nie, University of Helsinki, Finland, Sha Tao, Beijing Normal University, China.

Learning to read a second language is challenging, partly due to the constraints on neural processing of reading from one's native language background. Chinese, as a morph-syllabic language, contrasts sharply to English that is an alphabetic language in terms of the transparency and mapping rules between phonology and orthography (DeFrancis, 1984). Previous studies found that native Chinese readers failed in integrating letter-sound automatically in reading English while native alphabetic readers who learned English as a second language succeeded (Yang et al., 2016; Wang et al., 2018). However, with explicit attention, native Chinese readers successfully integrated English letters and sounds (Wang et al., 2018). Musical training can improve musicians' attention (e.g., Bialystok and DePape, 2009; Moreno & Bidelman, 2014), and then may help second language learners' brain overcome the constraints from learners' native language background and successfully process the second language with enhanced attention. Therefore, this study aimed to examine whether and

how long-term professional music training may help native Chinese readers automatically integrate English letter-sound in their brain.

Fifteen musicians with more than 10-year of professional musical training and 15 non-musicians participated in the experiments. All participants were native Chinese speaking university students who were recruited through internet advertising in Beijing. All musicians were majored in music, while non-musicians did not have any professional music training. Musicians and non-musicians were comparable in their age, education levels, general abilities, English learning experiences and English language proficiency (all  $p > 0.22$ ). They completed a cross-model MMN paradigm (Froyen et al., 2008) with two conditions (AV0: synchronized audio-visual stimuli, AV200: audio stimuli 200ms delayed) and an audiovisual oddball paradigm (P3a; Putkinen et al., 2015) that examined brain response to English letter-sound integration and involuntary attention, respectively. A group of 15 native English readers completed the cross-model MMN paradigm.

Results indicated that musician native Chinese readers showed enhanced cross-model MMN as same as native English readers did when the deviant sounds and the corresponding letters were synchronized in the cross-model MMN paradigm, while the non-musician native Chinese readers did not. However, musician native Chinese readers also showed enhanced cross-model MMN when the deviant sounds appeared 200ms later than the corresponding letter whereas native English readers did not. Therefore, musical training may help native Chinese readers automatically integrate English letter sound by improving musicians' general cross-model integration. Further, we found that musicians showed stronger P3a than their non-musician peers, and the stronger P3a were significantly correlated with the stronger cross-model MMNs. Thus, musical training may help native Chinese readers automatically integrate English letter-sound with enhanced top-down attentional modulation.

**P2-09 Motor excitability during pain observation does not match behavioural response times after pain observation: A pre-registered study,\* Michael Galang,** McMaster University, Sukhvinder Obhi, McMaster University.

Previous TMS/EMG studies have shown that there is a decrease in motor excitability during pain observation. In contrast, recent behavioural studies have shown that response times are faster after pain observation, suggesting that there is a mismatch between motor excitability during pain observation and response times after pain observation. We hypothesized that this mismatch may be explained by task instructions, as participants in TMS/EMG studies are instructed to relax their hands while behavioural studies necessarily have participants in a state of perpetual readiness. However, methodological differences make comparisons between these results difficult. As such, the aim of the current study was to directly test this relationship within a single experiment. Participants watched videos of hands in painful/non-painful scenarios while motor excitability was assessed using TMS/EMG. In the “Active” block, they responded to a cue that appeared immediately after each video; in the “Passive” block, they relaxed their hand. Results showed that there was no increased activity during pain observation in the “Active” block, although participants responded faster after pain observation. Surprisingly, we also did not find the expected TMS/EMG effect (in either block). We discuss these results in relation to empathy, motor preparation, and the avoidance of publication bias.

**P2-10 Social exclusion reduces the sense of agency: evidence from intentional binding,\* Rubina Malik, McMaster University, Sukhvinder Obhi, McMaster University .**

Social exclusion is known to induce an immediate threat to one’s perceived sense of control. The sense of agency is an important human experience, strongly associated with volitional action. Healthy participants perceive the temporal interval between a voluntary action and its effect to be shorter than the same interval when it separates an involuntary action and effect. This temporal illusion is known as intentional binding and is used experimentally to index the implicit sense of agency. The current study investigated whether activating memories of social exclusion alters intentional binding. Results show that action-effect interval estimates are significantly longer after remembering an episode of social exclusion than after remembering an episode of social inclusion, or a no priming baseline condition. A control experiment, involving tone-tone interval estimates, revealed no significant main effect of condition, eliminating the possibility that any differences in interval estimation were due to a general effect of

social exclusion (inclusion) priming on time perception, rather than the effect of social exclusion on sense of agency. This study is the first to demonstrate the link between feelings of social exclusion and the pre-reflective sense of agency.

**P2-11 Emotion Enhancement of Memory in Face Recognition: Encoding, Retrieval, and Gaze Behaviours,\* Olivier Brown, University of Ottawa, Isabelle Boutet, University of Ottawa, Justin Chamberland, University of Ottawa, Charles Collin, University of Ottawa.**

Emotion enhancement of memory (EEM) is the improvement of human recollection due to the emotional valence of stimuli. Previous studies support EEM, and in particular a negativity effect among younger adults. That is, younger adults have a bias for attending to, and better recognizing, stimuli with negative valence, although results are sometimes contradictory. Few studies have explored whether EEM is due to the impact of emotions on encoding and/or retrieval mechanisms. We tested younger adults on an old/new face recognition task; Angry, happy, and neutral faces were presented at both learning and test to determine whether EEM effects occur at encoding or retrieval, or both. Gaze behaviours were measured during both learning and testing stages using an Eyelink 1000 eye-tracker. Recognition memory was best for faces presented with a happy expression at both learning and test. Higher performance for happy faces was not attributable to allocation of attention to regions containing information thought to be diagnostic for face recognition. Our results suggest that happy faces are more likely to give rise to feelings of familiarity, especially when task difficulty is high. Our results do not support a negativity bias in younger participants.

**P2-12 Resilience, trauma, and social desirability in Canadian university students,\* Nina Hedayati, Wilfrid Laurier University, Jeffery Jones, Wilfrid Laurier University.**

Resilience is the ability to maintain or regain mental health after facing adversity. The relationship between resilience, trauma, and social desirability was unknown. 1037 Canadian undergraduate students completed questionnaires (Connor-Davidson Resilience Scale [CD-RISC], Brief Resilience Scale [BRS], Trauma History Questionnaire [THQ], and the

Marlowe-Crowne Social Desirability Scale [M-C SDS]). The M-C SDS controls for response bias. The frequency distributions of the CD-RISC (for those with and without trauma) and M-C SDS (for those with trauma) were approximately normally distributed but the BRS was not. All subscales of the THQ (crime, general disaster, and physical and sexual experiences) were correlated with the THQ total score. The THQ subscale of physical and sexual experiences was correlated with the THQ subscale of general disaster. The CD-RISC and BRS, the CD-RISC and M-C SDS, and the BRS and M-C SDS were correlated. Resilience scores were higher in those without trauma than those with trauma for the BRS and the opposite was true for the CD-RISC. Those without trauma answered more socially desirable than those with trauma. These findings suggest that the CD-RISC better assesses resilience than the BRS, and it can be used together with the THQ and M-C SDS in an assessment.

**P2-13 The impact of social anxiety on the neural processing of emotional faces,\* Nina Hedayati**, Wilfrid Laurier University, Rachel McCaig, Wilfrid Laurier University, Kayleigh Abbott, Wilfrid Laurier University, Nichole Scheerer, Simon Fraser University, Jeffery Jones, Wilfrid Laurier University.

Introduction: Individuals with social anxiety (SA) have an excessive fear of being negatively evaluated. Highly SA individuals tend to pay more attention to negative facial expressions. This study examined the influence of emotional valence, social relevance, and SA level on face perception. Methods: High and low SA individuals viewed faces that displayed happy, angry, and neutral expressions on a monitor. An electroencephalogram (EEG) was recorded during two viewing conditions (passive task and meet task). In the passive task, participants were exposed to all face stimuli. In the meet task, participants were told that they would have to give a speech to one of two people presented in the passive task. Event-related potential components (P1, N170, EPN, and LPP) were analyzed. Social anxiety, depression, and distress questionnaires were administered. Results: Preliminary analyses of the data showed that emotion type affected the direction of the P1, N170, and LPP peak amplitudes from the passive to the meet condition for both anxiety levels. The EPN component showed a change in the peak amplitudes from the passive to the meet condition depending on the anxiety level, with a decrease for high and an increase for low SA. Questionnaire data will be discussed.

**P2-14 Color imagery overrides the representations driving inter-trial priming effects,\* Brett Cochrane**, McMaster University, Vanessa Ng, McMaster University, Bruce Milliken, McMaster University.

It is well established that pop-out search performance is more efficient when a singleton target feature repeats rather than switches from one trial to the next – an effect known as Priming of Pop-out (PoP). It has been proposed that the PoP effect is due to passive and automatic representations of color that are unaffected by top-down strategy. Recently, Cochrane, Nwabuike, Thomson, and Milliken (2018) demonstrated that color imagery reversed the PoP effect when participants generated color imagery that was opposite in color to that of the previous target. Here, we investigate whether color imagery truly impacted the representations driving the PoP effect. Over the course of five experiments, two primary patterns of results were observed. First, color imagery appeared to eliminate the passive build-up of the PoP effect over the course of multiple repeat trials. Second, the PoP effect was eliminated on trials in which participants reported strong color imagery. Our results suggest that color imagery overrides the representations typically driving the PoP effect, challenging the strongly bottom-up interpretations of selection history effects noted in the literature.

**P2-15 The effect of visuo-vestibular onset asynchrony and velocity on acceleration detection,\* Darren Kenney**, McMaster University, O'Malley Shannon, McMaster University, Martin Von Mohrenschildt, McMaster University, Judith Shedden, McMaster University.

Humans integrate visual and physical (vestibular and proprioceptive) cues to facilitate self motion perception. The present study measured reaction times (RTs) to visual and physical acceleration cues at stimulus onset asynchronies (SOAs) to better understand the temporal dynamics of visual-vestibular integration. The first experiment involved 2 blocks with 21 SOAs (range: -166 to 166ms; 16ms intervals), 1 block with physical cues only, and 1 block with visual cues only. RTs in the SOA block were fastest when the stimuli were presented in sync, however, RTs in the visual only block were the fastest overall. We suspected that the SOA block produced a dual-task interference effect, and

thus conducted a second experiment where the single-modality trials were mixed in with 5 SOAs (range: -100 to 100ms; 50ms intervals). Here it was confirmed that in sync RTs were faster than visual-only RTs. To understand whether physical and visual RTs were influenced by velocity and acceleration, we conducted a third experiment where we modified these variables with 3 SOAs (range: -100 to 100ms; 100ms intervals). When visual cues were presented first, RTs were highly affected by velocity and relative acceleration, whereas when physical cues were presented first, RTs were roughly equivalent across accelerations.

**P2-16 Neural evidence for the inefficient selection and storage of fear-related distractors in anxious individuals,\* Christine Salahub, Brock University, Stephen Emrich, Brock University.**

Threatening information (such as spiders or fearful facial expressions) automatically captures attention. However, excessive attention to perceived threat may be disadvantageous, as is commonly seen in individuals with anxiety. These individuals ruminate on threatening information, taking their attention away from goal-relevant tasks. This is supported by findings that anxious individuals inefficiently filter task-irrelevant fearful faces from working memory (WM). Although it is known that these individuals store more distracting information in memory, it is not known at what stage of processing this misallocation of resources occurs. It could occur during perceptual processing, memory encoding, or WM maintenance. Here, we examined this question using electrophysiological measures of attentional selection (N2pc) and WM maintenance (CDA). We found that state anxiety correlated with attentional selection of fearful distractors, such that more anxious individuals had larger N2pc amplitudes toward fearful distractors compared to neutral distractors. We also replicated previous findings that anxiety predicts storage of fearful distractors in WM, as indicated by the CDA. The attentional bias toward fearful distractors (N2pc) predicted WM storage (CDA). In sum, we found that it is the misallocation of neural resources to fearful distractors during memory encoding (and not maintenance) that predicts inefficient storage in WM.

**P2-17 Age-related hearing loss and falls: Characterizing the link between the auditory system and the vestibular system,\* Grace Gabriel, University of Toronto; Toronto Rehabilitation Institute, Joshua Gnanasegaram,**

University of Toronto; The Hospital for Sick Children; Toronto Rehabilitation Institute, Laurence Harris, York University, Sharon Cushing, The Hospital for Sick Children; University of Toronto, Karen Gordon, The Hospital for Sick Children; The University of Toronto; Toronto Rehabilitation Institute, M. Kathleen Pichora-Fuller, University of Toronto, Bruce Haycock, University of Toronto; Toronto Rehabilitation Institute, Jennifer Campos, University of Toronto; Toronto Rehabilitation Institute.

Older adults (OAs) with hearing loss are at 3x greater risk of falling than OAs with normal hearing. In this study, we investigate the possibility that an increased risk of falls may be due to paralleled declines in the auditory and balance (vestibular) systems.

We began by limiting sensory input arriving from other senses (e.g., visual, auditory) in order to isolate perceptual information arriving primarily via the vestibular organs in a group of OAs with and without hearing loss, and a group of younger adults (YAs). We then moved seated participants in the directions of heave or pitch, and evaluated the strength of motion needed for participants to, 1) detect their own movements, and 2) discriminate between two movements. We also tested their standing balance.

We found that OAs are less sensitive at detecting movements than YAs. More interestingly, we found that OAs with hearing loss are less sensitive at discriminating between movements than OAs with normal hearing. These results are echoed by the standing balance task results.

In sum, the data suggest that there may indeed be vestibular sensitivity differences that are associated with age-related hearing loss. This may explain the previously demonstrated falls risk observed in this population.

**P2-18 Task switching and bilingualism in young and older adults: a behavioral and electrophysiological investigation, Cassandra Morrison, University of Ottawa, & Bruyère Research Institute, Rocío López Zunini, Basque Center on Cognition, Brain and Language, San Sebastián, Spain; University of Ottawa, & Bruyère Research Institute, Shanna Kousaie, University of Ottawa, Cognitive Neurological Institute, McGill University, , Vanessa Taler, University of Ottawa, & Bruyère Research Institute.**

The current study investigated behavioral and electrophysiological (event-related potential; ERP) differences associated with task switching in a

sample of young and older monolingual and bilingual adults. ERPs associated with task preparation (switch and mixing positivity) and task execution processes were investigated (N2 and P3b). Participants performed a cued letter-number task switching paradigm that included single task and mixed task blocks, while their electroencephalography was recorded. Behavioural results revealed smaller switch and mixing costs in bilinguals relative to monolinguals, which was observed in both young and older participants. ERP results revealed that bilinguals exhibited a smaller cue-locked switch positivity and a trend towards a smaller mixing positivity relative to monolinguals. Overall larger target-locked N2 amplitudes were observed in bilinguals relative to monolinguals. However, no P3b differences were observed in young adults, whereas bilingual older adults exhibited smaller P3b amplitudes than monolingual older adults. The smaller behavioral mixing and switch costs observed in bilinguals suggest that bilinguals exhibit superior sustained attention and faster task-set reconfiguration processes compared to monolinguals. The ERP measures provide evidence for more efficient brain processes associated with task preparation and some evidence for a superior conflict monitoring system during task execution in bilinguals relative to monolinguals.

**P2-19 Quantifying the subject meaning of words in the English language,** Susan Lutfallah, University of Windsor, Lori Buchanan, University of Windsor.

Large scale studies have gathered widely accepted norms for characteristics of language such as concreteness and valence by generating values for these characteristics through human ratings of words (Brysbaert, Warriner, Kuperman, 2014; Warriner, Kuperman, Brysbaert, 2013). Affective valence refers to the subjective pleasantness or unpleasantness of a word, while concreteness refers to the relative tangibility of a word. Semantic richness is another characteristic of language that has most often been measured using one or more variables such as semantic neighbourhood density (SND), number of features (NoF), and contextual dispersion (Pexman et al., 2008), but has yet to be defined as its own characteristic of language. The current study operationally defined semantic richness as the amount of meaning given to a word. Using an online Q-Methodology design, undergraduate students were asked to rate words on one of three dimensions (concreteness, valence, or semantic richness). In addition to compiling a list

of ratings for the newly defined characteristic of semantic richness, we found that the ratings for concreteness and valence correlated very highly with the current accepted norms. These findings provide a first look at the average variation in the amount of meaning associated with different words.

**P2-20 Unitization of audio-visual conjunctions is reflected by shifts in processing architecture,** Susan van den Boogaard, University of Amsterdam, The Netherlands, Jackson C. Liang, University of Toronto, Morgan D. Barense, University of Toronto.

How can you find your personal bicycle in a crowded bicycle storage? A process called unitization is thought to tightly integrate your bicycle's unique combination of features, allowing it to pop out even amidst many overlapping features. However, how this works in the human brain is largely unknown. Here we test the idea that unitization allows faster processing of a complex object by promoting its features to be processed in parallel. Participants learned to identify conjunctions of birdcalls and images as belonging to a Lake or River. We constructed birds that directly matched trained conjunctions, and a Recombined set of birds that were never trained. We tested participants' ability to identify Lake features while manipulating the saliency of the audio and visual features. The resulting reaction time distributions were analysed using the Systems Factorial Technology framework to determine the audio-visual processing architecture (e.g. parallel, serial, or coactive). Consistent with unitization theory, we observed survivor interaction contrasts (SICs) indicating parallel processing for Intact birds. Furthermore, we observed SICs consistent with serial processing for Recombined birds, despite sharing features with the Intact birds. These data show how unitization sharpens perceptual processing for familiar conjunctions and is robust to confusion from overlapping features.

**P2-21 Using Resting-State fMRI to Examine the Neural Underpinnings of Individuals Differences in Approach- and Avoidance-Related Personality Traits,** Alyssia Wilson, University of Winnipeg, Jennifer Kornelsen, University of Manitoba, Stephen Smith, University of Winnipeg .

The Behavioural Inhibition System/ Behavioural Approach System (BIS/BAS) is a questionnaire used to measure anxiety and reward-focused personalities. The characteristics measured by this questionnaire are predictive of individual differences in inhibitory and impulsive behavioural tendencies, respectively. In the current study, we investigated the neural mechanisms underlying these individual differences. Forty-three individuals completed a BIS/BAS assessment questionnaire and a resting-state functional MRI scan. Scores on the four subscales of the BIS/BAS were covaried with the functional connectivity of seven resting state networks (default mode, central executive, salience, visual, sensorimotor, auditory, and orbitofrontal networks). The BIS and BAS-Drive scales showed the largest effects within the functional connectivity of the CEN. The BAS-Reward scores had higher effects in the DMN and BAS-Fun scale was found to have the greatest influence over the connectivity of the SN. These changes showed how individual differences in approach- and inhibition-related personality traits are related to the functional connectivity of the brain's resting-state networks.

**P2-22 Information format, decision making, and individual differences in scratch card gambling, Madison Stange**, University of Waterloo, Alexander C. Walker, University of Waterloo, Jonathan A. Fugelsang, University of Waterloo, Derek J. Koehler, University of Waterloo, Mike J. Dixon, University of Waterloo.

Scratch cards are a popular and accessible form of legalized gambling, yet little is known about decision-making processes within this domain. Previous research has shown that individuals are biased by “unclaimed prize” information – the number of prizes still available to be won – when evaluating scratch-card games. However, this information is completely non-diagnostic as to the true value of a given scratch card game. We attempted to eliminate this bias in decision making by providing participants with diagnostic payback percentage information in either a numerical (Experiment 1) or graphical format (Experiment 2). When participants were presented with payback percentage numerically, the biasing effects of unclaimed prize information persisted; however, when this information was presented as a graphic, the bias was eliminated and participants were able to evaluate each scratch card game based on its true value. Further, in related experiments, we observed positive correlations between problem

gambling severity and scratch card play frequency and negative correlations between analytic thinking style and both scratch card play frequency and problem gambling severity. Taken together, it may be that problem players, with less analytical thinking styles, may theoretically be helped to make more optimal decisions by presenting diagnostic information in salient, intuitive, graphical formats.

**P2-23 Not so fast: Individual Differences in Impulsiveness are only a Modest Predictor of Cognitive Reflection, Shane Littrell**, University of Waterloo.

The Cognitive Reflection test (CRT; Frederick, 2005) is one of the most widely used behavioral measures of reflective thinking. Performance on the CRT is often attributed to impulsiveness (Frederick, 2005; Jimenez, Rodriguez-Lara, Tyran, & Wengstrom, 2018), but recent work on the relation between dispositional impulsiveness and the CRT has failed to find a strong association (Littrell, Fugelsang, & Risko, 2018). Here we report two studies (N = 500), comparing different measures of dispositional impulsiveness, the CRT, and thinking styles. We found that, while impulsiveness was related to CRT performance, the association was weak once cognitive ability and other factors were taken into account. These results suggest that low scores on the CRT are not largely attributable to impulsiveness.

**P2-24 Repetition Blindness and Retrieval-Time Effects of Full- vs. Partial-Report Following the Rapid Serial Visual Presentation (RSVP) of Letters in Words, John Vokey**, University of Lethbridge, Scott Allen, University of Lethbridge .

Although commonly accepted as an encoding/representational/perceptual phenomenon, repetition deficits (“repetition blindness”) in Rapid Serial Visual Presentation (RSVP) can be shown to be markedly influenced by retrieval-time tasks independently of item encoding. We demonstrate such influences in a series of within-participant experiments where retrieval conditions are unpredictably varied after items have been experienced. Repetition deficits are demonstrated when full report of the presented item is required and in partial-report conditions where the repeated letter is included in the retrieval cue but not in partial-report conditions where the repeated letter is not included in the retrieval cue. Such effects are not

expected if repetition deficits in RSVP are thought to be principally a function of the encoding/representation/perception of the trial experience.

P2-25 **A computational description of addiction as a learning process.**  
Peiyang Jian, Queen's University, Mary Olmstead, Queen's University.

Prior to the 20th century, addiction was viewed as a moral failure with addicts showing poor self-control and bad choices. Theoretical views shifted in the late 20th century with the introduction of the brain disease model of addiction. This disease model argues that addiction is a result of brain changes which renders addicts powerless and incapable of choice. Today, the brain disease model dominates both medical research and public education (Pickard, Ahmed and Foddy, 2015). Recently, however, researchers have identified the weaknesses of the brain disease model, including denying critical determinants of addictive behaviours such as choice, developmental and social factors. These perspectives have been incorporated into a learning model of addiction, that defines addiction as a developmentally acquired neurological state that attributes disproportional desire to use drugs (Lewis, 2017). The purpose of this project is to develop a computational model to describe and examine the learning model of addiction. First, factors theorized to be critical to addiction by the learning model are identified. This project then develops a simplified conceptualization of the learning model of addiction. By exploring a variety of computational methods, the project examines the learning model's overall validity, predictability and size of effect in addictive behaviours.

P2-26 **Striking a balance between having more sports or more time on sport: Effect of extracurricular sports on postural stability among different standing postures in children.** Piali Bhati, University of Toronto Scarborough, Theodore Cheung, University of Toronto Scarborough, Gobika Sithamparanathan, University of Toronto Scarborough, Mark Schmuckler, University of Toronto Scarborough.

This study investigated the relation between sports engagement and postural stability development in children. A sub-set of data from an experiment examining postural stability (measured by centre of pressure's mean velocity) of children from 3 to 11 years old in three different standing postures with or without visual input was analyzed with respect to parental

reports of children's extracurricular sports participation. Standing postures included natural stance (feet shoulder width apart), feet together stance, and tandem stance (heel-to-toe). The results showed that an increased variety of extracurricular sports played (measured in terms of the number of sports in which children participated) was correlated with decreased body sway measures in natural stance with eyes closed, after controlling for age. Greater total hours of sports participation correlated with increased body sway in the tandem stance with eyes closed, of which the association was explained away by the specific age effect. No correlation between sports participation and body sway in the feet together stance was observed. These results suggest that playing a wider variety of sports is related to improved postural control in stable conditions, whereas investing more time in a single sport was not associated with change in postural stability in unstable conditions.

P2-27 **Increasing scientific reasoning to reduce endorsement of pseudoscience.** Carrie A. Leonard, University of Lethbridge, Robert J. Williams, University of Lethbridge, V. (Toria) Violo, Mount Royal University.

Pseudoscientific belief systems have been implicated in numerous harms, including the use of risky/unproven alternative medicines. Paranormal beliefs are a sub-facet of pseudoscientific belief that are also associated with deleterious outcomes such as those seen when one relies on prayer healing instead of science-based medicine. Some researchers have attempted to reduce paranormal beliefs through educational interventions. These interventions have typically employed the direct debunking of paranormal beliefs, and have demonstrated significant reduction effects. Given the debunking focus of these courses however, demand effects cannot be ruled out as an explanation for the evidenced reduction effects. It is also not clear if the reduction effects evidenced in previous interventions generalize to other pseudoscientific beliefs. Understanding the extent to which scientific-reasoning based educational interventions reduce pseudoscience and paranormal beliefs was the primary aim of this research. A novel intervention designed to scientific-reasoning skills, and avoid potential demand effects, was created and administered. Significant reductions in both paranormal and non-paranormal pseudoscience beliefs were found post-intervention. Aside from being of theoretical interest, understanding the relationship between science based education and

pseudoscience belief reduction has the potential to inform future interventions designed to mitigate the development of and/or reduce presently held paranormal beliefs.

**P2-28 Using mindfulness meditation to improve the emotional well-being of graduate students, Lauren Martyn, Western University, Emily G. Nielsen, Western University, John Paul Minda, Western University.**

Research suggests that mindfulness meditation improves emotion regulation (Arch & Craske, 2006), diminishes stress and anxiety (Miller et al., 1995), and reduces the occurrence of rumination (Ramel et al., 2004). The present study sought to assess these claims among graduate students — a group who, in recent years, have demonstrated high levels of stress and mental illness (Eisenberg et al., 2007; Gibson, 2019; Pang, 2017). Participants were randomly assigned to either an experimental group ( $n = 77$ ) or a delayed-start control group ( $n = 63$ ). All participants completed a series of self-report measures designed to assess perceived well-being, mindful cognition, and emotional intelligence. Following the completion of these measures, the experimental group participated in a 4-week mindfulness program. At the end of this program, all participants completed the self-report measures for a second time. The control group then participated in the same 4-week mindfulness program and, at the end of this program, all participants completed the self-report measures for a third and final time. Completion of the mindfulness program was associated with significant decreases in stress, negative affect, and depression, as well as significant increases in resilience, mindful cognition, and emotion regulation.

**P2-29 Emotional enhancement of memory in aging and mild cognitive impairment, Giovanna Busa, University of Ottawa and Bruyère Research Institute, Farooq Kamal, University of Ottawa and Bruyère Research Institute, Cassandra Morrison, University of Ottawa and Bruyère Research Institute, Christine Sheppard, Bruyère Research Institute, Vanessa Taler, University of Ottawa and Bruyère Research Institute.**

Remembering information over a long period of time requires attention and memory skills that can be enhanced by emotions (emotional enhancement of memory effect); however, it remains unclear the extent to which

emotions influence memory processes in individuals with memory decline. The current study examines the influence of emotions on long-term memory in healthy older adults ( $n=36$ ) and people with mild cognitive impairment (MCI;  $n=13$ ). Participants completed an old/new recognition task while their brain activity (event-related potentials), reaction time, and accuracy were recorded. Stimuli were faces displaying happy, angry, or neutral emotions. Preliminary data indicated that, compared to older controls, MCI exhibited lower accuracy, longer reaction times, smaller P300 amplitude, and longer N170 latency. These findings suggest that cognitively healthy older adults are better at recalling emotional versus non-emotional information than MCI. Specifically, MCI recruited fewer cognitive resources for stimulus recognition (smaller P300s) and required more time to process faces (longer N170s) than healthy older adults.

**P2-30 Pointing towards home: Updating and transforming simulated optic flow information affects individual differences in computerized path integration tasks, Nadia Wong, McMaster University, Laura Jin, McMaster University, Nickolas Rubakha, McMaster University, Hong-Jin Sun, McMaster University, Sue Becker, McMaster University.**

Computer-simulated optic flow was used to investigate updating and transformation of spatial cues in 2 experiments. Stationary participants were presented with passive movement. Trajectories included a forward translation, rotational translation, and another forward translation. Afterwards, participants rotated a virtual dart to point back to the trial origin (Goeke et al., 2013). Individuals who updated their heading (Turners) pointed in the direction of the origin, while others (Non-Turners) pointed in the opposite direction, potentially because they failed to update (Gramann et al., 2005). If Non-Turners failed to update, they should have difficulty when identifying the correct bird's eye perspective of their end position and heading relative to the origin out of 4 possible images (Experiment 1). However, no differences were observed between groups regarding performance in identifying the bird's eye perspective. In Experiment 2, participants were asked to rotate their 'virtual viewpoint' to look towards the origin. In contrast to dart responses (Experiment 1), viewpoint responses diminished the differences between groups. Results from Experiments 1 and 2 suggested segregation of responses between groups may result from differing abilities to manage spatial updates. Non-Turners'

weaknesses may trigger difficulties in handling transformations between self-experienced optic-flow and responses requiring an external perspective.

P2-31 **Can priming counter the mismatch effect in reading?**, Mariah Lecompte, Laurentian University, Denis Vaillancourt, Laurentian University, Emalie Hendel, Laurentian University, Annie Roy-Charland, Université de Moncton, Joël Dickinson, Laurentian University.

The missing-letter effect (MLE) is observed while reading and searching for a target letter. The letter is more often omitted in frequent function than in rare content words. Previous research has found that passages containing gender schema violations result in a decrease in reading speeds, which can be diminished through the use of priming. The purpose of this study was to use the MLE to examine the effect of priming on reading speeds when violating gender schemas to further understand the impact of schema stereotypes on cognitive processing. Priming was used by presenting character gender prior to career (e.g. the female mechanic), predictions of which involved a subsequent increase in reading speeds. Additionally, Eyelink1000 was used in order to track eye-movements to understand the impact of priming conditions and schema congruency on fixation rates and durations. Participants (N=40) were presented with identical passages with the primed group exposed to the gender of the character prior to the career, and non-primed group exposed to gender after career. Results suggest that schemas are not created equal for each gender and priming only partially reduce their impact. Results are discussed as a function of the Attentional-Disengagement model and the mismatch effect in reading.

P2-32 **Letter position coding flexibility in bilinguals**, Huilan Yang, University of Western Ontario, Debra Jared, University of Western Ontario, Manuel Perea, Universitat de València, Spain, Stephen J. Lupker, University of Western Ontario.

The orthographic code is the code that represents letter identity and letter position information in the word being read. It is important that the orthographic code represent the positions of letters correctly so that words like “teach” and “cheat” can be distinguished. Most (English) orthographic processing models can accommodate the idea that the letter position coding is somewhat imprecise, although there are limits to this imprecision

(Davis, Kim & Forster, 2008). For various reasons, readers of other languages and/or bilinguals reading in their (English) L2 may show a different level of tolerance of position uncertainty than English L1 readers (Yang, Chen, Spinelli & Lupker, in press).

The present research investigated letter position coding flexibility in L2 English bilinguals (Chinese-English and Spanish-English), when reading English, contrasting their effects with those of English monolinguals in a masked priming task in which the “related” primes were the target words spelled backwards (backward related condition: txen—NEXT, unrelated condition: ytic—NEXT). Although English monolinguals showed no priming, such was not the case for the bilinguals. These results suggest that bilinguals have more flexible (i.e., less precise) letter position coding when reading in their L2 (English) than monolinguals. Various reasons for this difference are discussed.

P2-33 **The Aphasia Friendly Business Campaign**, Julia Borsatto, University of Windsor, Lori Buchanan, University of Windsor.

Aphasia is a language disorder that affects a person’s ability to speak, read, write, or understand. The severity of aphasia varies with each individual, but within the context of communication exchange, all forms create pervasive communication barriers that make participation in society difficult. With well over 100,000 Canadians with aphasia, it is more common than Parkinson’s disease or muscular dystrophy, yet Canadian businesses and organizations are often ill-equipped to accommodate this invisible disability. The Aphasia Friendly Business Campaign is working to eliminate this barrier to accessibility. This campaign is a knowledge mobilization project that aims to assist businesses increase accessibility to people with communication disorders through a comprehensive training session. Businesses are offered the opportunity to receive training on what aphasia is, and are taught how to facilitate a conversation with customers that have aphasia. The training protocol has been developed and the campaign is being offered to participating businesses. To evaluate the efficacy of the one-hour training program, pre-and post- surveys are administered to participants. The increase in public awareness and knowledge regarding aphasia and the ability of local businesses to use supportive communication strategies both have pragmatic implications for increasing the autonomy of people with aphasia in our community.

**P2-34 Would you rather buy a Robble or Ochet: The influence of orthographic neighborhood on nonword recall, Darren Schmidt**, University of Windsor, Daniela Wong Gonzalez, University of Windsor, Dirusha Moodley, University of Windsor, Jessica Hurtubise, University of Windsor, Lori Buchanan, University of Windsor.

At present, the majority of research on brand names pertains to marketing, advertising and consumer purchasing behaviours. However, understanding brand names in relation to psycholinguistics, specifically orthographic neighborhood, can be very beneficial to marketers and manufacturers working with novel brands. Orthographic neighborhood refers to the number of words that can be created when one letter of a word is changed and this variable has been shown to impact recall and recognition in words. However, this relationship has not been well studied in nonwords that might be suitable candidates for novel brand names. Here we determine whether this finding extends to pronounceable nonwords that might serve as potential brand names. Seventy undergraduate students were presented a list of 30 pronounceable nonwords with varied orthographic neighborhood size (15 large and 15 small). After studying each word within the list, participants were randomly assigned to a recall or recognition memory test condition. Both recall and recognition favoured nonwords from large orthographic neighborhoods. These findings suggest that novel brand names may be more memorable to consumers if they come from large orthographic neighborhoods.

**P2-35 The role of rumination in the effect of executive function on math performance in older elementary school students, Melissa Kang**, University of Toronto, Anne-Claude Bedard, University of Toronto, Rhonda Martinussen, University of Toronto.

This study examined the relationship between executive function (EF) and students' math performance (MP) as a function of their level of rumination. It was hypothesized that students with higher EF would have higher MP scores. However, this association is moderated by the level of rumination reported by students when coping with academic difficulties. This study was conducted with laboratory school students from grades four to six (n=69, mean age = 11.2). Parents reported on their children's EF. Students

completed standardized math measures and a questionnaire regarding their academic coping strategies. Hierarchical regression analyses were conducted and showed an interaction between EF and level of rumination in predicting students' MP. Students with higher EF tended to demonstrate higher MP. Additionally, among students with high EF, those with high levels of rumination tended to perform worse than those with low rumination. Conversely, among students with low EF, those with high levels of rumination tended to perform better than those with low rumination. Students with greater EF were more susceptible to MP deficits if they tended to ruminate in face of academic challenges. Ultimately, the benefits of EF on MP is moderated by level of rumination.

**P2-36 Is there a cognate priming advantage for Chinese-English bilinguals? Lingling Li**, University of Western Ontario, Stephen J. Lupker, University of Western Ontario.

In masked translation priming experiments, cognates often produce a larger priming effect than noncognates (Nakayama et al., 2013; Voga & Grainger, 2007). According to the phonological account of this cognate priming advantage, when L1 and L2 involve different scripts (as is the case for Japanese-English or Greek-English bilinguals), this advantage is due to the additional phonological facilitation that is available for cognate targets. In the present research we asked the question of whether the cognate priming advantage exists for Chinese-English bilinguals. Our cognates were English-based Chinese loanwords and our experiments examined priming in both L1-L2 and L2-L1 directions. In both experiments, there was evidence of translation priming but only in the L2-L1 direction was there any evidence of a cognate priming advantage. We propose that, although the phonological account of the cognate priming advantage may be correct, language-specific issues are also important. As a deep orthography, logographic Chinese characters don't generate phonology sufficiently rapidly to provide priming when used as masked primes and their lexical processing is not strongly affected by phonological information from alphabetic primes when used as targets.

**P2-37 Costs and benefits of using a non-dominant language in simulated negotiation tasks, Niloufar Farjam**, McMaster University, Catherine Connelly, McMaster University, Elisabet Service, McMaster University.

Despite accelerated globalization, little is known about the cognitive consequences of mental work in a second language. Our study reports on the effects of using a dominant vs. non-dominant language in negotiation tasks. Our design compared performance in the same bilingual individuals on the same negotiation tasks in a first and a fluent second language. Our participants were native Persian speakers who speak English as a second language. All participants negotiated against other participants in a randomized paired design. The negotiation occurred once in English and once in Persian, with the order of languages counterbalanced. Due to the complex nature of negotiations involving complicated face-to-face social interactions, we hypothesize that the cognitive load imposed by negotiating in a second language will have implications for the strategies that people use. Negotiation strategies fall into two main types - “distributive” or “integrative” strategies. Distributive strategies involve competitive, less cognitively-demanding tactics, whereas integrative strategies involve cooperative, more cognitively-demanding tactics. Preliminary data will be reported. We expect that the cognitive load associated with negotiating in a second language will interfere with the participants’ ability to arrive at multiple proposals that equally benefit both parties involved, and suggest employment of distributive as opposed to integrative strategies.

**P2-38 The effects of studying, testing, and distraction on memory.**  
**Alexandra Mackie**, St. Thomas University, Sandra Thomson, St. Thomas University.

Retrieval practice has been shown to improve long-term memory retention beyond the effects of restudying. Recent research using word pairs and cued recall tasks has demonstrated that this testing effect persists, and is even larger, under conditions of divided attention. These findings are consistent with other studies demonstrating that divided attention has more detrimental effects on encoding than retrieval. The present study aims to extend these findings by investigating the testing effect under divided attention using educationally-relevant study materials, retrieval conditions, and retention intervals. Participants initially read two prose passages with full attention. They then restudied one of the passages and performed a free recall test of the other passage. Half of the participants completed the restudy and free recall tasks alone (full attention condition), while the other

half completed them while simultaneously monitoring tones and responding selectively to high pitched tones (divided attention condition). All participants returned seven days later to complete a final free recall tests for both passages under full attention. Observing a larger testing effect in the divided attention condition would provide further support for the notion that the encoding benefits of retrieval practice are resistant to distraction, and would have additional implications for classroom learning.

**P2-39 Clearing prospective memory for takeoff: cognitive networks adapt to workload demands during flight.**  
**Jinous Mirzaagha**, Carleton University, Kathleen Van Benthem, Carleton University, Chris Herdman, Carleton University.

Research suggests that prospective memory (PM) may be activated through a network of cognitive processes, which is referred to as the multi-component theory of PM. In aviation, the ability to detect cues associated with the PM task is a particularly robust predictor of PM. In the present study we investigated the relative contributions from executive planning, auditory spatial working memory and stimulus detection rates (through an auditory peripheral detection task [PDT]) to PM. PM data was collected from 51 pilots as they flew two legs of a cross-country route in a flight simulator. Pilots were given a visually-cued PM task and the PDT in addition to the regular flight tasks. Our results indicate that the PDT hit rate was the strongest predictor of PM in the low-workload condition, followed by working memory and age. The PDT hit rate was also the strongest predictor of PM in the high-workload condition, followed by task management. These findings support a multi-component theory of prospective memory, where underlying cognitive functions adapt to task demands, and thus vary in their contribution to PM. Furthermore, visually-cued PM was predicted by an auditory cue detection measure, suggesting a cross-modal feature of the important cue detection mechanism.

**P2-40 Facial Processing in Working Memory.**  
**Farooq Kamal**, University of Ottawa, Ottawa and Bruyere Research Institute, Cassandra Morrison, University of Ottawa, Ottawa and Bruyere Research Institute, Vanessa Taler, University of Ottawa, Ottawa and Bruyere Research Institute.

It remains unclear how facial identity and emotional expressions are processed and the extent to which emotions influence working memory processes involved in facial recognition. The present study examined visual processing of facial identity and emotional expression using electroencephalography. Twenty-five young participants completed a delayed matching-to-sample task while their brain activity, accuracy, and reaction time were recorded. Stimuli were faces displaying happy, angry, or neutral emotions. Participants recognized faces better when both the identity and emotional expression either matched or differed from the previously-learned image. Angry faces elicited smaller N200 amplitudes than happy or neutral faces. Participants exhibited prolonged latencies for non-matching identity and emotions in the N200, P300, and N400 compared to matching identity and emotions. The results suggest that the human brain is more attuned to process matching face images where both the identity and emotional expression matched or both differed. Visual processing of facial identity and emotions at different times suggests that information is processed in a serial manner. Fewer resources are required for faces displaying angry emotions than for faces displaying happy and neutral emotions.

**P2-41 Processing fluency does not mediate judgments of learning for high and low frequency words, Rabia Farmahan**, Memorial University of Newfoundland, Kathleen Hourihan, Memorial University of Newfoundland, Jonathan Fawcett, Memorial University of Newfoundland.

Participants were presented with high and low frequency words while variation in pupil diameter was recorded to gauge processing fluency at encoding; following each trial, participants made an immediate judgment of learning (JOL) for the preceding word. Behavioural results indicated that high frequency words were better recalled during a later test and given higher JOLs than low frequency words. Additionally, pupillometric results demonstrated greater pupil dilation for low frequency words than high frequency words, indicating that low frequency words were processed more effortfully (i.e., less fluently) than high frequency words. A multilevel mediation model was fit to estimate the trial-by-trial relation between word frequency and JOLs and to determine whether it was mediated by processing fluency (as measured by pupil diameter). Although this model supported our earlier conclusions (high frequency words predicted higher

JOLs and lower pupil dilation during a given trial), this relationship was not found to be mediated by processing fluency (pupil dilation did not predict JOLs). Results are discussed in terms of modern theories of meta-memory, particularly relating to the role of processing fluency and beliefs.

**P2-42 Associative memory and aging : The role of integrative associations, René-Pierre Sonier**, Université de Moncton, Dominic Guitard, Université de Moncton, Marie Poirier, University of London, Jean Saint-Aubin, Université de Moncton.

It is well established that young adults perform better than older adults on associative memory tasks. According to the associative deficit hypothesis (Naveh-Benjamin, 2000), the age-related deficit in episodic memory tasks is due to difficulties in forming and retrieving new associations. However, this deficit could be attenuated when participants could use pre-existing relations between words. Badham, Estes, and Maylor (2012) showed that integratively related word pairs, words that can be linked together to form a sensible phrase (e.g., horse-doctor), facilitates associative memory compared to unrelated word pairs. We revisited this effect with a new set of stimuli controlled for more factors than in previous studies. A total of 48 younger (18-32 years old) and 48 older adults (65-80 years old) learned pairs of integratively related words as well as unrelated word pairs. At test, the first word of each pair was presented as a cue. For young and older adults, recall was superior for integrative ( $M = .68$  and  $M = .66$ , respectively) than for unrelated pairs ( $M = .56$  and  $M = .54$ , respectively). However, contrary to the predictions of the associative deficit hypothesis, older adults did not benefit more than younger adults from those associations.

**P2-43 An investigation of memory code formation for multisensory object identification, Sarah MacEwan**, Mount Allison University, Genevieve Desmarais, Mount Allison University.

Humans can identify objects accurately by sight or by touch, but how the underlying object representations are created remains unclear. Various models propose visual codes, verbal codes, or a combination of codes. We investigated these models by asking participants to learn to recognize novel objects by sight or by touch, and presenting various kinds of distractors (haptic, verbal, visual, or none) during encoding. Participants then

completed an experimental phase where they were presented with two objects (one seen and one grasped), and asked to identify one of the two objects. Half of these trials were congruent (two copies of the same objects) while the other half were incongruent (two different objects were presented). Consistent with previous findings, incongruent information interfered with identification mostly when participants who learned to recognize objects by sight were asked to identify the haptically-presented object. This is consistent with the idea that encoding objects haptically creates a representation easily accessible to vision, while there is no similar process for visual encoding. Interestingly, none of the distractors presented at encoding impacted performance, suggesting that the passive presentation of distractors may not be enough to interfere with memory formation.

**P2-44 Controlling unwanted information: The effects of retrieval induced forgetting on the probability and fidelity of long-term visual representations, Iain Gamba**, Memorial University of Newfoundland, Kelsi Hall, Memorial University of Newfoundland, Catarina Ferreira, University of Birmingham, Maria Wimber, University of Birmingham, Jonathan Fawcett, Memorial University of Newfoundland.

Retrieval-induced forgetting (RIF) is a paradigm in which retrieving an item when prompted with a cue (e.g., FRUIT-A for APPLE) reduces the accessibility of competitors also associated with that cue (e.g., PEAR). Despite replication across a variety of materials (e.g., words, images) most studies focus on how retrieval practice influences the accessibility of competitors in the form of reduced recall or recognition. The current study investigated whether RIF might also reduce the fidelity with which those competitors are represented in memory. Coloured images of everyday objects were presented alongside their category and object label (e.g., CLOTHING-SHORTS) during an initial study phase. Participants then practiced retrieving the name and colour for a subset of those objects using typed-responses and continuous color judgements. They were then tested for all items in the same manner. A mixture model revealed unpracticed competitors to be characterized by both a reduction in the probability of retrieving those items as well as the fidelity with which participants reproduced the original colour. In short, control processes invoked to reduce interference impact underlying memory representations in a manner

untapped by conventional measurement techniques: Forgetting reduces access as well as the precision with which a memory representation is retrieved.

**P2-45 A Cross-cultural Study Examining Differences in Children's Memory Processes: A Comparison Between Chinese and Canadian Children, Andrew Tkatchyk**, Wilfrid Laurier University, Hongyuan Qi, Wilfrid Laurier University, Kim P. Roberts, Wilfrid Laurier University.

It has been established that significant differences in individuals' cognitive processes occur as a function of culture. Previous literature (Peterson, Wang, & Hou, 2009) found that Chinese children's memories focused on social details (e.g., family outings) whereas Canadian children reported more individualistic details (e.g., solitary play). The present study investigates how culture affects children's memory retrieval using a computerized recognition task. Thirty children from China and 25 children from Canada (Mage = 7.5 years old) were recruited. Each child watched a slideshow story displaying both social-oriented scenes (e.g., helping others) and individual-oriented scenes (e.g., making an autonomous choice). Five to seven days later, the same participants completed a computerized recognition test aimed to extract children's accuracy and reaction time in recognizing social- vs. individual-oriented stimuli. This test could provide valuable data reflecting the underlying mechanisms of memory processing. Given the previous literature (Peterson et al., 2009), we expect that Chinese children will have higher accuracy rates and shorter reaction times in recognizing social- vs. individual-focused stimuli compared to Canadian children. Overall, our results could provide converging evidence outlining how children's memory recollections differ across cultures when using a recognition task that eliminates the influence of potential confounding factors (e.g., language).

**P2-46 Taking another look at suppression-induced forgetting: A meta-analytic synthesis of the think/no-think paradigm, Daniel Todorovic**, University of Waterloo, Benjamin Levy, University of San Francisco, Kathrin Eschmann, Saarland University, Germany, Michael Klein, University of Waterloo, Michael Anderson, University of Cambridge, UK, Jonathan Fawcett, Memorial University of Newfoundland.

Suppressing retrieval of an unwanted memory has been shown to reduce its accessibility later on. This finding, referred to as the Think/No-Think effect or suppression-induced forgetting, is most often studied using the Think/No-Think paradigm. According to the inhibition account, exerting cognitive control to suppress unwanted memories directly impairs their retrievability both over time and in different contexts. These findings and their proposed explanations have significant real world implications, extending to eyewitness testimony and to mental illnesses such as post-traumatic stress disorder. Given the importance of these processes and their implications, we felt it appropriate and necessary to conduct a comprehensive quantitative review. To this end, we meta-analytically synthesized all studies using the Think/No-Think paradigm from 2001 to 2018 with the aim of quantifying the magnitude of the Think/No-Think effect across the currently available literature and exploring potential moderating variables. We report an update to our previous discussion of these data, including a more complete sample of included studies. Results support a small-to-moderate effect. These findings are discussed with respect to theoretical perspectives and boundary conditions.

**P2-47 Spatial memory in the Goto-Kakizaki rat model of diabetes, Loriele M. F. Dietze**, Wilfrid Laurier University, Lana Toameh, Wilfrid Laurier University, Cassandra D. Vivian, Wilfrid Laurier University, Paul E. Mallet, Wilfrid Laurier University, Diano F. Marrone, Wilfrid Laurier University; University of Arizona.

It has been proposed that type 2 diabetes mellitus is a form of accelerated aging (Kent, 1976). Given that spatial memory is impaired with age, the current study compared hyperglycaemic Goto-Kakizaki (GK) rats and age-matched Wistar rats in the Morris water maze. Results showed GK and Wistar rats do not differ in spatial memory ability, as both strains improved path length to reach the platform over 4 training days. However, GK and Wistar rats differ in the path length travelled in the target quadrant during the probe trial. Search strategies in the water maze became more precise for both strains, where GK rats were less precise than Wistar rats. A urinary glucose test performed on the first and last days of the water maze, revealed that urine glucose significantly decreased after the water maze for the GK rats. This finding supports prior literature that exercise lowers glucose levels. Golgi-Cox staining was used to examine granule cell dendritic

spine densities in the dentate gyrus. Spine densities were significantly decreased for GK rats in each molecular layer in the suprapyramidal blade. Results suggest type 2 diabetes and accelerated aging may be linked, but the deficit is not absolute as plasticity may exist.

**P2-48 Influences of evidence and emotion in motivated reasoning, Giovanni Quartararo**, University of Saskatchewan, Valerie Thompson, University of Saskatchewan.

Within a reasoning context, the appraisal of an argument may be modulated by argument strength as well as emotionally-relevant content. Additionally, an individual's ability to correctly discern between strong and weak arguments may be impeded by previous beliefs and motivations. Motivated reasoning theory posits that arguments involving emotional material are not appraised based on argument strength; rather information is recruited to justify previously held beliefs. In contrast, dual process theories predict that while fast, initial (Type 1) processes should be sensitive to beliefs, deliberate and analytic (Type 2) processes should account for argument strength. The current investigation aims to reconcile the contrasting predictions.

Participants (N = 126) receive vignettes that contain arguments that vary in their believability (believable/unbelievable), the strength of the argument itself (strong or weak) and the emotional content (emotional/neutral). Utilizing a dual-response paradigm, participants will give a primary (automatic) response under a strict time limit. A secondary (analytic) response will then be collected in which no time limit is imposed. In line with dual process theories, we predict that participants will be sensitive to both beliefs and argument strength on emotionally valenced items and secondary responses should show an increase in argument strength appraisal.

**P2-49 Challenges measuring the influence of perceptual fluency on judgments of learning (JOLs), Skylar Laursen**, University of Guelph, Evan Mitton, University of Guelph, Jasmyn Skinner, University of Guelph, Chris Fiacconi, University of Guelph.

Judgments of learning (JOLs) are predictions of future memory performance made based on an individual's evaluation of prior learning. Recently there has been considerable interest in understanding how individuals make these judgments. One line of theorizing has speculated that JOLs are derived from

the implicit utilization of a variety of different cues, of which only some are indicative of future memory performance. The present series of experiments examine the role of one particular cue, perceptual fluency (i.e., perceptual ease with which information is processed), in guiding individuals' JOLs. Using a methodological approach first introduced by Masson (1986), we manipulated the perceptual fluency of words outside of participants' awareness. Although we found that our manipulation did indeed increase perceptual fluency, as measured by reaction times (RTs), participants did not appear to use fluency to guide their JOL ratings. However, participants selected perceptually fluent words as more memorable when making a forced-choice decision between a fluent and disfluent word. Interestingly, this latter effect appeared only when participants were not asked to name each word aloud. This result points to potential reactivity when using overt measures of perceptual fluency, and poses a challenge for investigations of the role of fluency in memory predictions.

**P2-50 Audiovisual rapid recalibration: A proposed alternative method of measurement, Daniel Nienhuis**, McMaster University, **Brendan Stanley**, McMaster University, **David I. Shore**, McMaster University.

Sensory signals from singular events do not arrive at multisensory areas of the brain simultaneously—signal propagation, sensory transduction, and neural transmission times differ across the senses. As such, the perceptual system requires a flexible temporal window within which asynchronous sensory signals are integrated into a single conscious percept. The flexible nature of this window allows the perceptual system to adapt to asynchrony in physical stimuli. This temporal recalibration has been observed in all modality pairings tested, but is especially rapid in the audiovisual pairing. Studies to date use lengthy experimental protocols, typically requiring a long adaptation period and a large numbers of trials. Here, we present a modified procedure that reliably produces audiovisual recalibration without an adaptation period and with fewer trials. On each trial, two pairs of audiovisual stimuli were presented and participants judged the synchrony of the second pair. The first pair (the prime) was presented asynchronously (either sound-leading or vision-leading) and the second pair (the probe) was presented either synchronously or separated by a variable stimulus onset asynchrony. Judgments about synchrony were influenced by whether the

prime was sound-leading or vision-leading, demonstrating audiovisual recalibration.

**P2-51 The benefit of scene context on the parafoveal processing of object, Ryo Tachibana**, Queen's University, **Monica Castelhana**, Queen's University.

Studies in reading have shown that word information in the parafovea (4-5° from fovea) is integrated faster across fixations when it is visually similar than dissimilar (Rayner, 1998). With objects, Castelhana and Pereira (2018) found that identical and visually similar object previews in the parafovea (4°) further facilitated recognition when viewed in a semantically consistent scene context. Other studies of object recognition have shown that even when it is presented for a brief time, scene backgrounds that are semantically consistent play a role in object identification (Boyce, Pollatsek & Rayner, 1989). However, it remains unclear whether prior knowledge of scene context presented for a brief duration affects parafoveal processing. We examined how long the exposure of a preview scene is necessary to produce a benefit for parafoveal processing of objects. Surprisingly, there was no advantage to having a short (50ms) or long scene preview (250ms) prior to processing the target. Consistent with the previous study, we found that processing was facilitated with an identical preview of the object. These findings suggest that while the preview of identical object enhances the parafoveal processing, the prior knowledge of scene context played a smaller role.

**P2-52 Vestibular contribution to the crossed-hands deficit, Reidun K. Garapick**, McMaster University, **Kaian Unwalla**, McMaster University, **Sarah D'Amour**, York University, **Laurence R. Harris**, York University, **David I. Shore**, McMaster University.

Locating a touch on the body requires the integration of an external reference frame, based on visual and gravitational information, with an internal reference frame, based on somatotopic information. When hands are crossed over the midline these reference frames conflict, which leads to less accurate stimulus localization, a phenomenon known as the crossed-hands deficit (CHD). The present project investigates whether adding noise to the vestibular system, which can be presumed to decrease reliance on the external reference frame, reduces the CHD. Unpredictable, disruptive

galvanic vestibular stimulation (dGVS) consisting of a sum of sine waves of different frequencies was applied to the mastoid process of participants. Participants judged the temporal order of vibrations applied to the left and right thumbs. There was a negligible effect of the GVS on the CHD. This suggests that the vestibular system does not play a major role in the transformation from internal to external reference frames required for tactile localization in a static observer or in the resolution of any conflicts between those reference frames.

**P2-53 Developing a memory representation: Do we visualize or do we verbalize objects as we explore them?, Carly Penrose**, Mount Allison University, Geneviève Desmarais, Mount Allison University.

Participants typically perform better when testing conditions match learning conditions, a phenomenon labeled encoding specificity. Interestingly, recent findings in visuo-haptic object identification violate this principle: participants who learn to recognize objects haptically perform just as well when asked to identify objects by sight as by touch. One possibility is that participants who explore objects haptically visualize the objects they explore, creating a multisensory memory trace equally accessible to vision and touch. We evaluated this possibility by asking healthy undergraduate participants to learn to recognize novel objects either by sight or by touch. Participants completed sequences of learning trials where they explore each object, and test trials where they recall the name of each object. During learning trials, some participants were presented with a visual distractor (half of participants viewed letters and the other half viewed nonverbal characters) they had to recognize later, while other participants completed a distractor-less control condition. Consistent with past findings, our results violated encoding specificity for participants who learned to recognize objects haptically. Interestingly however, only the verbal distractors interfered with learning. These results suggest that the creation of memory representation for novel objects mediated by a verbal code rather than through visualization.

**P2-54 Perceptions of Food Allergy Importance, Aleksandra Redko**, University of Windsor, Lori Buchanan, University of Windsor.

As an invisible disability, food allergies are often misunderstood by many people (Pearson, 1988; Marklund, Wilde-Larsson, Ahlstedt, & Nordström,

2007). Although previous research has reported the lack of understanding of food allergies using self-report measures (Gupta et al., 2009), this exploratory study sought to explore opinions towards food allergies using a psycholinguistic approach, whereby undergraduate students rated the importance of allergy-related words compared to health-related words. An online Q Methodology (Lutfallah & Buchanan, 2018) was used to obtain ratings from forty undergraduate participants: The students rated the importance of each word in relation to other words in a distribution using a range of from -6 = not important, 0 = important, to +6 = very important. With the exception of “anaphylaxis” and “food allergy”, allergy-related words were rated as less important than other medical words (4 of 6 words related to allergies were rated between -6 and 0). This observation speaks to society overlooking food allergies and emphasizes the need for education programs about food allergies and other health conditions.

**P2-55 Representations automatically evoked by a depicted hand, Morgan Teskey**, University of Victoria, Daniel N. Bub, University of Victoria, Michael E.J. Masson, University of Victoria.

Previous research suggests that viewing a depicted hand generates lateralized, limb-specific motor codes. We investigated this possibility by presenting hand images as task-irrelevant primes. Results from a series of Simon-like key-press experiments, as well as a tactile-detection task, showed that response times were reduced due to the left/right correspondence between an egocentrically presented hand prime and the responding hand. However, this correspondence effect was reversed when hands were presented from an allocentric viewpoint, suggesting that correspondences effects do not reflect a simple mapping between depicted hand laterality and response hand. Instead, correspondence effects may arise due to a spatial code generated by properties of the stimuli, or by the integration of the hand with a whole-body representation in a particular spatial arrangement. Alternatively, correspondence effects may reflect motor representations which, in the case of allocentrically presented images, may map to a hand with a non-corresponding identity based upon the way in which we interact with a hand belonging to another person, or due to misattribution of laterality based on visual features of the hand.

**P2-56 Socioeconomic status and self-other processing: Socioeconomic status predicts interference in the automatic imitation task, Sumeet Farwaha, McMaster University.**

High power and status individuals have been found to be less attuned to the behaviour of others in the social environment. Previous work using neural measures has shown that socioeconomic status (SES) influences the degree to which people are attuned to the actions of others. However, it is unclear whether such effects on brain activity translate into behaviourally significant outcomes. Here, we examined differences in automatic imitation between high SES and low SES individuals from the local community. The automatic imitation task involves participants making actions in response to a symbolic cue while simultaneously being exposed to an action that is incongruent or congruent with the cued response. Patterns of interference reveal the extent to which the congruence of the observed action affects performance of the cued response. Interference thus indexes self-other processing, whereby high levels of interference suggest an increased susceptibility to being affected by the actions of others. Our results showed that individuals from low SES backgrounds exhibited more interference than individuals from high SES backgrounds. These findings suggest that differences in SES are linked to differences in self-other processing, which is relevant for broader behavioural patterns exhibited by individuals at varying levels of a social structure.

**P2-57 Paranormal Belief and Attitudes toward Human Rights, Sanyar Sohrabi, Carleton University, Ahmad Sohrabi, University of Kurdistan, Sanandaj.**

The current study aimed at revealing the relationship between paranormal belief and human rights. For this purpose, two questionnaires were used, the Revised Paranormal Belief Scale (RPBS) and the Attitudes Toward Human Rights Inventory (ATHRI). The analysis of the data ( $n = 220$ ) showed a significant negative correlation between the two scales. In addition, based on the ANCOVA results, participants with lower compared to higher paranormal belief had a more positive attitude toward human rights. Furthermore, in the multiple regression analysis, the traditional religious belief and superstition subscales of the RPBS scale were the main predictors for attitude toward human rights. Therefore, both analyses support the idea

that belief in paranormal phenomena decreases positive attitudes toward human rights.

**P2-58 Intermittent sucrose access: Sweetness vs. calories, Jarret Folmer, Wilfrid Laurier University, Roelof Eikelboom, Wilfrid Laurier University.**

Non-deprived rats given intermittent all-day ad lib access to a 4% sucrose solution augment their daily consumption much more than rats with continuous access (Eikelboom & Hewitt 2016). For higher sucrose concentrations (i.e. 16%), intermittency does not appear to increase consumption. This could be due to ceiling effects; sweetness maximising consumption, or calories limiting consumption. These two explanations were tested using solutions that differed in calories or taste by adding saccharin. Two bottle choice tests demonstrated that rats drinking a 12% sucrose solution and a 4% sucrose solution sweetened with 0.1% saccharin (SS solution) preferred the solutions equally. 6 groups of rats received either 12% sucrose, the SS solution, or 4% sucrose everyday (continuously) or intermittently every 3rd day for 23h. Rats receiving SS and 4% solutions intermittently drank more than their continuous counterparts.

Intermittency had no effect on rats drinking 12% sucrose, suggesting that the effects of intermittent access on high sucrose concentrations are limited by caloric intake. Tests examining alternate day 4% sucrose consumption for all rats are underway, as previous work has found that differences in consumption between rats given continuous or intermittent access to a high sucrose concentration emerge after switching to a lower concentration.

**P2-59 Cognitive impairment in posttraumatic stress disorder, Marc Bedard, University of Ottawa and Bruyere Research Institute, Ottawa, Canada, Cassandra Morrison, University of Ottawa and Bruyere Research Institute, Ottawa, Canada, Vanessa Taler, University of Ottawa and Bruyere Research Institute, Ottawa, Canada.**

It is expected that 50-70% of people will be exposed to potentially traumatic experiences. Although the likelihood of developing posttraumatic stress disorder (PTSD) following traumatic experiences is low, the lifetime prevalence of PTSD is high at between 9-13%. Cognitive dysfunction among those with PTSD therefore represents a common source of disability, indicating the utility of screening for PTSD to inform possible cognitive

impairment. Analyses were run on data from the Canadian Longitudinal Study on Aging (CLSA), a nationwide study on health and aging involving people between the ages of 45 to 85. Analyses were run on 798 participants who screened positively for PTSD (PTSD+) using the Primary Care PTSD screen, and 18,182 healthy adults who did not (PTSD-). Participants completed tests of declarative memory, processing speed, and executive functioning, including a test of prospective memory. After adjusting for age and education, those with PTSD+ were more likely to be impaired on both immediate and delayed declarative memory, processing speed, as well as on executive functioning measures of category fluency, set shifting, and prospective memory. The data indicate sensitivity to detect diffuse cognitive impairment among those who screen positively for PTSD.

**P2-60 Bistable Perception in Overlapped Face Stimuli, Chelsea Denis,** University of Ottawa, Isabelle Boutet, University of Ottawa, Charles Collin, University of Ottawa.

We sought to determine if the perception of transparently overlapped face stimuli (Boutet & Chaudhuri, 2001, *Perception*, 30(6), 743-753) is similar to perception of other bistable figures (e.g., Necker cube, face-vase stimulus). It has been proposed that faces are processed in a more holistic manner than other objects, and this might lead to competing facial perceptions having greater stability. To test this, participants (N=23, 19 female) were shown 20 stimuli composed of pairs of transparently overlapped faces where one was rotated 45° clockwise and the other 45° counter-clockwise. Participants indicated which face currently dominated perception via key-presses. We examined the impact of two face-related variables on the mean rate and frequency distribution of perceptual reversals: 1) Similarity between faces, 2) Emotional expressions of faces. Two additional bistable figures were used as control stimuli: the “young woman/old woman” illusion and Rubin’s face-vase stimulus. Data suggest that face stimuli behave like other multistable stimuli, in that frequency distributions of alternation rates follow a gamma function. Neither face similarity nor emotional expression significantly modulated mean rate of alternations. We conclude that multistability of stimuli composed of faces is subserved by a similar mechanism to that underlying the perception other multistable figures.

**P2-61 Are Emotional Memories Harder to Intentionally Forget? A Meta-Analysis, Kelsi Hall,** Memorial University of Newfoundland, Emily Fawcett, Memorial University of Newfoundland, Jonathan Fawcett, Memorial University of Newfoundland.

Emotional experiences can have a lasting impact on our mental health. The current meta-analysis aimed to determine whether this is partly because emotional memories are less susceptible to intentional forgetting. We conducted an electronic search of PsycINFO, PsychARTICLES, PubMed and Google Scholar until October 2018 using the keywords item method, directed forgetting, intentional forgetting, emotion, emotional, valence, negative, and positive. Studies using emotional stimuli in an item-method directed forgetting paradigm measuring recall or recognition were included, whereas clinical populations and participants over age 40 were excluded. Preliminary analyses revealed superior memory for remember items compared to forget items – suggesting a directed forgetting effect – across neutral, negative, and positive conditions. However, whereas there was no difference in the magnitude of the directed forgetting effect between negative and positive items, there was a diminished directed forgetting for negative or positive items, compared to neutral items. Our results suggest that both negative and positive experiences are less susceptible to intentional forgetting compared to neutral experiences.

**P2-62 Neonatal D9 Tetrahydrocannabinol exposure increases depression-related behaviours in adult rats., Megan Chladny,** Laurier University, Paul Mallet, Laurier University, Noah Mandel, Laurier University, Peticca Aurora, Vassal, Anita Sikic, Laurier University.

Marijuana is a widely used illicit drug among pregnant women in Western societies. However, little is known about the consequences of using marijuana during pregnancy such as any long-lasting effects it may have on the offspring. Additionally, it is difficult to assess the consequences of perinatal exposure to marijuana alone given that cannabis-smoking pregnant women often engage in polydrug use. In the present study, a forced swim task (FST), sucrose preference task (SPT), and marble burying task (MBT) were used to assess anxiety and depressive-like behaviours in adult rats following neonatal THC exposure. Additionally, c-fos immunohistochemistry was used to examine neural activity following the

forced swim task. THC (5 mg/kg, s.c.) or its vehicle was administered daily to male and female CD (SD) IGS rats from postnatal day (PND) 4 through 14. Behavioural testing began on PND 41. Results revealed that rats exposed neonatally to THC consumed more sucrose solution compared to the vehicle controls, however this difference was not significant. In the FST, THC-exposed rats spent significantly more time escaping and less time swimming compared to the vehicle control animals. THC-exposed rats also spent more time immobile than vehicle-exposed rats, but this difference was not significant ( $p=0.07$ ). No treatment effects were observed in the MBT. In an experiment still in progress, Fos immunoreactivity is being quantified in several brain regions involved in anxiety- and depression-related behaviours including lateral orbital (LO), medial orbital (MO), and the ventral orbital (VO) frontal cortex, prelimbic region, hypothalamus and thalamus.

**P2-63 A gamified tool for measuring reflexive and sustained attention towards pain-relevant stimuli with diagnostic potential, Katelyn Baik, Queen's University, Geoffrey Harrison, Queen's University, Dean Tripp, Queen's University, Daryl Wilson, Queen's University.**

Much of the research on pain and attention focuses on how distractions can be used to alleviate pain, with little research considering the interruptive functions of pain on attention. The present study examined a novel tool for detecting pain catastrophizers by examining two component processes of attention, reflexive and sustained, in individuals who do or do not catastrophize over the threat of pain. In this task, participants' eyes were tracked while they played a game of spot the differences, searching for photoshopped differences between an original and altered image on the left and right thirds of a widescreen monitor while pain-relevant or pain-neutral images are presented in the middle third of the screen. We measured reflexive attention as the mean time to first fixation to a pain-relevant

image and sustained attention as the difference between total time spent looking at pain-relevant vs pain-neutral images. Pain catastrophizers had reduced sustained attention but faster reflexive attention to pain-relevant stimuli compared to non-catastrophizers. Further, scores on the Pain Catastrophizing Scale were strongly negatively correlated with sustained attention, and strongly positively correlated with reflexive attention. These findings strongly support the utility of this tool for measuring attentional biases towards personally relevant stimuli.

**P2-64 Response and location feature bindings across imagined and perceived objects, Rocelyn Uy, McMaster University, Brett Cochrane, McMaster University, Hong-Jin Sun, McMaster University.**

An important function of attention is to integrate features processed in distinct brain areas into a single coherent object representation. The immediate outcome of this binding process has been termed an event file. A key result that supports the existence of event files is the partial repetition cost – slow responses for events that contain partial feature overlap with an earlier event. Recently, Cochrane and Milliken (2019) demonstrated similar event file binding effects for visual and response features when participants imagined rather than perceived a first event prior to responding to a following visual event. Here, we evaluated whether visual and location feature binding effects in imagery and perception follow similar principles. Participants were cued to generate color imagery in a box located at either the top or bottom of the display. Participants then performed a color discrimination task on a target that appeared in one of the two locations. We observed that event file binding effects were produced for visual and location feature when the first event was imagined. However, the pattern of these event file binding effects qualitatively differed from those produced when the first event was a perceptual color.

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## Abstracts for Poster Session #3

**Sunday June 9<sup>th</sup>, 8:45am-10:15am, Science Teaching Complex, Atrium**

**P3-01 The effects of exogenously-directed touch on multiple-object tracking (MOT), Mallory E. Terry, University of Guelph, Ian M. Thornton, University of Malta, Lana M. Trick, University of Guelph.**

Multiple-object tracking (MOT) involves keeping track of several targets as they move among identical distractors. Pylyshyn (2001) proposed that some of the cognitive mechanisms used in MOT were necessary for physically touching specific items among others as they moved. Does touching specific items during MOT interfere with performance? Thornton & Horowitz (2015) used an iPad task where participants had to touch items that changed colour (exogenously-directed touch) and found little interference. Building from this result, we had participants track up to five targets in displays with ten items, measuring performance in terms of the percentage of correctly identified targets. We compared performance in five conditions (task order counterbalanced). The first was the classic tracking task, where items did not change colour and there was no requirement to touch. We then looked at how item colour change affected performance when there was no need for touch, comparing the effects of target and distractor change. Finally, we measured performance when participants had to touch targets or distractors that changed colour (touch latencies were collected). We found performance deteriorated when participants had to touch items that changed colour while tracking, though this difference was largest when participants were required to touch distractors.

**P3-02 The retrieval of representations in episodic visual long-term memory induces a partial reactivation of the processes present during encoding., Mathieu Charbonneau, University of Montreal, Pierre Jolicoeur, University of Montreal.**

In previous work, retrieval of encoded lateral stimuli elicited a temporal contralateral negativity (TCN), suggesting that the memory trace was

lateralized. We tested whether the TCN was affected by the vertical position of encoded stimuli, like the N2pc, a marker of visual attention during encoding that is larger in the lower (vs. upper) hemifield. Participants first encoded 20 images presented successively in randomized quadrants while equivalent scrambled images were present in the other quadrants. At test, old (seen at encoding) and new images were shown in the middle of the screen sequentially and the task was to indicate if it was old or new. N2pc was elicited at encoding when the target was in the lower hemifield. However, a contralateral positivity was seen when the target was presented in the upper hemifield. During recall, a contralateral negativity at fronto-central electrodes was found when old items were previously presented in the lower hemifield, whereas a contralateral positivity was observed for the upper hemifield stimuli. Therefore, a centrally presented stimulus during recall produced a lateralised component similar to the activity observed during encoding, suggesting visual information processing during recall may be, at least partially, a reactivation of processes presents during encoding.

**P3-03 Inhibitory Control Settings and the Simon Effect, Colin McCormick, Dalhousie University, Raymond Klein, Dalhousie University, Jason Ivanoff, Saint Mary's University, Lindsay Wescott, Saint Mary's University, David Debly, Saint Mary's University.**

Responses that spatially correspond with the location of a stimulus are often faster, and more accurate, than spatial responses that conflict with stimulus location. This Simon effect is thought to be the result of a natural tendency to respond to the location of stimulus (Simon, 1969). Little is known, however, about the role that inhibitory control settings (i.e., putative mechanisms that de-emphasize particular stimulus-response pathways) play in a Simon task. In the first experiment, we randomly intermixed (in varying proportions) peripheral cues and peripheral targets

known to elicit a Simon effect. Consistent with an influence of inhibitory control, we observed a smaller Simon effect in blocks of trials with a proportionately larger frequency of peripheral cues. In the second experiment, we compared performance in a block of Simon task trials without a cue to a block of trials where peripheral cues predictably alternated with a Simon task. In this experiment, there was no evidence that the mere presence of the cues had an impact on the Simon effect. We discuss these findings in the context that inhibitory control plays on spatial response priming in a Simon task.

**P3-04 Two timers? Endogenous and exogenous alerting in an intuitive temporal cueing task.** Colin McCormick, Dalhousie University, Ralph Redden, Dalhousie University, Raymond Klein, Dalhousie University.

A temporal cueing effect (TCE) refers to improved reaction time following a valid temporal cue in comparison to an invalid temporal cue, which provides evidence that observers effectively focused attention to the appropriate point in time. Recently (McCormick, Redden, Lawrence, and Klein, 2018), we observed independence of exogenous and endogenous temporal attention when implementing a novel signaling method (Lawrence & Klein, 2013) within the canonical temporal cueing paradigm (Kingstone, 1992). However, in an attempt to alleviate task demand, we were limited to the analysis of detection responses instead of the more informative discrimination responses. This is because we were unable to obtain TCEs in the endogenous condition when using discrimination responses, which we suspect was due to the large cognitive load generated from a combination of stimulus and task demands.

For the current experiment, we have modified methodological components to alleviate cognitive demand to allow for the implementation of discrimination targets in the Kingstone paradigm, providing the opportunity to analyze speed-accuracy trade-off differences for endogenous and exogenous temporal attention.

All project materials can be found on the Open Science Framework (<https://OSF.io>), registered under the above title.

**P3-05 Resolving the issue of reliability in the measurement of sustained attention.** Geoffrey Harrison, Queen's University, Kristen Nolan, Queen's University, Daryl E. Wilson, Queen's University.

Measures of attention are notoriously unreliable. Though less problematic for experimental approaches, poor reliability is severely detrimental to the study of individual differences in attention. To address the dearth of reliable tools for measuring attention, our lab adapted the Whole Report Working Memory Task (WRWMT) and developed a novel task we call the Spot the Differences Task (STDT). The WRWMT is a visual working memory capacity task where participants report the colour of every item in the display. This task provides a measure of working memory capacity that relies heavily on sustained attention and an objective measure of the number of complete attentional failures via the number of trials participants perform at chance. In the STDT, participants' eyes are tracked while they search for photoshopped differences between an original and altered image during which highly salient sexually explicit, or neutral, stimuli are presented in the middle of the screen. Failures of reflexive and sustained attention are measured by the time to first fixate, and the total time spent looking at, distracting images. All the measures from these tasks displayed high test-retest reliability supporting their use for measuring individual differences in attention.

**P3-06 The influence of color imagery on spatial facilitation and Inhibition of Return effects.** Shireen Fikree, McMaster University, Brett A. Cochrane, McMaster University, Dr. Hong-jin Sun, McMaster University.

Following an abrupt onset cue at a peripheral location there is facilitation for responses to targets displayed near that location. When the temporal interval between cue and target onset is greater than about 300 milliseconds (ms), the opposite result occurs; responses are relatively slow for targets at cued locations - termed Inhibition of Return (IOR). Here, we explored whether color imagery could influence the facilitation and IOR effects. We used a cue-target procedure that presented exogenous cues (red/green) at two peripheral locations on the left and right side of the fixation simultaneously. Following a short interval (50 ms) or long interval

(650 ms), a target was presented at one of these peripheral locations. Before the cue-target procedure, participants were instructed to imagine one of the exogenous cue colors. We demonstrate that the facilitation and IOR effects were associated with the cue color that was incongruent with color imagery, suggesting that color imagery reduced attention capture for similarly colored exogenous cues. However, the results here do not preclude the possibility that color imagery engaged a different set of processes than those typically driving facilitation and IOR effects.

P3-07 **Integrating open science in the teaching of cognitive research methods**, Ralph Redden, Dalhousie University, Students of PSYO 3131, Dalhousie University, Brett B.T. Feltmate, Dalhousie University, Colin R. McCormick, Dalhousie University.

Openness, transparency, and reproducibility are widely accepted as fundamental aspects of scientific practice. However, a growing body of evidence suggests that these features are not readily adopted in the daily practice of most scientists. The Centre for Open Science has been championing efforts for systemic change in the scientific process, with newly adopted practices such as preregistration and open sharing of data and experimental materials. In an effort to inculcate these practices early in training, we have integrated several key components of open science practice into an undergraduate research methods course in the cognitive sciences. Students were divided into four research teams, each with the goal of carrying out a replication experiment related to the study of attention; specifically temporal orienting, task-switching, prior entry, and the attentional blink. Teams were required to preregister their replication experiment, and importantly, to consider a priori the criteria for a successful replication. They were also required to collect and analyze data, prepare manuscripts, and disseminate their findings in poster symposia and oral presentations. All project materials can be found at <https://osf.io/gxkfq/> subsequent to completion of the course. Critical appraisal of the goals and implementation of the course will be discussed.

P3-08 **Decoding electrophysiological correlates of task-dependent attention to object features**, Nina Lee, University of Toronto Scarborough,

Lin Guo, University of Toronto Scarborough, Adrian Nestor, University of Toronto Scarborough, Matthias Niemeier, University of Toronto Scarborough, York University.

Attention to features such as motion, colour or contours can aid visual processes throughout one's visual field. This feature-based attention is active at early stages of processing, and appears to operate along parallel, additive channels if more than one feature is attended. We have found that additive effects hold true when multiple features are attended to in an object perception task which necessitated perceptual integration and decisional processes. This is consistent with the idea that attention is applied to whole objects, and thus, to later stages of perception. To clarify the time frames of attention to object features, here we recorded from 64 scalp electrodes in human participants while they viewed real objects. Objects had one of two shapes and colours, respectively. Critically, colours indicated the weight of the objects. Further, to manipulate attention, participants either grasped and lifted the objects or touched them with their knuckle so that shape and colour were more or less task-relevant. Pattern classification of shape and colour based on spatiotemporal EEG data revealed that accuracy peaked 100-200 ms after stimulus presentation. Shape classification was more robust than colour, although both were independent of task, inconsistent with the notion of task-related attentional modulation of features.

P3-09 **A failure to replicate the endogenous Inhibition of Return effect using an onset detection task**, Sameera Singh, McMaster University, Brett Cochrane, McMaster University, Hongjin Sun, McMaster University.

When there is a short temporal interval (e.g., 50-100 ms) between an abrupt onset cue and target, target detection is faster when it appears at the cued location compared to uncued location (e.g., the facilitation effect). In contrast, when there is a relatively long temporal interval between cue and target (e.g., >300 ms), the opposite result occurs; target detection is slower at the cued location compared to the uncued location (e.g., the Inhibition of Return effect; IOR). The IOR effect has been robustly demonstrated using abrupt onset cues (exogenous cues) that occur at a peripheral location prior

to an onset detection task, however, there are only few studies that have observed IOR effects when a peripheral location was cued with a central arrow (endogenous cues). Over the course of four experiments, we explored the reproducibility of the endogenously cued IOR effect using an onset detection task. Our results revealed that exogenous cues produced the typical pattern of facilitation and IOR effects, however, endogenous cues consistently failed to produce the IOR effect. We suspect that the IOR effects are tenuous in endogenous cuing procedures and do not engage the processes underlying the IOR effect produced by exogenous cues.

**P3-10 Slots rein in the wandering mind and induce flow in problematic gamblers, Tyler B. Kruger, University of Waterloo, Katrina Pander, University of Winnipeg, Stephen Smith, University of Winnipeg, Mike J. Dixon, University of Waterloo.**

Researchers have proposed that some gamblers have trait-level attentional problems in everyday life but that slots rein in their wandering minds, and induce a flow-like state. Here we directly compare mind-wandering in a laboratory task, and in a slots task. In the lab task, participants modulated the press of their force on a button to synchronize with auditory tones that differed in sound intensity. They then played a slot machine simulator. In the force and slots tasks, participants were interrupted six times using thought probes. Participants revealed high rates of mind wandering in the lab task but significantly lower rates during slots play. They also showed greater positive affect, and less negative affect during slots play but surprisingly equivalent amounts of flow. We then replicated the same procedures, but used a sample containing significantly more disordered gamblers. In this second sample slots led to less mind wandering, less negative affect, more positive affect and crucially, significantly greater flow than in the force task. When both samples were combined, flow during slots was significantly correlated with problem gambling status. We conclude that slots not only rein in wandering minds, but also induce flow—especially for those with disordered gambling.

**P3-11 The Restorative Effects of Greenspace and Spiritual Environments, Varsha Gobin, University of Waterloo, Hanna Negami, University of**

Waterloo, Emily Grant, University of Waterloo, Colin Ellard, University of Waterloo.

Decades of past literature have established greenspace as a restorative environment. More recently, studies have shown that environments other than greenspace have the potential to be restorative. Spiritual environments in particular have been shown to provide a restorative benefit; however, research has not yet compared the restorative effects of spiritual environments to that of greenspace. In this study, we investigated and compared restorative effects of greenspace and spiritual environments, using a greenhouse, a chapel, and a classroom (neutral environment). In a within-subjects design, we compared the restorative benefits of a greenhouse and chapel using measures of positive and negative affect, perceived restoration, and attention, as well as physiological measures of heart rate and skin conductance collected from 31 University of Waterloo students. Results showed similar levels of positive affect and perceived restoration between the greenhouse and the chapel; and positive affect and perceived restoration were significantly greater at the greenhouse and chapel compared to the classroom. Our results indicate that spiritual and greenspace environments may provide similar or equal amounts of restoration benefits.

**P3-12 Aging, Movement Variability and Motor Adaptation, Leisha Lustic, Trent University, Brown, Trent University.**

There is currently a debate on whether or not increased movement variability is beneficial or detrimental to motor learning. As we get older, movement variability increases. Is age-related increased movement variability beneficial or detrimental to mass adaptation? We hypothesized that greater movement variability associated with aging would result in an increase in speed of adaptation. Older and younger individuals completed a task in which they were asked to reach to targets appearing to the left or to the right as quickly and accurately as possible. During an adaptation block we applied a small weight to the participant's right arm. We measured participants' inherent movement variability and the speed with which they

adapted their reaching movements to the weight. We found that older individuals displayed greater movement variability than younger adults. Next, we will determine whether the groups adapted at different rates by measuring how speed, accuracy and precision changed with practice. Given the current stigma around aging as a time of decline, this research is important in determining whether or not certain aspects of aging may be hindering or helping motor performance.

**P3-13 Behavioural discrimination for gist of everyday scenes, Nghi Hoang**, University of Toronto and Rotman Research Institute, Fahad Ahmad, Rotman Research Institute, Morris Moscovitch, University of Toronto and Rotman Research Institute.

Behavioural discrimination between repeated and similar items is assumed to rely on a neural mechanism known as pattern separation. Pattern separation has been assessed in humans by the Mnemonic Similarity Task (MST), which measures recognition memory at test for previously presented items (targets), lures that are similar to targets, and novel items (foils) (Bakker et al., 2008). This study adapted the MST to measure if difficulty in lure discrimination at retrieval, as observed in the MST, is maintained when multiple exemplars of the same category are presented at both encoding and retrieval. The goal was to investigate if behavioural discrimination is mediated by prior knowledge of exemplars per scene category more so than by 'pattern separation' of overlapping items. Thirty-two undergraduate students studied three exemplars per scene category, and were tested on 24 targets, 24 lures, and 24 foils. Contrary to findings reported by Stark and Stark (2017), there was no significant difference in recognition accuracy between lure and target discrimination. Participants showed higher false recognition to targets than lures. Our findings suggest that in the context of multiple exemplars, behavioural discrimination of exemplars per scene category may rely more on prior knowledge and less on pattern separation.

**P3-14 Relating pupillometric and behavioural indices of mental effort in item-method directed forgetting, Evan Forward**, Dalhousie University, Julia Greenham, Memorial University of Newfoundland, Marcus Alves, Memorial

University of Newfoundland, Tracy Taylor, Dalhousie University, Jonathan Fawcett, Memorial University of Newfoundland.

Forgetting in an item-method directed forgetting paradigm has been shown to slow responses in the period immediately following the forget instruction and to facilitate removal of attention from the representation of the preceding study item, including its spatial location. These findings have been interpreted as evidence of an active control process associated with the cessation of rehearsal. However, recent findings using pupillometry have produced conflicting evidence favouring relatively reduced processing demands immediately following the forget instruction as evidenced by relatively larger pupil dilation following the remember instruction. The current experiment sought to compare these findings directly by integrating both pupillometry and a secondary probe response task into the same directed forgetting paradigm. Both effects replicated: In addition to a significant directed forgetting effect – with greater recognition of remember than forget items at test – we observed longer response times following forget instructions but larger pupil dilations following remember instructions. We discuss ways in which these findings may be reconciled into a coherent theoretical framework.

**P3-15 Can stress sensitivity, reactivity, and resiliency be predicted using scene discrimination?, J. Colton Macdonald**, University of Regina, Laurie Sykes Tottenham, University of Regina.

The subiculum is involved in stress response regulation and perceptual discrimination, with greater neural activity observed for scenes than faces and objects. The present study investigated whether scene discrimination performance can predict stress sensitivity, reactivity, and trait-resiliency, providing a behavioural proxy of subiculum functioning. Participants completed a resiliency measure and perceptual discrimination task (scenes, faces, objects) followed by a high or low stress Trier Social Stress Test (TSST). STAI-state and salivary cortisol were assessed before and after the TSST, and heart rate (HR) and blood pressure (BPS, BPD) were recorded throughout. Scene discrimination reaction time (RT) was negatively correlated with  $\Delta$ BPD overall and with  $\Delta$ cortisol (trend) in the high stress

condition, and  $\Delta$ BPS and accuracy were positively correlated in the high stress condition. Object discrimination accuracy was negatively correlated with  $\Delta$ BPS and marginally with  $\Delta$ STAI-state and resiliency overall. For face discrimination, a positive trend occurred between RT and resiliency and a negative trend between accuracy and  $\Delta$ HR overall, being significant in the high stress condition. In general, better scene discrimination performance was found in participants demonstrating larger stress responses, whereas better object and face discrimination performance was found in those with less stress reactivity and sensitivity, but also lower resiliency.

**P3-16 Metaphor Comprehension in a Deep Dyslexic Participant, Hamad Al-Azary**, University of Alberta, Tara McAuley, University of Windsor, Lori Buchanan, University of Windsor, Albert Katz, University of Western Ontario.

Deep dyslexia is an acquired language disorder characterized by semantic irregularities in reading aloud, such as producing semantic errors (e.g., reading the word “weird” aloud as “odd”) and difficulty reading aloud abstract words (e.g., “fate”) than concrete words (e.g., “paper”). In this case-study, we examine whether deep dyslexia affects higher-level semantic processing; namely, metaphor comprehension. To that end, we asked GL, a participant with deep dyslexia, to rate novel metaphors (e.g., “indecision is a whirlpool”) along with literal (e.g., “a gorilla is an ape”) and anomalous (e.g., “arrival is a shoestring”) sentences for comprehensibility. The topics of the metaphors (e.g., “indecision” in the item above) varied on concreteness, such that they were either abstract or concrete. Also, the semantic neighbourhood density (SND) of the constituent nouns (e.g., “indecision”, “whirlpool”) was manipulated such that items were high or low-SND. GL rated the literal sentences as maximally comprehensible and rated the abstract-low SND metaphors, which were the semantically sparsest, as comprehensible. However, other, more semantically rich metaphors (i.e., those with concrete or high-SND constituents) were treated as non-comprehensible with ratings indistinguishable from ratings given to anomalous sentences. Such results suggest a selective metaphor impairment based on semantic richness.

**P3-17 Internal simulation of speech emotion, Fran Copelli**, Ryerson University, Joseph Rovetti, Ryerson University, Emily Wood, Ryerson University, Sean Gilmore, Ryerson University, Frank Russo, Ryerson University.

The perception of emotion in speech has previously been associated with desynchronization of the mu rhythm as well as automatic facial mimicry. These correlates are thought to reflect an internal simulation of vocal-facial movements. In the current study, we consider how the sensory modality through which speech is perceived affects the level of internal simulation, as reflected in mu desynchronization and facial mimicry. To test this, young adult participants perceived speech emotion samples that were either auditory-only, visual-only, or audio-visual. Concurrently, mu desynchronization was measured with electroencephalography (EEG) and facial mimicry was measured using electromyography (EMG). Preliminary EEG results found mu desynchronization across all modalities, with the highest levels of desynchronization occurring in response to visual-only and audio-visual speech. This pattern of findings is consistent with the view that internal simulation of movement is most robust under multisensory observation conditions and that it tends to be primarily influenced by visual input. EMG results are expected to align with these preliminary mu desynchronization findings.

**P3-18 Faking bad: Using event-related spectral perturbations to examine intentionally invalid memory performance, Jenna Wright**, University of New Brunswick, Perry Dykens, University of New Brunswick, Kenneth Troy Harker, University of New Brunswick.

This study sought to examine the influence of invalid performance on the event-related spectral perturbation (ERSP) responses on a challenging test of recognition memory. Previous work by Harker and Connolly (in preparation) has demonstrated that event-related potential (ERP) response by participants who intentionally feigned a memory impairment was not different from the ERP response recorded in participants who performed the memory task validly. As ERSPs can expose features of event-related brain activity not apparent in ERP waveforms, we re-analysed the data from

a recognition memory test for faces for which participants attempted to feign a memory impairment. We found that ERSPs to old faces in this task were characterized by subtle indicators of suppression relative to new faces when participants were intentionally invalidating responses. These results are discussed in relation to the behavioural performance on this task and the potential use of neurophysiological responses to predict cognitive performance and future applications of neurophysiology in the clinical assessment of memory.

**P3-19 The effect of rTMS to the primary motor cortex on near-hand target processing, Adriana Paoletti**, Trent University, Mikeela Skellekie, Trent University, Liana Brown, Trent University.

Individuals display enhanced perception of targets when they are presented near hand. This effect appears to rely on the same mechanisms that process visual information for action. The theory of affordances suggests that all objects afford specific motor responses that are automatically generated upon viewing them. It is possible that the generation of potential actions is enhanced when targets are located near one's hands. To investigate whether action potentiation drives the near-hand effect, participants were asked to respond to a target presented either near or far from a hand placed in the display. Participants completed this task both under normal conditions and under the influence of 1 Hz rTMS applied to the left motor cortex for 15 minutes; rTMS should suppress action potentiation by targets near the right hand. We found a significant right near-hand effect in both the control and rTMS conditions. For the left hand, we found a significant near-hand effect in the control condition, but surprisingly, it was reversed in the rTMS condition. We consider the possibility that right-hemisphere motor cortex activity – released from interhemispheric inhibition after rTMS suppression of the left motor cortex – may interfere with the near-hand effect. We reconsider the action-potentiation hypothesis within the context of these findings.

**P3-20 Examining the two-stage model of donation decisions: What about the proportion dominance effect?**, Mane Kara-Yakoubian, University of

Waterloo, Michelle Ashburner, University of Waterloo, Evan F. Risko, University of Waterloo.

The Affective Two-Stage Model of Donation Decisions proposes that donation decisions can be split into an initial yes or no decision, and a subsequent decision of donation amount; with the former predicted by mood management and the latter by empathy (Dickert, Sagara, & Slovic, 2011). In the present research, we investigate this model with a manipulation of the proportion of lives saved. Previous work has demonstrated that there is an inclination to aid victims when the rescue proportion is high, an effect known as the Proportion Dominance Effect (PDE). Recent research suggests that the PDE is caused by perceived impact, and not emotions (Erlandsson, Björklund, & Bäckström, 2014). From the perspective of the Two-Stage Model, it is unclear which stage the PDE would influence, as perceived impact is not considered. This provides an important opportunity to expand the model. Using a within-subject design that consisted of high and low rescue proportion vignettes, we find that as rescue proportion increases, willingness to donate (Stage 1) and amount donated (Stage 2) increase. Thus, the PDE, at least using a within-subject design, appears to influence both of the putative stages in the Affective Two-Stage Model of Donation Decisions. Implications will be discussed.

**P3-21 Using a novel conflict paradigm to understand the role of the medial temporal lobe in approach-avoidance conflict decision-making and outcome uncertainty**, Sonja Chu, University of Toronto Scarborough, Cendri Hutcherson, University of Toronto Scarborough, Rutsuko Ito, University of Toronto Scarborough, Andy Lee, University of Toronto Scarborough.

Medial temporal lobe (MTL) regions have been implicated in the processing of learned approach-avoidance (AA) conflict but it is unclear if these structures are responding to conflict (i.e. opposing motivations and outcomes) or uncertainty (i.e. varying likelihood of outcome occurrence). To investigate this, 24 participants first learned to approach or avoid novel visual objects that were positive, negative, or neutral with the goal of maximizing reward and minimizing punishment. Approaching a positive object led to a reward, approaching a negative object led to a punishment,

and approaching a neutral object/avoiding any object resulted in no outcome. Following successful learning, subjects were presented with pairs of these objects during fMRI: No-Conflict (positive-neutral, negative-neutral, neutral-neutral) and Conflict (positive-negative). The likelihood of receiving the outcome associated with the objects in each pair was also manipulated (either 100% likelihood of receiving both outcomes or 50% likelihood of receiving one or the other), resulting in 8 possible conditions. Our data revealed that behavior and MTL activation were driven by conflict as opposed to uncertainty. Irrespective of uncertainty, AA conflict was associated with greater perirhinal cortex activity. This suggests that involvement of MTL structures during AA conflict may reflect conflict processing per se, rather than outcome uncertainty.

**P3-22 A comparison of craved and favourite foods in undergraduate students.** Angela Mastroianni, Wilfrid Laurier University, Roelof Eikelboom, Wilfrid Laurier University.

Food cravings are common among university students (Weingarten & Elston, 1991). Preference for favourite foods can be distinguished from cravings (Rozin, 1979). How craved and favoured foods correlate is not entirely clear and was explored in the current study. Pilot work suggested that food cravings can be specific. E.g. craving Domino's pepperoni pizza well done vs. craving a savoury. The degree of specificity in craved and favourite foods was quantified. **METHOD:** An online mass testing survey solicited the top 3 craved and favourite foods from 1603 undergraduate students. The two lists were compared for differences and correlations. Participants were instructed to report as much detail as they like, which allowed for the analysis of food specificity. **RESULTS:** Responses revealed marked differences between craved and favourite foods. Frequencies results showed that some foods were more craved than favoured or vice versa. Specificity was evident for craved and favoured foods. This work supports the incentive salience theory, which suggests that food reward has a dual nature and involves 'wanting' (craving) and 'liking' (affective) components (Robinson & Berridge, 1993; 1998).

**P3-23 Logic Vs. Preference: Differentiating Between Decision Strategies and their Implications on Gender Perceptions**, Noor Alazary, University of Windsor.

The present research project offers a novel method of investigating varying perceptual decision processes by characterizing the gaze trajectory of decision-making strategies across logical and preferential decision types. Information processing via the visual world paradigm is used to quantify cognitive load and deliberation time of each condition. Participants were asked to judge 1 of 2 items on-screen as higher value. In the first condition the option pairs differed in value (logical/empirical condition), in the second condition the option pairs were equal in value (preferential condition). Results suggest that both decision strategies can be characterized by greater cognitive load during empirical choice and greater deliberation time during preferential choice.

**P3-24 Priors and posteriors: Teaching Bayesian reasoning to learners varying in knowledge of probability**, Yichu Zhou, University of Waterloo, Colin MacLeod, University of Waterloo.

How does prior knowledge influence determination of an effective strategy for teaching basic Bayesian reasoning? We began by assessing participants' knowledge of high-school-level probability, and used the results as a proxy for prior knowledge. An instructor then led the participants through a series of Bayesian reasoning problems using one of two randomly assigned teaching strategies. One group was taught to solve the problems using frequency trees as a visual aid; another group was taught to solve the same problems using the Bayesian formula. A significant improvement was shown for participants with lower prior knowledge using the frequency tree method, whereas the difference between methods was not significant for participants with higher prior knowledge. According to the cognitive load theory, learners with low prior knowledge require greater guidance during learning to offset high cognitive load whereas learners with high prior knowledge have greater capacity for automatic processing. Participants with low prior knowledge benefitted much more when exposed to frequency trees whereas participants with high prior knowledge generally learned

comparably well with the two methods. Clearly, prior knowledge can interact with the effectiveness of a teaching strategy and should be taken into account in developing teaching techniques.

**P3-25 Temporal perception of multisensory cues as potential predictors of cybersickness, Ogai Sadiq, University of Waterloo.**

While the central nervous system (CNS) may be efficient in integrating multisensory information presented through natural environments, virtual reality (VR) poses challenges for the CNS in doing so. Although VR systems are becoming widely used, VR exposure often causes cybersickness possibly due to temporal discrepancies between multiple sensory events. As large individual differences in the perceived simultaneity of multisensory events have been reported in the literature, here we sought to assess if individual differences in perceived temporal order judgement (TOJ) of multisensory cues can predict cybersickness in VR. We conducted two TOJ tasks where participants judged the temporal order of audio-visual (AV) or audio-head movement cues to measure the temporal binding window (TBW) and point of subjective simultaneity (PSS). Participants subsequently explored two VR environments and cybersickness levels were quantified using the Simulator Sickness Questionnaire (SSQ). Results indicate a positive correlation between the AV PSS and SSQ, suggesting that the time required for light to precede sound for perceived simultaneity may predict cybersickness. We also find a trend that those with wider AV TBWs may be more susceptible to cybersickness. Although further analysis is necessary, our preliminary results suggest that shared sensory processing mechanisms subserve both temporal processing and cybersickness.

**P3-26 Children's Sensitivity to Linguistic Context in Spelling, Derrick Bourassa, University of Winnipeg, Sherri Rice, University of Winnipeg.**

Spelling development is critically dependent upon the child's ability to use linguistic context to deal with the many sound-spelling ambiguities in the English language. One such case involves sensitivity to inflectional suffixation. We examined the ability of 2nd and 4th Graders to capture inflected vs. noninflected noun and verb distinctions in a pseudoword spelling task. We found that both age groups proved to be sensitive to the

inflected-noninflected noun distinction; however, only the 4th Graders were sensitive to the inflected-noninflected verb distinction. We discuss the implications of these findings from theoretical and practical perspectives.

**P3-27 The use of pronouns to indicate interest or disinterest in an online textual conversation, Charley Sharkey, Nipissing Univeristy, Scott McQuain, Nipissing Univeristy, Nea Saunders, Nipissing Univeristy, Maggie Gravelle, Nipissing Univeristy, Darren Campbell, Nipissing University.**

Online communication is a prevalent method for developing new relationships. Unlike face-to-face communication, online communication depends heavily on conversational content and language choice due to the lack non-verbal feedback. Quantitative textual analysis identified several relationship-relevant language choices. Forming positive relationships depend on partner's conversational responsiveness, part of which reflects word choices, such as pronoun usage. To further investigate the role of language used in online relationship formations, we conducted a study, using subtle manipulation of expressed levels of interest. We hypothesized that participants prompted to show more interest would use more pronouns, and those prompted disinterest would use fewer. Our sample and basic design consisted of 45 participant engaging in a 20-minute, text-based, online chat. Our quasi-experimental manipulation consisted of one conversational partner being prompted to express more or less interest during the third five-minute window. Consistent with our hypothesis, the disinterest prompt decreased the number of personal pronouns relative to the other three five-minute windows. The interest prompt, however, did not show significant results. These findings reaffirm the importance of personal pronouns in conversational processes. These findings and future studies could lay the foundation for future algorithms to assist Individuals with social processing difficulties.

**P3-28 Cross-modal noise compensation in audiovisual words, Stephanie Deschamps, University of Toronto Scarborough, Hanna Zhang, University of Toronto Scarborough, Shanthos Thirunavukkarasu, University of Toronto Scarborough, Blair C. Armstrong, University of Toronto Scarborough.**

We investigated the ability to perceive spoken words under noisy conditions via an adaptive audiovisual (AV) Lexical Decision Task. This training method utilizes intact reading abilities to aid the perception of noisy spoken words, with the goal of gradually weaning participants off of the visual text cues and rely on the noisy auditory cues. A baseline condition with a fixed amount of visual noise was contrasted against a condition in which the visual noise adapted based on participants' accuracy. Participants in both conditions were given a post-test where noisy spoken words were presented without any visual cues. Performance on this test functioned as a measure of the effectiveness of the two training conditions.

The results revealed both training conditions increased participants' ability to perceive noisy speech relative to control conditions in which only the noisy audio stimuli were presented, but the performance increase was more pronounced in the adaptive condition. Potential clinical applications for clinical populations such as cochlear implant users will be discussed.

P3-29 **Effects of a partial second language on third language beginners' reading of pronominal clitics**, Chelsea Whitwell, McMaster University, Elisabet Service, McMaster, University.

The growing body of third language (L3) research has found that acquiring a true second language (L2) is distinct from acquiring an additional, third language. Different hypotheses have argued the possible effects previous languages can have in L3 acquisition (Rothman, Cabrelli Amaro & de Bot, 2013). In this study, we investigate the syntactic transfer of pronominal elements called clitics into beginner L3 Spanish and Italian in Anglophone Canadian students with the minimum five years of French education. We test the effect of placement of accusative clitic positioning in verbal clusters on self-paced reading. To determine whether a partial L2 can act as a source for transfer in addition to determining a general facilitative effect of an L2 on an L3 (Jaensch, 2009), different L2 proficiencies in beginner L3 learners are controlled. Attachment of the pronominal element in restructuring contexts is manipulated to detect difficulties with L3 target-like placement of the clitic, pointing to a Romance processing strategy. Alternatively, learners may process the structures following an English

strategy of strong pronouns. The reading times can reveal effects of transfer and L2 proficiency. Our results will show whether transfer from a partially acquired L2 is possible at the early stages of L3 learning.

P3-30 **A system of their own: Is number naming special**, Natalie Ford, Trent University, Michael Reynolds, Trent University.

It is unclear how Arabic digits are named, with some researchers claiming they are read like words and others claiming they are named like pictures. Four experiments addressed this issue by looking for evidence that different settings of the cognitive system are used to name digits (e.g., 4) and words (e.g., four or cat). Digits and words were presented on a screen one at a time and were alternated in a predictable AABB sequence. Response time was compared on trials where the notation switched (A->B or B->A) and trials where it repeated (A->A or B->B). The presence of a response time cost to switching between digits and words would be consistent with different settings of the cognitive system being used to name these notations, while the absence of a switch cost would be consistent with the same settings being used. No switch costs were observed in Experiment 1, where subjects switched between digits and number words, consistent with the same settings of the cognitive system being used to name these notations. However, switch costs were observed in Experiment 2, where subjects switched between naming digits and non-number words, and in Experiment 3, where subjects switched between naming number words and non-number words, consistent with different settings of the cognitive system being used to name numbers and non-number words. Lastly, no switch cost was observed in Experiment 4, where subjects switched between naming non-number words from two different semantic categories. These results are inconsistent with the claim that digits are read like words.

P3-31 **Word frequency effect: The relationship of lexical entries between visual and auditory language**, Leticia Arbex, University of Windsor, Lori Buchanan, University of Windsor.

The word frequency effect refers to the ubiquitous observation that that words with a higher frequency will be identified faster than words with a

lower frequency (Preston, 1935). In the past, this finding has come primarily from visual lexical decision tasks using visual word frequencies but frequency effects with auditory lexical decision tasks have also been observed. However, limited research has been done looking at the relationship between the word frequency effect and the modality in which those words are normally encountered. The current study looks at the effect of differing auditory and visual word frequencies. Participants performed a visual lexical decision task with words of high and low frequency but importantly there were four frequency conditions High Auditory- High Visual, High Auditory-Low Visual, Low Auditory-High Visual, and Low Auditory-Low Visual. The extent to which the relationships between frequencies play a role in visual word recognition will be discussed. In brief, it appears that hearing a word often can compensate for seeing it rarely.

**P3-32 The psychometric properties of a novel semantic battery for mild cognitive impairment, Avery Ohman**, University of Ottawa, Laura Thompson, Bruyere Research Institute, Christine Sheppard, Bruyere Research Institute, Laura Monetta, Centre de recherche de l'Institut universitaire en santé mentale de Québec, Département de réadaptation, Université Laval, Vanessa Taler, University of Ottawa.

**Objectives** – Semantic memory one of the first cognitive domains to decline in mild cognitive impairment (MCI). Current measures of semantic function do not effectively assess semantic declines or are time-consuming to administer. This study aims to examine the psychometric properties of a novel screening tool developed to detect semantic impairments in MCI.

**Methods** – The five-task battery was administered to 51 healthy older adults (OA) and 24 MCI patients; data was scored by two independent scorers. Test-retest reliability (n=17) was assessed 3-5 months from original testing. Construct validity was evaluated by comparing battery performance to traditional measures of semantic function. Face validity was examined through five structured interviews with professionals with expertise in MCI and language.

**Results** – OA outperformed MCI patients. Participants' scores did not significantly change over time, and inter-rater reliability was high overall and for each task. Performance on the semantic battery correlated with other measures of semantic function. Face validity interviews suggested the battery appropriately assesses semantic impairments but should be shortened to five minutes.

**Discussion** - Findings suggest the semantic battery is an appropriate and reliable assessment of semantic function. Next steps include modifying the battery to become more efficient for clinical use.

**P3-33 Does the association between social support availability and memory differ between men and women? An analysis of the Canadian Longitudinal Study on Aging, Avery Ohman**, University of Waterloo, Colleen Maxwell, University of Waterloo, Suzanne L. Tyas, University of Waterloo, Mark Oremus, University of Waterloo.

**Objectives** – Accompanying the rapidly aging Canadian population is an increase in the prevalence of age-related memory decline. Modifiable factors such as social support availability (SSA) are worthy of study because they may help maintain memory function. However, the impact of SSA on memory may vary between males and females, and evidence on the topic has not been gathered from large-scale population-based studies in a sample that includes both middle- and older-aged adults. Therefore, this study aims to investigate whether the association between SSA and memory differs in men and women, using baseline data from the Comprehensive cohort of the Canadian Longitudinal Study on Aging (CLSA).

**Methods** – The Comprehensive cohort (n = 30,097) was recruited within 50 kilometres of 11 sites spread across Canada. Participants' ages ranged from 45-85 years at baseline. We will use multiple linear regression to explore the association between memory (measured using the REY immediate and delayed recall tests) and SSA (measured using the Medical Outcomes Study-Social Support Survey), controlling for variables such as age, education, and province. This research aims to improve the understanding of the relationship between social support availability and memory. Preliminary results will be ready for CSBBCS's upcoming conference.

**P3-34 Degree of food processing influences memory of food images in females, Christine Tenk**, Brescia University College at Western University, Leila Mackay, Western University.

People are biased toward choosing better remembered foods to eat and studies have begun to examine what food characteristics result in better memory for these foods. How the degree of food processing (i.e. manufacturing) affects memory for foods has not yet been examined. Female undergraduate students (n=35) completed a yes-no recognition memory test. The study phase presented 30 food (naturally/minimally processed, processed, and ultra-processed) and 30 non-food images. Thirty minutes later, these images plus 60 'new' images were presented. Recognition of images and reaction times were measured, and data on body mass index (BMI) and eating style were obtained. Confirming our prediction, ultra-processed foods were recognized significantly faster and significantly better than natural/minimally processed, but not processed foods. In contrast, there were no significant differences between processed and naturally/minimally processed foods. Neither reaction time nor recognition index for ultra-processed foods was significantly correlated with reported palatability and desirability for the foods, BMI, or eating style which could suggest an implicit mechanism such as increased incentive or hedonic value. Studies should examine whether this enhanced memory for ultra-processed foods contributes to food choice especially since Canada's new Food Guide (released 2019) recommends limiting consumption of ultra-processed foods.

**P3-35 Limits on test-potentiated new learning: A test of between-list relationships, Monique Carvalho**, University of Guelph, Harvey Marmurek, University of Guelph.

Test-potentiated new learning (Chan et al., 2018) refers to the benefit of testing studied material on the subsequent learning of new material. In a seminal study, Tulving and Watkins (1974) presented a list of A-B paired-associates followed by a picture. Testing the A-B pairs facilitated learning of a subsequently studied A-D list relative to an interpolated picture-drawing task. Tulving and Watkins (1974) proposed that retrieval of the first list removes it as a source of interference when learning the second list. We

extended their procedure by including as the second list a C-D control list and a repeated A-B list. We also replaced the picture-drawing task with a re-study condition. Both the interpolated task (test, re-study) and the second list type (A-B, A-D, C-D) were varied between subjects with approximately 25 participants per group. There was an interaction such that testing the A-B list led to better cued-recall than did re-study of the A-B list on the repeated A-B and A-D second lists but not on the C-D list. Contextual change due to novel stimuli among word pairs may limit the benefit of testing.

**P3-36 Working memory capacity affects trade-off between quality and quantity only when stimulus exposure duration is sufficient: Evidence for the two-phase model, Chaoxiong Ye**, University of Jyväskylä, Finland, Hong-Jin Sun, McMaster University, Qianru Xu, University of Jyväskylä, Finland, Tengfei Liang, Liaoning Normal University, China, Yin Zhang, Liaoning Normal University, China, Qiang Liu, Liaoning Normal University, China.

The relation between visual working memory (VWM) capacity and attention has attracted much interest. In this study, we investigated the correlation between the VWM capacity and the ability to voluntarily trade off the precision and number of items remembered. The two-phase resource allocation model proposed by Ye et al. (2017) suggests that for a given set size, it takes a certain amount of consolidation time for an individual to control attention to adjust the VWM resources to trade off the precision and number. In order to verify whether trade-off ability varies across VWM capacity, we measured each individual's VWM capacity and then conducted a colour recall task to examine their trade-off ability. By manipulating the task requirement, participants were instructed to memorise either fewer items in a high-precision way or more items in a low-precision way. We conducted two experiments using stimulus duration longer than predicted critical value (Experiment 1) and stimulus duration shorter than predicted critical value (Experiment 2). While the results of Experiment 1 showed a positive correlation between the VWM capacity and trade-off ability, the results of Experiment 2 showed a lack of such correlation. These results are consistent with the prediction from the two-phase model.

**P3-37 Defining distinctiveness: A computational and experimental analysis, Jackie Spear**, University of Manitoba, Randall K. Jamieson, University of Manitoba.

We present data from a recognition experiment examining semantic distinctiveness. Participants studied distinctive, critical words embedded in eight different categorized lists. At test, three different types of lures were presented: critical word related lures, categorical related lures, and unrelated lures. Hit rates were comparable for the categorized and distinctive words; false alarm rates were elevated for lures that were semantically related to the categorized lists but not for lures that were semantically related to the distinctive words. We derive vector-based representations of word meaning with distributional models of semantics to fit the data. Our results bring the often ill-defined construct of distinctiveness under experimental and computational scrutiny and present productive methods to define distinctiveness within existing theoretical frameworks.

**P3-38 Effects of curiosity and reward on memory for relevant and irrelevant information, Audrey Shulman**, Ryerson University, Liyana Swirsky, Ryerson University, Julia Spaniol, Department of Psychology, Ryerson University.

Curiosity is an intrinsic motivator shown to improve recall for trivia facts as well as memory for temporally proximal unrelated information. Similarly, extrinsic motivation from financial reward has been linked to improved recall performance. How do these intrinsic and extrinsic sources of motivation interact? According to the “undermining effect” (Murayama & Kuhbandner, 2011) extrinsic sources of motivation dampen the benefits conferred by intrinsic motivation. The current study sought to test the undermining effect and establish whether the effect generalizes beyond target information to unrelated information. Participants perform a trivia task in which they learn trivia facts ranging in level of curiosity. During this task, unrelated face stimuli are interspersed among trivia items. Half of the participants are extrinsically motivated by monetary incentive for correct guesses to trivia questions. After a 24-hour delay, participants’ memory for

trivia items and faces are assessed. Replicating Gruber and colleagues (2014), we predict a recall advantage for trivia answers that participants were highly curious about, as well as for unrelated faces paired with high-curiosity trivia. Moreover, consistent with the undermining effect, we predict that this curiosity-induced benefit for trivia recall and face recognition will be dampened in the extrinsic reward condition.

**P3-39 Investigating Memory for Pictures in Directed Forgetting using the Double-Item Paradigm, Pelin Tan**, Queen's University, Emma Caplan, Queen's University, Geoffrey Harrison, Queen's University, Daryl Wilson, Queen's University.

Intentional forgetting enables the redistribution of cognitive resources to relevant information. In our current work, we implemented a novel variant of the item-method directed forgetting (DF) paradigm to examine how individuals allocate these limited cognitive resources while attending to multiple visual stimuli. We chose to use complex and naturalistic objects as our stimuli to better approximate DF in applied situations. Participants were given memory instructions to either remember or forget two unrelated pictures at the same time. In the “mixed” condition, participants were required to remember one picture and forget the other. In the “pure” condition, participants were required to either remember both or forget both pictures. We found a strong DF effect in both cue conditions, with a smaller DF effect in the mixed-cue condition. This difference in DF effect was driven by Forget pictures being remembered better in the mixed-cue condition than in the pure-cue condition, with no difference in memory performance for Remember pictures. Our results provide compelling initial support for the utility of our novel variant of the item-method DF paradigm and that DF mechanisms operate differently under conditions of mnemonic conflict.

**P3-40 Risk-Taking and Delay Discounting as Predictors of Academic Procrastination, Ahmad Sohrabi**, Department of Psychology, University of Kurdistan, Sanandaj and Carleton Cognitive Modeling Lab, Denesh Shariati, Department of Psychology, University of Kurdistan, Sanandaj

The present study aimed to reveal the role of risk-taking and future-oriented decision making in predicting academic procrastination. The statistical sample includes 74 undergraduate and graduate students (34 females; age  $M=19-39$ ,  $SD=5.8$ ). The participants were recruited through announcement. Two computerized cognitive tasks, the Balloon Analogue Risk Task (BART) and Delay Discounting were employed as well as Solomon and Rothblum's academic procrastination questionnaire. Statistical analysis was done through Multiple Regression analysis, using SPSS Software. The results showed that academic procrastination can be significantly predicted by risk-taking and future-oriented decision-making (delay discounting). Interestingly, academic procrastination was positively predicted by risk-taking and negatively by delay discounting, i.e., future-oriented decision making, where the ratio of picking future money (accepting high-value cheque compared to low-value cash) specifically played an important role in the delay discounting task. Therefore, optimal performance in computerized tasks can be used as indexes for procrastination in general, and here academic procrastination.

**P3-41 Production Using a Distinctive Voice is Equivalent to Using One's Own Voice**, **Rachelle Wakeham-Lewis**, Memorial University of Newfoundland, Hannah Willoughby, Memorial University of Newfoundland, Jason Ozubko, State University of New York at Geneseo, Jonathan Fawcett, Memorial University of Newfoundland.

The production effect refers to the finding that words read aloud are better remembered than words read silently. A distinctiveness-based account of this phenomenon suggests that production results in a distinctive memory trace that facilitates retrieval. Therefore, anything that makes the productive act more distinctive should result in a larger production effect. To test this account, a standard production task was modified to include a distinctive voice condition (specifically, the voice of Elvis). Furthermore, each participant was assigned to a "High-Voice" group (most words read in Elvis' voice) or a "High-Self" group (most words read in their own voice). The purpose of this variable was to further manipulate the distinctiveness of production in a novel voice by varying the relative frequency of that voice. Contrary to our hypothesis, the production effect for words read in a

distinctive voice was no larger than the production effect for words read in one's own voice; in fact, only in the "High-Voice" group did we find a reliable production effect for the distinctive voice condition. Results are discussed in terms of the mechanisms and cognitive effort involved in reading words aloud in a voice other than one's own.

**P3-42 The effect of variability correspondence in unfamiliar face matching**, **Julia Pringle**, University of Regina, Chris Oriet, University of Regina.

In a face-matching task, subjects compare photos of a target person to different photos of the target or to photos of similar-looking foils. People are highly accurate when matching familiar faces but considerably worse when matching unfamiliar faces. Previous studies suggest that unfamiliar face matching improves when observers study multiple high variability images of the target. These results suggest that identifying an unfamiliar face improves when the studied photos contain greater within-person variability. The present study examined face matching accuracy when two high or low variability study images of a target identity were followed by two high or low variability comparison images of either the same or a foil identity. Within-person variability was manipulated across trials. Of interest is the correspondence in variability of the study and comparison images (e.g., matching: low study variability, low comparison variability; mismatching: low study variability, high comparison variability). If greater within-person variability in study images per se improves matching, higher accuracy is expected irrespective of whether comparison image variability is high or low. Alternatively, high variability may only benefit matching when the comparison images are also high in variability. Results are discussed within the context of current understanding of statistical summary representations.

**P3-43 Ambiguity as a Driving Factor of the Effectiveness of Doublespeak**, **Garni Assadourian**, University of Waterloo, Alexander Walker, Martin Harry Turpin, Ethan Meyers, Jennifer Stolz, Derek Koehler, Jonathan Fugelsang, University of Waterloo

Doublespeak is a form of deceptive language that is pseudo-communicative; it can make the immoral seem more ethical, and the atrocious seem more

acceptable. In this study, ambiguity, operationalized as participants' memory for previously presented action depicting statements, was proposed to be a driving factor of the effectiveness of doublespeak. Fuzzy-trace theory suggests two types of representations of memory: gist, which is a general, fuzzy idea of a memory, and verbatim, a detailed representation of a memory. Verbatim representation is subject to decay at a quicker rate than gist memory, and is also essential in resisting suggestibility. Two-hundred forty-eight University of Waterloo students participated in an in-lab study in which they were split into two conditions: a gist and verbatim memory condition. All participants read the same six action depicting statements, and then played Tetris for 20 minutes in order to facilitate verbatim memory decay. In the verbatim condition, participants re-read the six statements, while those in the gist condition did not. Finally, all participants were given a memory task and a doublespeak task, in which they were asked to rate their agreement with either an agreeable description of a previously read statement, or a disagreeable one. A marginal difference between ratings of agreement between agreeable and disagreeable terms was found. Though we did significantly influence memory, the marginal effect may be due to the fact that our memory manipulation was not sufficient to elicit enough verbatim decay.

**P3-44 Functional connectivity of brain activation is moderated by spatial strategy use in schizophrenia, Kesia C. Courtenay**, Ryerson University, Leanne K. Wilkins, Ryerson University, Todd. A Girard, Ryerson University, Bruce. K Christensen, McMaster University, Jelena King, McMaster University, Michael Kiang, McMaster University, Veronique. D Bohbot, McGill University.

Schizophrenia spectrum disorders (SDD) involve impairments in spatial memory; however, these deficits may depend on the spontaneous cognitive strategy participants use to navigate spatial paradigms. Whereas SDD individuals using hippocampus-dependent navigation strategies (cognitive mapping) show spatial-memory deficits, those using response-based strategies (e.g., landmark-based or self-object relations) generally have intact performance. Recent brain-imaging work from our team has demonstrated that this selective deficit may be attributable to hippocampal

hypoactivation in SDD when using a spatial strategy specifically. The present study further explored the neural correlates of mnemonic strategy use in SDD using the 4-on-8 virtual maze task (a human analog of the rodent radial-arm maze) and functional connectivity analyses (partial-least squares). Results show a profile of covaried activity indicating abnormal recruitment of temporal regions during retrieval and indicate frontal-temporal disconnection in the SDD participants using a spatial strategy, as compared to SSD response learners and a healthy comparison group. Participants in the SDD-response group activated similar brain regions to healthy comparisons, but recruited these areas to a greater extent, suggesting a neural inefficiency during retrieval processing despite normal behavioural performance. Future work will further investigate the neurocognitive differences and implications of spontaneous spatial memory strategies in SDD.

**P3-45 The impact of music training on cognitive abilities in older adults, Benjamin Zendel**, Memorial University of Newfoundland, Gregory West, Université de Montréal, Jessica Benady-Chorney, Université de Montréal, Isabelle Peretz, Université de Montréal, Sylvie Belleville, Université de Montréal.

A number of studies have shown that musical training, and musicianship are associated with enhanced cognitive abilities, including IQ, and working memory; however, most of these studies were cross-sectional, and the few that were longitudinal with random group assignment were done in younger adults. To determine if the cognitive benefits associated with musicianship in older adults can be caused by music training, participants (age > 55) were randomly assigned to one of three groups. The first group completed six months of self-directed computerized music lessons (MUS). The second group served as an active control, and learned to play a 3D video game for six months (VID). The last group served as a no-contact control (CON). After training working memory abilities were selectively enhanced in the MUS group compared to both other groups, while IQ scores marginally improved in the MUS group compared to the other groups. Paralleling these cognitive enhancements, there was increased grey-matter in the dorsolateral prefrontal cortex, and caudate in the MUS group. These brain regions are

related to working memory and planning goal-directed actions, both critical components of cognition. It is therefore likely that music training can improve cognitive abilities in older adults.

**P3-46 Students in China know recent Western popular music but do not show a typical Western "Reminiscence Bump", Jingyuan Sun, University of Prince Edward Island, Annabel Cohen, University of Prince Edward Island.**

Eighteen Chinese-born Mandarin/English bilingual students (mean age = 19.9 years) attending University in China responded to an on-line Qualtrics questionnaire about Western popular music, previously employed in Canada (Cohen & MacLean, 2018, at BBCS). For each of 25 Western hit songs, popular between 1968 and 2017, participants rated familiarity and identified title, artist, and year of popularity. Songs were cued by 10-sec audio excerpts. Familiarity was highest for songs popular since 2010, but dropped dramatically for all earlier songs. The same high familiarity for recent songs appeared for Canadian students in Canada, but familiarity declined gradually with decreasing recency and then increased for songs popular during their parents' youth, consistent with a "Reminiscence Bump" (Krumhansl & Zupnick, 2013). Complex sociopolitical and technological factors can partially account for differences in musical exposure and imply large contextual differences in musical knowledge of students from Canada and China. With increasing globalization and relaxing of regulations regarding communications in China, these differences may decline in future; however, for now, in order to reduce extraneous variation in studies of music cognition, cultural background of participants requires consideration. These findings do not exclude the possibility of a Reminiscence Bump for music reflecting Chinese culture.

**P3-47 Prospective power analysis for multilevel designs using SIMR, Janeen Loehr, University of Saskatchewan.**

Prospective power analysis has become increasingly important as problems caused by low statistical power have received more attention. At the same time, multilevel designs and associated mixed-effects model analyses are becoming more common, e.g., for analyzing data from participants nested within pairs or trials repeated within participants. Prospective power

analysis for multilevel designs is challenging for at least two reasons: the model structure of interest must be accommodated, and each of the model's parameters must be estimated (Lane & Hennes, 2018). I will present two examples of prospective power analyses for multilevel designs carried out using the SIMR package (Green & Macleod, 2016) in the R statistical platform. The first example calculates the number of participants required for a study in which participants are nested within pairs. The second example calculates the number of trials and participants required for a study in which participants are tested alone. Existing datasets are used to estimate model parameters, and SIMR is used to fit the corresponding multilevel model and then estimate power at a range of sample sizes using Monte Carlo simulation. Code for running the simulations will be provided.

**P3-48 The LEAP-Q: Is it a reliable bilingual language proficiency measure?, Nawal Mustafa, University of Windsor, Lori Buchanan, University of Windsor.**

In bilingual research, the extreme variability of the participants' second language (L2) proficiency levels makes it difficult to investigate their lexical processing mechanisms. One commonly used measure is the Language Experience and Proficiency Questionnaire (LEAP-Q). It is considered a reliable tool for assessing language-proficiency; however, it has a fundamental flaw. Bilinguals who are not exposed to a fluent form of their L2 do not provide accurate ratings on this measure. In a previous study, I used the LEAP-Q on 90 Urdu-English bilinguals from Pakistan. They rated themselves as being highly proficient in both Urdu (L1) and English (L2). This is misleading information because qualitative observations revealed significantly lower L2 proficiency which was supported by the slow mean reaction times (RT) of their L2 word recognition. Thus, in the present study, I compare the LEAP-Q scores of Urdu-English bilinguals from Pakistan versus Canada and assess their word recognition performance using a lexical decision task. I expect to find similar proficiency ratings for both groups, but with faster RT for Canadian Urdu-English bilinguals. This study is crucial in bringing awareness to the limitations in the LEAP-Q that may result in inaccurate ratings due to cultural influences, thus, threatening construct validity.

**P3-49 Effect of refresh rate on motion smoothness perception and vection strength, Sophie Kenny**, VPixx Technologies, Séamas Weech, University of Waterloo, Michael Barnett-Cowan, University of Waterloo.

Research shows that smoothness of motion in optic flow stimuli influences the extent to which participants experience vection, the illusory sense of self-motion accompanied by postural compensation. The refresh rate of visual displays is an important factor in smoothness perception, as motion is achieved as a result of a step-wise displacement of a visual element for discrete time periods. Studies of self-motion using low-contrast and medium-speed stimulus motion on a 60 Hz display have suggested that perception of motion smoothness asymptotes at 60 Hz and that vection is impaired when lower refresh rates are simulated. However, many self-motion and immersiveness studies employ high contrast, high spatial frequency stimuli with greater motion energy, whose rendering benefits from faster refresh rates. We project high contrast optic flow stimuli at 22.5 °/s, 30 °/s and 37.5 °/s and use a staircase procedure to identify the perceptual thresholds that correspond to the perception of smooth motion. We use a PROPixx projector capable of 0.69 ms temporal resolution to simulate refresh rates ranging from very slow (3 Hz) to extremely rapid (1440 Hz). We then report the effect of supra- and sub-threshold stimulation on self-reported vection and postural instability.

**P3-50 Image reconstruction reveals the visual content associated with perception and memory for facial expression in borderline personality disorder, Chi-Hsun Chang**, Department of Psychology at Scarborough, University of Toronto, Anthony Ruocco, Department of Psychology at Scarborough, University of Toronto, Natalia Drobotenko, Department of Psychology at Scarborough, University of Toronto, Andy Lee, Department of Psychology at Scarborough, University of Toronto, Rotman Research Institute, Baycrest Centre, Adrian Nestor, Department of Psychology at Scarborough, University of Toronto.

Previous work has suggested that individuals with borderline personality disorder (BPD) have difficulty in recognizing emotional expressions. However, prior work has only relied on a small set of prototypical

expressions. More importantly, it is unclear how BPD individuals misperceive and misremember expressions. The present work aims to address these issues by appeal to an image reconstruction approach as applied to a large set of emotional expressions. To this end, participants provided similarity ratings of expressions for pairs of visually-presented face stimuli or for pairs consisting of one face stimulus and a face recalled from memory. These ratings were then used to construct a multidimensional expression space, and the appearance of facial expressions viewed or recalled from memory was derived from the structure of this space. Our findings revealed that both healthy control and BPD data support successful reconstructions of facial expressions. However, the underlying representational space was different across the two groups in that valence dominated the structure of the control space while arousal dominated the structure of the BPD space. Thus, the current work provides new insights into the structure of expression representations and into its divergence across different populations.

**P3-51 The effect of arousal, valence, and subjective liking of music on visually induced motion sickness, Katlyn Peck**, Ryerson University, Frank Russo, Ryerson University, Jennifer Campos, Toronto Rehabilitation Institute, UHN, Behrang Keshavarz, Toronto Rehabilitation Institute, UHN.

Visually induced motion sickness (VIMS) is a common phenomenon in users of virtual environments, often resulting in discomfort, dizziness, and/or nausea. The goal of the present study was to investigate how valence, arousal, and subjective liking of music affect VIMS. Eighty healthy adults watched a video of a bicycle ride filmed from a first-person perspective while listening to different types of music. First, 40 participants were randomly assigned to one of four groups that listened to pre-selected, classical music varying in valence and arousal (happy, peaceful, agitated, sad). Second, we maximized the level of subjective liking of music by asking 20 participants to select their favourite songs, which were then played during the video. A control group (n = 20) watched the video without music. The Fast Motion Sickness Scale and the Simulator Sickness Questionnaire were used to measure VIMS. While valence and arousal had no effect on VIMS, subjective liking of music played a crucial role: Participants who

listened to their favourite music or who liked the pre-selected classical music reported significantly less VIMS compared to the control group or to those who did not like the pre-selected music. Our results suggest that music can successfully reduce VIMS severity.

**P3-52 The role of near work, time outdoors, and physical activity in myopia development, Marlena Pearson, Ryerson University.**

Uncorrected refractive error causes visual impairment and blindness in millions of people worldwide, and myopia is among the most common forms of refractive error. Previous research has explored a range of genetic and environmental factors in the development of myopia. According to the near work hypothesis, engaging in long durations of focusing on nearby objects (e.g., reading, using screens) increases myopia risk. There is also evidence that higher levels of time outdoors protects against myopia, since exposure to daylight may help to increase retinal dopamine production. However, although physical activity also has a number of possible mechanisms by which it may positively affect eye development, such as changes in vascular function, growth hormones, or other systemic factors, findings reported in the literature suggest that lower levels of physical activity likely do not explain these relationships to a significant degree. This work evaluates increasing time outdoors and decreasing near work as interventions for myopia, as well as assesses the extent to which lower levels of physical activity may be related to myopia risk posed by higher volumes of near work or lower durations of time outdoors.

**P3-53 Where is your origin? Individual differences in spatial updating using optic flow, Laura Jin, McMaster University, Nadia Wong, McMaster University, Nickolas Rubakha, McMaster University, Jennifer Lin, McMaster University, Sue Becker, McMaster University, Hong-jin Sun, McMaster University.**

We studied spatial updating through optic flow using the Starfield task (Gramann et al, 2013) which was used to characterize participants' spatial strategy as allocentric or egocentric. Stationary participants viewed computer-simulated optic flow generated from motion of random dot patterns. The movement trajectory included a forward translation, a

rotation/translation combination, and another forward translation. At the end of travel, participants rotated a dart to point back to their origin. Approximately 45% of participants (identified as turners, Gramann et al, 2005) pointed to the general direction of the origin, while another 45% (non-turners) pointed in a different direction as if they failed to update their heading. Non-turners in this task have been assumed previously to employ an allocentric strategy. However, similar proportions of these groups were found in two viewing conditions: (1) through a computer monitor or (2) through a circular aperture which blocked the view of monitor frame, suggesting non-turners' response strategy was not due to the use of a stationary background as a reference. In addition, when asked about GPS use preferences, turners tended to prefer a north-up view while non-turners preferred a self-up view, suggesting that turners can better handle the discrepancy between egocentric direction and map orientation.

**P3-54 The contributions of field of view and eye movements in allocentric spatial navigation: insights gained from older adults, Khushi Patel, Ryerson University.**

Spatial navigation is the ability to travel from one location to another using landmarks. Different strategies (e.g., allocentric, egocentric, stimulus-response) can be used to navigate successfully within a given environment. Among older adults, deficits have been observed in allocentric navigation, which has been associated with impaired binding abilities and age-related changes within the hippocampus. The hippocampus is responsible for mediating the relationships between different spatial representations (e.g., binding landmarks). However, some studies have shown that encoding and processing of visual information also contribute to the process of binding environmental information. The lower level visual functions (e.g., field of view, eye movements), their associated regions (e.g., area V1, brainstem), and regions responsible for relaying visual information to the hippocampus (e.g., entorhinal cortex, retrosplenial cortex, parahippocampus) also deteriorate with age. This paper discusses evidence which suggests that although the hippocampus plays an important role in binding abilities and navigation, degradation in lower level visual functions and visual processing

structures that feed into the hippocampus may also contribute to allocentric spatial navigation.

**P3-55 Accuracy of athletic trainers in judging the authenticity of facial expressions of pain in children: an eye tracking study, Matthew Baker, Laurentian University, Mélanie Perron, Laurentian University.**

The purpose of this study was to assess the accuracy in detecting facial expressions of pain in a pediatric population between athletic trainers and the general population using eye tracking technology. Previous research has focused on health care providers and parents, where both identified pain expression authenticity better than chance, but showed difficulty identifying genuine pain expressions. Athletic trainers are a novel population with experience managing pain in acute settings. Previous research suggests empathy may play a role in estimating others' pain intensity, therefore the relationship between participants' empathy and their accuracy detecting facial expressions of pain was examined. It was also observed if there is a relationship between related emotional traits and estimates of the children's pain intensity. Athletic trainers and healthy university students were invited to participate in the study. They were asked to complete emotional questionnaires, followed by the judgement task, where they viewed video stimuli of children in experimental pain while having their eye movements recorded, and judged the authenticity of their pain expression. Upon preliminary analyses there appeared to be no significant differences between athletic trainers and the control group in their judgement accuracy of pain expression; however, both groups were more accurate than chance.

**P3-56 , Self Responsiveness and Disclosure in Relationship Formation During Online Conversation, Maggie Gravelle, Nipissing University, Scott McQuain, Nipissing University, Charley Sharkey, Nipissing University, Darren Campbell, Nipissing University.**

One-in-five relationships begin through online communication. Conversational responsiveness and self-disclosure are key components in forming successful online relationships. Participants completed a 20-minute, text-only, naturalistic online chat. Participants did not meet in person and did not know each other's identity. We randomly assigned one of the

conversational partners to express either interest (n=16), disinterest (n=15), or continue chatting (i.e., the control condition, n=12) during the third five-minute epoch. text-based chat. Each of these unacquainted partners reported on the relationship outcomes, conversational satisfaction, and communication process via self-report scales. We hypothesize that the Interest-prompted partners would report more positive relationship outcomes and the Disinterest-prompted partners would report less positive relationship outcomes relative to the Continue chatting partners. Conversational engagement and self-disclosure showed linear increases across the three groups. Moreover, the Disinterested group reported lower feelings of being liked and lower liking their conversational partner relative to the control group. These findings offer unique insight into the online relationship-formation process with a participant-driven, subtle experimental manipulation of interest during a naturalistic acquaintanceship conversation.

**P3-57 Online communication: accuracy of judging personality traits, Kayla Greenman, Nipissing University, Nea Saunders, Nipissing University, Charley Sharkey, Nipissing University, Scott McQuain, Nipissing University, Darren Campbell, Nipissing University.**

Chatting online is increasingly popular, but lacks the visual and non-verbal social signals inherent in face-to-face interactions. When interacting with others, determining if they are open-minded (Openness), reliable (Conscientious), sociable (Extraversion), cooperative (Agreeable) and emotionally stable (versus Neurotic) has clear implications. Openness and conscientiousness are more accurately detected during online communication compared to neuroticism and extraversion which depend more on non-verbal social feedback. Thirty-three pairs of females rated their personality traits, completed a text-based, online chat for twenty minutes, and then rated their conversational partners' personality traits. Recognition accuracy was defined by how closely a partner's ratings matched self-ratings. To examine personality-trait accuracy, we subtly manipulated sub-groups of participants to express interest or disinterest during the third, five-minute period of the online conversation. Across the full sample, the correlation across self and partner ratings were moderate

for openness, conscientiousness, extraversion, and agreeableness, while neuroticism ratings were not correlated. Among participants expressing disinterest, agreeableness accuracy levels became negligible, and neuroticism became inversely accurate. Among participants expressing interest, accuracy levels increased significantly across the five personality traits. Of the few online communication accuracy studies, this is the first experimental manipulation of interest levels and personality trait accuracy during naturalistic acquaintanceship conversations.

**P3-58 The dynamic synergy of brain and body to support complex cognitive tasks, Adam Fraser**, Carleton University, Kathleen Van Benthem, Carleton University, Chris Herdman, Carleton University.

Devices that measure biological signals unobtrusively during complex cognitive tasks support the development of models that explain the relation between peripheral physiology and cognitive performance. We report on a novel method for predicting high-risk phases of flight from pilot physiological indices of mental workload. Temperature, heart rate, and epidermal activity were collected via a wrist-worn device while 51 pilots flew a cross-country route in a full-scale flight simulator. Task demands varied from low to high during flight. A time series analysis revealed decreases in HR and epidermal activity were tied to periods of flight associated with high mental demands, such as low altitude flight. This neurovisceral integration was most strong in pilots exhibiting high performance. A discriminant analysis found that good classification of low and high mental workload periods of flight could be predicted by HR, EDA, and skin temperature. However, the contribution of each biometric index varied in a step-like function related to expertise. Our findings support a model of neurovisceral integration such that decreased HR occurs at moments of elevated executive functioning. HR along with other biological signals show potential for serving as indicators of important cognitive functions as well as piloting skill.

**P3-59 The roles of mood and arousal in anticipating cognitive effort for a sustained attention task, Veerpal Bambrah**, York University, Elina Gama Fila, York University, John D. Eastwood, York University.

Individual differences in the feeling of cognitive effort are critical for the deployment and persistence in exerting effort. Although people attempt to come up with an unbiased estimate of how future events will influence their future affective state, their assessment is often contaminated by unique influences on their current affective state. This study investigated the roles of mood and arousal on individuals' anticipation of cognitive effort for a sustained attention task. Participants reported their "baseline" mood and arousal and then completed the task. They reported their discomfort level and their mental effort required directly after completing brief practice trials and during the task. Analyses revealed that individuals in a positive mood anticipated the task to require more effort, but mood was unrelated to how effortful the task actually felt. Although participants' mood did not impact their anticipation of discomfort, positive mood was associated with less felt discomfort. Finally, highly energized participants anticipated feeling less discomfort, which was consistent with their actual experience. Individuals often under-estimate the effort they will exert and the discomfort they will feel during a sustained attention task, yet their mood and arousal at the time of making predictions are associated with their anticipations and actual experiences.

**P3-60 Does attention modulate the Colavita effect?, Laura Schneeberger**, Mount Allison University, Geneviève Desmarais, Mount Allison University.

Whether attention impacts multisensory integration is unclear: some research indicates that attention modulates integration while other does not. Often, studies reporting an effect of attention use more highly-demanding primary tasks and secondary tasks than studies that do not. We therefore examined the effect of attention on audiovisual integration by using a Colavita task (where participants typically fail to detect the auditory component of an audiovisual stimulus) and varying the demands of a secondary task. Participants reported the modality (e.g. visual, auditory, or audiovisual) of either abstract or concrete stimuli, and completed these tasks under full attention or while concurrently completing a foot tapping pattern that was simple (Experiment 1) or complex (Experiment 2). In Experiment 1, participants produced more errors during bimodal trials, but there was no Colavita effect, and no effect of attention. Experiment 2

produced a Colavita effect (there were more ‘visual-only’ than ‘auditory-only’ errors in response to bimodal trials), but this effect was not modulated by attention. These findings suggest that, when a relatively easy task like modality detection is used, attention does not affect audiovisual integration. It is therefore possible that the demands of the primary task influence whether attention will influence integration.

P3-61 **Cognitive and environmental contributions to mental health outcomes after pediatric stroke**, Angela Deotto, York University, Claire Champigny, York University, Mary Desrocher, York University, Robyn Westmacott, The Hospital for Sick Children.

Stroke is an acute cerebrovascular insult that can occur in the perinatal period, infancy, or childhood. Pediatric stroke can cause neurobehavioural impairments, which may affect psychosocial development. The current study investigated mental health in pediatric stroke patients, as well as the medical, personal, and environmental factors which may contribute to mental health outcomes. Thirty-one children between the ages of 8-18 years with a history of ischemic stroke and 34 demographically equivalent healthy controls participated. Using standardized psychological test batteries, participants were assessed for psychosocial functioning, intelligence, executive function, motor function, and neurological status. Data on parent and family functioning were also collected. Group comparisons revealed that mood, anxiety, self-confidence, and emotion regulation were areas of concern in a significant percentage of stroke patients. Pediatric stroke patients experiencing difficulties with learning and motor skills were most at risk for mood related concerns. Parent mental health was the strongest environmental predictor of mental health in the stroke group and represents an area to target future interventions.

P3-62 **Metacognition and uncertainty during a visual classification task**, Billal Ghadie, Carleton University, Guy Lacroix, Carleton University, Chantal Lemieux, Ottawa University.

A well-documented facet of human cognition is the ability to monitor uncertainty through metacognitive processes. Paul et al. (2011) demonstrated that this ability applied to categorization tasks that relied on

both declarative and nondeclarative memory. However, it is unclear to what extent uncertainty and calibration are related. Therefore, the goal of the present experiments was to address this question. Experiment 1 largely replicated Paul et al.’s paradigm.

Participants were randomly assigned to complete a categorization task following either a rule-based or information-integration-based structure (See Ashby et al., 1998). Participants had to identify category membership or select an uncertainty response. Experiment 2 was similar except that participants had to present a retrospective calibration judgment and the uncertainty response option was removed. Preliminary analyses suggest that the calibration measure may be more sensitive to participants’ metacognitive knowledge than uncertainty.

P3-63 **The application of functional near-infrared spectroscopy to auditory research**, Joseph Rovetti, Ryerson University, Huiwen Goy, Ryerson University, Rebecca Nurgitz, Ryerson University, Frank Russo, Ryerson University.

Functional near-infrared spectroscopy (fNIRS) is a neuroimaging method that is rapidly increasing in popularity. While it is similar to functional magnetic resonance imaging (fMRI) in that it measures the hemodynamic response, fNIRS is relatively convenient, non-invasive, tolerant of motion artefacts, and quiet. These features all render it suitable for auditory research, although at the moment, only a small minority of fNIRS studies have used auditory tasks. Thus, the aim of the current study was to apply fNIRS to the measurement of cognitive effort in auditory tasks. In Experiment 1, 16 young adults completed a visual and auditory working memory task (n-back) at four levels of difficulty. We found that oxygenation of the prefrontal cortex (PFC) increased with task difficulty. In addition, oxygenation in the dorsolateral PFC was higher for the auditory n-back than for the visual n-back. In Experiment 2, 16 young adults completed a speech-in-noise task (SPIN) at two levels of target word predictability and two signal-to-noise ratios (SNR). We found that PFC oxygenation was higher for lower levels of target word predictability and of SNR. Both sets of results are

in agreement with previous studies using fMRI and support the use of fNIRS for auditory research.

**P3-64 Noticing and detecting change: Is there a role for spontaneous reminding?** Dana Strauss, University of Guelph, Chris Fiacconi, University of Guelph.

Detecting change requires that individuals notice differences against a background of similarity. We conducted 2 experiments that examined whether change detection involves spontaneous reminders of similar prior events. Participants studied two lists of related and unrelated cue-target word pairs containing a mixture of pairs that changed between lists (e.g., A-B, A-D), as well as pairs that did not change (e.g., A-B, C-D) while making a

relatedness judgment for each pair. Following study, participants were shown the cues from list two and were asked to, 1) recall the target associated with the cue in list two, 2) indicate whether the target for that cue changed between lists, and 3) recall the original target from list one. We found that participants were more likely to detect change when the change involved a salient switch in meaning across lists. To probe whether change detection was triggered by spontaneous reminding during the second list, we examined reaction times (RTs) for relatedness judgments during this list. We found evidence that RTs to pairs in list two discriminated between those pairs for which change was and was not subsequently detected. These results are discussed in relation to the role of spontaneous reminding in change detection.