

Carleton University Cognitive Science

Spring Graduate Conference 2024



Abstract Booklet

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Richcraft Hall, Carleton University

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WiCSC+ Trainee presents:
Academic CVs and Resumes
Room 1: RB2220 & RB2224
10:20-10:50

The WiCSC+ Trainee Board will be delivering a workshop aimed at students wishing to learn more about academic CVs and resumes. Members of the Board will provide a brief presentation on the differences between a traditional resume and an academic CV. This will be followed by an open Q&A session hosted by panelists with a range of academic, alt-ac, and industry work experience.

What is WiCSC+? WiCS-Canada is the Canadian Chapter of Women in Cognitive Science, an NSF-funded organization in the U.S. affiliated with the Psychonomic Society. Heading into its 20th year in 2021, WiCS has offered important professional development and networking opportunities to scientists in the fields of cognitive science, cognitive neuroscience, and related disciplines. We hope WiCS-Canada will enable similar opportunities, in a way that is tailored to the Canadian research context.

The WiCSC+ Trainee Board: Who are we and what do we do? The Women in Cognitive Science Canada Trainee Board is made up of trainees (undergraduate students, graduate students, and early career researchers) across universities in Canada who are engaged in research in the cognitive sciences. The trainee board offers information and resources toward trainees in cognitive sciences (undergraduate students, graduate students, and early career researchers) regarding issues related to various career trajectories to help other trainees navigate school, jobs, and life in general.

***We want to highlight that all individuals are welcome to participate – members and affiliates of WiCSC+ need not identify as women.**

WiCSC + Trainee “Academic CVs and Resumes” Q&A Panelists

- **Taeko Bourque:** Taeko is a PhD Candidate in Cognitive Science at Carleton University under the supervision of Dr. Jo-Anne LeFevre. She is also Head of Operations for AfriBCD and the Knowledge Mobilization Specialist for the Observatoire Psycavi. She has gained valuable skills and knowledge through various graduate school opportunities, such as a Mitacs Accelerate internship, Research Assistantships, and Teaching Assistantships. Prior to graduate school, she gained experience working outside of academia, including at an engineering consulting firm, an interactive science museum, and as a freelance artist.
- **Vanessa Cunha:** Vanessa is a third-year MA-PhD Psychology student at the University of Ottawa under the supervision of Dr. Patrick Davidson. Apart from her student life, she is employed both within an academic and a non-academic setting. Specifically, she works at the INSPIRE Lab at uOttawa as a research assistant, helping answer any questions researchers may have about equipment, participant pools, and overall lab space and services. As well, Vanessa recently began working at the Department of National Defense as part of the Federal Student Work Employment Program (FSWEP), assisting Defense Research Scientists with their research investigations.
- **Liza Kahwaji:** Liza is a fourth year B.Cog.Sc. student at Carleton University working under Dr. Jo-Anne LeFevre in the Math Lab. She is currently working in the lab as a research assistant for the AIM (Assessment and Instruction for Mathematics) Collective. She previously completed the NSERC USRA (Undergraduate Student Research Award) in the lab as well. Liza is also involved in the Carleton community as the president of the Carleton Cognitive Science Association and part of the FASS student program.
- **Elora Wales:** Elora completed her Honours B.A. in Psychology at the University of Ottawa in April 2022 and has been working as the laboratory manager for Dr. Erin Maloney’s Cognition and Emotion Laboratory at the University of Ottawa ever since. In this role, Elora assists in the development of research projects, trains, supervises, and manages undergraduate students, takes care of day-to-day maintenance of the laboratory including scheduling, managing finances, and ensuring safety of laboratory members. This position, and similar research assistant positions can help recent undergraduates gain experience in the field of Cognitive Science while deciding what career they would like to pursue and can help boost their CV in the meantime.

United CogSci Associations presents:

Uniting Cognitive Science – Better the Future of CogSci Undergraduates

Room 1: RB2220 & RB2224

10:50-10:55

The UCA is an organization that seeks to create a strong and friendly network uniting CogSci associations and students from all over the world. It believes in the potential of connections to expand and consolidate a community that is welcoming, friendly, and diverse. Cognitive science at the moment consists of isolated groups, we are trying to bring them together in order to create a space that is truly interdisciplinary and integrates points of view from all over the globe. We want to act as a resource for students and cognitive science enthusiasts, for them to get insight about the programs, opportunities and research that is out there!

Speaker: Garance Barnoin

Honours Cognitive Science Undergraduate at McGill University in the Geddes' Lab of Motivational Neuroscience at the Neuro, Co-President of the Student Association of Cognitive Science at McGill University, United CogSci Associations Founder and CEO

Talks

Room 1: RB2220 & RB2224

11:00-12:10



Consciousness in Alzheimer's Disease: A Multidimensional Approach

Salah Aziz, Carleton University

Room 1: RB2220 & RB2224

11:00 - 11:05

Alzheimer's disease (AD) is a neurodegenerative disorder that gives rise to a diverse range of psychological changes across individuals. Some of these changes may involve alterations in consciousness. In particular, the overall state of one's consciousness – known as a global state of consciousness, is thought to be compromised by AD, reflected in impairments in cognitive abilities. A common approach to understanding the distortion of global states uses a levels-based taxonomy. In this paper, I critically examine recent literature on compromised global states of consciousness in individuals with AD. I will argue that the literature on AD thus far inadequately deploys the concept of a global state of consciousness, while the field of consciousness science has established its importance for understanding a range of neuropsychological conditions. I will argue that this insight applies to AD as well. Still, there is disagreement about how best to understand global states of consciousness, with the two prevailing views being a levels-based approach, which holds that consciousness exists on a spectrum or a hierarchy of different levels, and a multi-dimensional approach, which holds that consciousness is a complex construct that can be analyzed with multiple aspects or dimensions. I make the case for adopting the multi-dimensional approach over the levels-based approach and then show how doing so can account for the substantial heterogeneity of the alterations in consciousness observed in AD. By embracing a multidimensional perspective, we can potentially gain deeper insights into the complexity and intricacies of compromised global states of consciousness in AD.

Insights into Cognitive Reserve Using Multi-Modal MRI

Imola MacPhee, Carleton University

Room 1: RB2220 & RB2224

11:05 - 11:20

Bilingualism can mitigate behavioral signs of cognitive decline, despite classic anatomical signs of pathology in the brain. Using a combination of multi-modal MRI (task-based functional measures and structural measures) and behavioral data related to cognitive performance, our aim is to understand the contribution of neuronal architecture to cognitive reserve in bilinguals. At the microstructural level, we used neurite orientation dispersion and density imaging (NODDI) with diffusion weighted MRI to investigate dendritic structure and complexity. In the first phase of our study, twenty-three (n=23) young English-French bilinguals were assessed using language and cognition measures, and scanned using 3T MRI. Partial Least Squares Correlation (PLS-C) revealed that the degree of dendritic branching was associated with 3 latent variables capturing 1) French proficiency and age of acquisition (AoA) and 2) cognitive performance and an exploratory domain of 3) speech in noise perception. Functionally, we investigated the relationship between bilingualism and executive function, as well as hearing which can also impact cognitive reserve. Using PLS we demonstrated greater engagement of the language network in participants with better hearing in noise performance and greater efficiency (reduced activation) in executive function networks, particularly in the dorsolateral prefrontal cortex. In the next phase of research, structural and functional imaging techniques will be applied to an older adult population (age 60+). By doing so, we hope to better understand MRI based biomarkers of cognitive change in aging bilinguals. Long term, these regions could be targeted for intervention using factors known to contribute to cognitive reserve.

Other Authors: John Anderson

But What Did You Really Mean? Language Background and the Noisy Channel Theory

Tyler Call, Carleton University

Room 1: RB2220 & RB2224

11:20 - 11:35

The broccoli steamed the chef. The man handed the child to the ice cream cone. These are implausible utterances: their literal interpretation is unlikely given the meanings of the words and the order in which they are arranged. When a listener hears such an utterance, they can either interpret it literally or infer a non-literal interpretation, i.e., the one the speaker probably intended to convey. Inferring a non-literal interpretation is colloquially known as giving the speaker the benefit of the doubt. The noisy channel theory provides a framework for explaining how humans infer literal and non-literal interpretations of utterances. This theory posits that a listeners' priors (expectations about which utterances are likely given the context) combine with a noise model (knowledge of how utterances can become corrupted) to co-determine which intended meaning the listener infers. One study (Gibson et al., 2017) found that, for certain types of implausible utterances, speakers with non-native accents were more likely to receive the benefit of the doubt than speakers with native accents. However, understanding occurs in the mind of the listener. We replicated and extended one of Gibson et al.'s experiments to investigate whether listener language background factors—e.g., age of acquisition of English and whether English is a first or second language—affect non-literal interpretation rates of implausible utterances. In this talk, we will present our findings.

Other Authors: Olessia Jourvlev

**Neurobiological Correlates of Bilingualism:
A Multi-Method Structural Neuroimaging Approach**

Somayya Saleemi, University of Ottawa

Room 1: RB2220 & RB2224

11:35 - 11:50

Existing literature proposes that bilingual individuals may manifest discernible variations in subcortical regions, particularly within the hippocampus and basal ganglia, potentially stemming from the cognitive intricacies of managing two languages. Despite observed differences in volume or thickness across studies, the nuanced nature of these findings necessitates further exploration to establish consistent patterns and unravel the underlying mechanisms. Beyond subcortical structures, investigations reveal that bilingualism extends its influence to white matter structure and connectivity. This dual impact suggests a comprehensive effect on both the size of brain regions and the dynamic connections within and between these regions during language processing and other cognitive tasks. The present study seeks to contribute to this expanding knowledge by specifically examining subcortical thickness and white matter tracts. Emphasis will be placed on the nuanced interplay of factors such as age of acquisition, language proficiency, language entropy, and treating language as a continuous variable rather than dichotomous, recognizing its potential to shape the observed effects. This holistic approach aims to deepen our understanding of the intricate neurobiological consequences of bilingualism, bridging gaps in current knowledge and providing a foundation for future research and practical implications.

Other Authors: Shanna Kousaie

Schizophrenia-Like Traits and Linguistic Abilities in Two Languages: Results from a Large Online Study

Arthur Hamilton, Carleton University

Room 1: RB2220 & RB2224

11:50 -12:05

Bilinguals often receive clinical care in their second language (L2), but little research has compared how neurodivergent traits manifest in bilinguals' L2 vs. their first language (L1). A small literature indicates that bilinguals with schizophrenia (SZ) show more symptoms in L1 than L2. However, it remains unknown whether L1/L2 differences extend to the cognitive deficits associated with SZ. The present study assessed the relationship between 1) L1/L2 differences in linguistic cognition and 2) sub-clinical schizotypal traits, in a large online sample of bilinguals from the general population ($n = 679$). The goal was to assess the utility of conducting a similar study in people with SZ. Participants completed tasks measuring performance in four domains of linguistic cognition—lexis, semantics, syntax, and pragmatics—each in English and French. Participants also completed questionnaires on sub-clinical schizotypal traits and their demographic and linguistic background, and finally non-linguistic control tasks. As expected, participants performed better in their L1 than their L2 on all linguistic tasks. Within participants' L1, lower scores on all linguistic tasks were associated with higher levels of schizotypal traits; within participants' L2, the same associations appeared, except on the lexical task. To confirm this, participants with high and low schizotypal trait load were then matched with propensity score matching and compared. The group with high schizotypal trait load showed a significantly reduced L1/L2 difference on the lexical task but not the other tasks. Potential explanations for the hypothesis being confirmed only for the lexical domain are discussed, along with potential implications.

Talks

Room 2: RB2228

11:00-12:10



Timescales Connect Neural and Behavioral Dynamics.

Noah Chuipka, Carleton University

Room 2: RB2228

11:00 – 11:05

The human cortex evokes a vast repertoire of timescales in both time and frequency domains across various tasks. Both the brain and mind exhibit distinct timescales, whereas the shared information between neuronal and mental features can be named the “common currency.” We investigate the common currency hypothesis by analyzing electroencephalography (EEG) recordings and behavioural data in the NMED-M Stanford Research Data Collection dataset (n = 30) where participants listened to various musical stimuli, and afterwards rated their engagement levels on a long numerical scale sampled continuously over the duration of the music. We employ a sliding window analysis approach of both time and frequency domains to index the complexity of temporal dynamics in the EEG and behavioural data. The dynamic autocorrelation window (D-ACW) was used as a proxy of intrinsic neural timescales in the time-domain, whereas dynamic median frequency (D-MF) was examined to assess power-frequency activity. Afterwards, Granger causality was applied to test whether neuronal dynamics can temporally predict behavioural dynamics and the reverse. Our results demonstrate that fluctuating D-ACW and D-MF activity in the neuronal and behavioural data is unidirectional in that the neuronal can predict the behavioural (i.e., brain to mind), which in turn suggests information flow in temporal dynamics to constitute a common currency between the brain and mind.

Other Authors: Georg Northoff, Tom Smy

Effects of Captioning on Time Compressed Video Lecture Comprehension

Odin Fisher-Skau, Carleton University

Room 2: RB2228

11:05 – 11:10

In recent years, universities have rapidly adopted video lectures as a primary means of delivering course content. Consequently, students have begun taking advantage of video acceleration and captioning features included in most media players. The goal of this study was to examine the influences of captioning and playback speed on video lecture comprehension. To test this, participants were assigned to one of four playback speed groups, ranging from 1.0x to 2.5x normal speed. Participants watched two video lectures at their assigned speed, with one including closed captioning, before completing a quiz on its contents. Quiz performance was then compared across groups to assess the effects of playback speed, and between a participants' two lectures to assess the effects of captioning. A main effect for both speed conditioning and captioning was found. With respect to captioning, preferences, perceived performance impact and usage were also assessed.

Other Authors: Guy Lacroix

Defining Value for Bargaining Between Labour and Employer

Maria Vorobeva, Carleton University

Room 2: RB2228

11:10 -11:15

The negotiation of wages between labour and employer is a high-stakes negotiation for both parties. However, despite the fact that labour and employers often bargain when setting the wages, the bargaining game mechanism has rarely been used within traditional economics to analyze the conflict between labour and employer. This is due in large part due to a lack of definition of what sum exactly both parties are bargaining over. In this paper we show that by using the labour theory of value, we are able to define the sum being bargained over and thus can analyze the labour-employer bargaining using a bargaining game. Additionally we show how extra-bargaining behaviours such as striking, can be used by the disadvantaged party in a bargaining scenario to improve their situation.

Co-Constructing Professional Development: A Framework for Fostering Educators'

Professional Growth

Zachary Savelson, Carleton University

Room 2: RB2228

11:15- 11:30

Past research has found that professional development created for teachers is not as effective as it could be (Darling-Hammond et al., 2017; TNTP, 2015). To address this issue, a working group was formed in the spring of 2023. The goal of the group was to create a framework for how to co-construct professional development (PD) in education. This framework aims to provide guidance for the successful planning and implementing of PD. Drawing on the shared experience of its 12 interdisciplinary members (all of whom work within the broader field of education), the working group developed the framework through a process of co-construction. The main framework elements were initially identified by the group, and later confirmed through a review of the literature on fostering teacher change and high-quality teacher PD.

The framework is comprised of four essential components: 1) using an intentional teacher-centred design created using a multi-disciplinary approach, 2) fostering professional growth over time and in community, 3) grounding professional development in experiential learning and professional practice, and 4) inclusion of methods for measuring and monitoring professional growth to foster improvement and document successes. This presentation will describe each component and will discuss a potential method for implementing the framework in practice.

Other Authors: Alexandra Youmans, Zachary Hawes, Rebecca Merkle, Stephanie Gunning, Leanne Chisolm, Mikaila Collins, Cynthia Black, Lorraine Godden, Cameron Montgomery, Alison Tellos, & Kim Lacelle

Metacognitive Mechanisms of the Attentional Training Technique

Brendan Conway-Smith, Carleton University

Room 2: RB2228

11:30 -11:45

This paper articulates the cognitive mechanisms behind the Attentional Training Technique (ATT), a psychotherapeutic method effective in treating psychological disorders such as anxiety and depression. Despite ATT's recognized success, the cognitive and computational processes underlying it remain elusive. This study leverages the fMRI findings of Jahn et al. (2023) and a metacognitive skill model (Conway-Smith, West, & Mylopoulos, 2023) to demystify these mechanisms. We aim to clarify the components and stages of attentional training, offering a precise explanation of how it enhances attention control and emotional regulation. This explanation sheds light on the attentional mechanisms that improve the symptoms of specific disorders. Our findings contribute to a deeper understanding of metacognition's therapeutic benefits, presenting novel insights into the cognitive underpinnings of the Attentional Training Technique.

What's the Point of the Ground? Type Theory <3 Cognitive Model Semantics

Eilene Tomkins Flanagan, Carleton University

Room 2: RB2228

11:45 -12:00

Since Putnam (1988) closed the book on machine functionalism, not a great deal has been said about how much of an ontological crisis the cognitive models are in. While cognitive scientists have remained ambivalent about the meaning either *of* or *contained in* their models (notably Harnad, 1990 's challenge is discussed as a still-pending "problem" in want of a resolution), few seem particularly concerned about whether the whole endeavour has become pointless. Nevertheless, Putnam's challenge is extremely serious, and neither his solution, or the strong metaphysics of the alternatives are philosophically adequate. But, as scientists remain confident, in spite of lingering anxiety, that their work is not all for nothing, we should imagine that an adequate solution exists. I propose a distinct approach to recovering functionalism, arising from the practice of scientific measurement, and in so doing, I expose what we really mean when we call for "grounding".

Poster Session I

13:00-14:00



A Cross-National Study of Math Language Learning

Taeko Bourque, Carleton University

Poster Session 1, Poster 1

13:00-14:00

Students around the world are taught mathematics in many languages; often, the language of instruction is different from their home language. Does this language disparity influence children's mathematical learning? Immersion contexts provide a natural situation where the language of instruction (e.g., French, Irish) is separate from general language knowledge (e.g., English), allowing a clear test of this question. In the present research, we studied the relations between mathematical vocabulary and mathematical reasoning and arithmetic fluency for 7- to 9-year-olds from four groups: (1) children learning math in L1 (English) in Manitoba (n = 59), (2) children learning math in L1 (English) in Northern Ireland (n = 92), (3) children learning math in L2 (French-Immersion) in Manitoba (n = 88), and (4) children learning math in L2 (Irish-Immersion) in Northern Ireland (n = 64). We examined the concurrent and longitudinal relations between mathematical vocabulary and performance, controlling for domain-general skills (receptive vocabulary, working memory) and quantitative skills. Hierarchical multiple regression analyses indicated the importance of mathematics vocabulary, especially in immersion settings. Challenges in cross-country research collaborations are also discussed.

Other Authors: Chang Xu, Victoria Simms, Sheri-Lynn Skwarchuk, Helena Osana, Erin A. Maloney, Jo-Anne LeFevre, Judith Wylie

Measuring Preschoolers' Understanding of Number Words

Liza Kahwaji, Carleton University

Poster Session 1, Poster 2

13:00-14:00

One foundational skill that supports children's acquisition of advanced mathematics is cardinality, the understanding that the last number word in a counted set represents the number of items in the set. Researchers study cardinality using a range of tasks that measure number word knowledge. One measure is the Give-N task, where children create a set of items; another is the Point-to-X task, where children choose which item set corresponds to a number; a third is the How Many task, where children are asked to identify how many items they see in a set. Research has shown that success rates vary between measures, suggesting it is not clear how to assess cardinality. Because of this ambiguity a new measure, the sticker task, was constructed. In the sticker task, preschoolers are presented with a set of items, asked to re-create the set, and then asked to identify how many stickers are seen. Previous tasks only tested the ability to recognize or reproduce item sets; this novel task requires both. Directly comparing children's performance between all tasks, I expect tasks that require recognizing item sets will be easier than tasks requiring to produce item sets; I also expect the sticker task will reveal small developmental changes in number word knowledge. The results will add new insights into how number knowledge is acquired. Expanding and assessing different measures of cardinality will provide researchers with the best methods to investigate cardinality. This will have implications for supporting numerical development in the early years.

Other Authors: Rebecca Merkle, Jo-Anne LeFevre

Exploring the Relationship Between Rapid Automatized Naming Tasks and the Development of Reading and Numeracy Skills

Jenna Rice, Carleton University

Poster Session 1, Poster 3

13:00-14:00

Rapid Automatized Naming (RAN) tasks involve quickly naming serially presented visual stimuli and are linked to reading and numeracy proficiency. However, the extent to which variations of RAN tasks differently predict growth in these skills is unclear. This study examined the predictive power of two different RAN tasks on numeracy and reading development. Students ($N = 147$, $M_{\text{age}} = 7.8$ years) completed RAN tasks assessing non-symbolic quantity naming (RAN-Q) and letter naming (RAN-L) and cognitive assessments in grade 2. Their performance in arithmetic, number comparison, number line estimation, and reading was measured in grades 2 and 3. Both RAN tasks are assumed to measure students' efficient access to phonological representations. We assumed that RAN-Q also captures math-specific variance through efficient access to small quantities and RAN-L captures reading-specific variance through access to alphanumeric symbols. We hypothesized that RAN-Q would predict change in numeracy skills over one year, independent of RAN-L, and that RAN-L would predict change in reading, controlling for RAN-Q. Multiple regression analyses were conducted for each numeracy and reading outcome in grade 3, controlling for grade 2 outcomes and the non-domain-specific RAN measure. Results indicated that RAN-L predicted unique variance in grade 3 reading and RAN-Q predicted unique variance in grade 3 number comparison. RAN-Q and RAN-L predicted shared variance in the number line task. However, neither RAN measure independently predicted variance in arithmetic. These findings provide a nuanced view of the processes underlying quantity and letter RAN and their unique roles in children's numeracy and reading development.

Other Authors: Jo-Anne LeFevre, Erin Maloney, Helena Osana, Sheri-Lynn Skwarchuk

**Unlocking the Equation: Exploring the Impact of Early Numerical Competency in
Determining Future Mathematics Achievement**

Ayushi Chitranshi, Carleton University

Poster Session 1, Poster 4

13:00-14:00

As seen in the literature, mathematical competency and early numeracy skills are a good predictor of later mathematic achievement. Further research in this domain can support educators and practitioners determine the factors critical for early numeracy that can be used to create effective math instruction. An understanding of this multi-layered relationship between arithmetic achievement and early numeracy can have strong implications for educational practices and intervention design. Recent work in early math cognition has identified various numerical skills that correlate with differences in mathematical proficiency. In this poster we will explore the theoretical background investigating the relationship between arithmetic achievement and domain specific numerical skills including cardinality, that refers to the ability to represent the quantity of a set, ordinality, which is the ability of arrange numbers in a sequence, and number line knowledge, which refers to the ability to form a mental representation of a line on which each number corresponds to a position as per its magnitude. The poster will address the key findings from the literature, explore prominent research gaps and propose future directions aimed to identify early numerical competencies that uniquely contribute to later achievements in mathematics. Understanding the interplay between domain specific numerical skills and arithmetic proficiency holds implications for designing math curriculum and interventions that enhance mathematic learning outcome in early childhood.

Other Authors: Jo-Anne LeFevre, Heather Douglas, Rebecca Merkley, Shuyuan Yu

The Effect of Gender on the Efficacy of an Expressive Writing Intervention

Christen Potvin, Carleton University

Poster Session 1, Poster 5

13:00-14:00

Expressive writing (EW) interventions, tasks in which individuals write emotionally about a negative experience, have been successful in improving math performance and reducing cognitive intrusions (i.e. intrusive thoughts) experienced during math-related tasks. Cognitive intrusions have been found to affect men and women differently, and may be related to an individual's level of math anxiety. In the present study, we aimed to investigate the impact of EW on the frequency of cognitive intrusions with special consideration given to gender, an area of research that continues to be underrepresented. Based on existing research, we proposed four hypotheses: (H1) Those in the experimental condition will experience a reduction in intrusions reported pre- and post-intervention; (H2) Those who identify as women will experience a greater number of intrusions prior to EW; (H3) Those who identify as women will benefit more from the EW intervention than those identified as men; (H4) Math anxiety will mediate the relationship between gender and cognitive intrusions. We recruited 64 English-speaking undergraduate students (32 women) to complete a 45-minute online survey in which participants performed either an EW task (experimental), or trivial writing task (control). Participants also engaged in both a pre- and post-intervention math test, and were subsequently asked to report the frequency of intrusions experienced during each assessment. Results are forthcoming. Significant findings could better explain the connection between math anxiety, gender and intrusive thoughts. Likewise, this research may incentivize the use of EW tools in educational settings, thus improving student outcomes in mathematics.

Other Authors: Mia Gerber, Elora Wales, Erin Maloney

Do You Trust Me?

How Speech Rate and Filler Words Affect Credibility

Laura Burrell, Faith Chambers, Leah Marshall, Jenn Stranaghan, Grace Yee, Carleton University

Poster Session 1, Poster 6

13:00-14:00

This study explored whether the rate of speech and use of filler words in a statement's delivery affect how it is processed and in turn, how this affects how trustworthy we find the statement. 50 undergraduate students participated in the study. Each participant heard 100 audio stimuli and rated them for trustworthiness. Stimuli included fast and regularly spoken statements and statements with and without the use of filler words. We predicted that using filler words in speech would increase trustworthiness ratings due to added processing time. The findings did not support this; we found a significant decrease in trustworthiness ratings with the use of filler words. We also predicted that an increased speech rate would decrease the trust ratings due to increased processing difficulty. The findings did not support this; fast speech was rated as slightly more trustworthy than regular speech. There was a significant interaction between a fast speech rate and the inclusion of filler words. We predicted the rate of speech and inclusion of filler words would affect trust ratings negatively or positively; our results support this, with a significant interaction between speech rate and filler word usage on trustworthiness ratings. We found that filler words were tolerated better in faster speech than in slower speech. These findings can be used in the delivery of important messages, to give them more credibility.

**Bilinguals' Sentence Processing in the Presence of Auditory Distraction: Evidence from a
Self-paced Reading and Stroop Task**

Setareh Dorood, University of Ottawa

Poster Session 1, Poster 7

13:00-14:00

The aim of this study was to investigate the cognitive mechanisms bilinguals employ to suppress irrelevant auditory distraction. This study examined the facilitatory effect and inhibitory control of bilinguals to determine the relationship between executive functioning subcomponents and irrelevant auditory distraction inhibition. It also sought to determine if inhibiting L1 or L2 auditory distraction for bilinguals results in greater interference. Consequently, this study utilized the Stroop task and a self-paced reading task. The Stroop Task was implemented in three blocks: an English version, a French version, and a French-English bilingual version. Participants in the self-paced reading task were required to read French sentences word by word while irrelevant speech was presented in the background, once in French and once in English. French-English bilinguals were recruited. As these participants were French dominant it is hypothesized that French two-talker auditory distraction will cause a higher rate of interference compared to English two-talker auditory distraction. As participants are reading French sentences, French is the more activated language and causes more interference. Also, we hypothesized that bilinguals' inhibitory control in a domain general task is correlated with their ability in inhibiting auditory distraction and focusing on the sentences. Finally, exploring the relationship of processing time in the self-paced reading task in the presence of distracting speech, and Stroop task is promising in providing information how acquiring two languages would affect domain-general and domain-specific executive functioning.

Other Authors: Laura Sabourin

Individual Variation in French-L2 Spelling

Kenda Parsons, Carleton University

Poster Session 1, Poster 8

13:00-14:00

Canadian French Immersion programmes teach children and adolescents how to read and write in French as a second language with the goal to produce functional bilingual graduates. However, French Immersion students are not consistently attaining a level of French equivalent to native French speakers, as students' productive skills (e.g., writing) are typically fluent but not native-like by the time they graduate high school. However, little research examines these skills in late high school or recent graduates of French programmes. This study investigates the metalinguistic skills (specifically, morphological awareness and vocabulary) and literacy experiences (measured via reading frequency and print exposure tasks) that facilitate spelling ability in French. The proposed research specifies that frequent exposure to literacy in both English and French supports students' ability to parse and build words, thus building more precise and accurate orthographic representations. This is based on a model of statistical learning and the specificity of underlying representations. Data collection is currently ongoing with an expected sample of 91 participants between the ages of 16- to 25-years-old. Participants are either currently attending or have recently graduated from a form of official schooling in French (e.g., Core French, French Immersion). Participants will complete an online 30-45 minute survey with a range of literacy tasks and questions. Results will lend insight as to which literacy skills and practices should be emphasized in curricula across schooling and best support the acquisition of French literacy skills.

Other Authors: Monique Sénéchal

Why Do We Trust What We Hear?

Renad Al Farra, Naomi Brake, Tal Friedman, Stephane Tremblay, Danielle Vinson

Carleton University

Poster Session 1, Poster 9

13:00-14:00

This study investigated how perceptions of the trustworthiness of recorded statements may be influenced by two factors: the inclusion of filler words such as “um” or “uh” and different levels of audio quality. Data was collected from 49 Carleton University students tasked with providing truth ratings of 100 trivia statements on a 1-100 scale. Our study found that statements spoken without filler words were rated as significantly more true than statements spoken with filler words. Additionally, audio quality did not seem to affect truth ratings of trivia statements. Our results indicated that speakers who aim to be perceived as truthful should limit their use of filler words when speaking.

Examining Head-Driven Phrase Structure Grammar

Chester Leopold, Carleton University

Poster Session 1, Poster 10

13:00-14:00

The field of generative linguistics has undergone many changes during the past 60 years. The term, ‘generative linguistics’ captures a number of different theories that share certain assumptions about how the language faculty generates hierarchical phrase structures. Yet certain of these theories differ in important respects. This presentation examines one generative theory—Head-Driven Phrase Structure Grammar (HPSG). I will discuss some of the assumptions about the lexicon this theory makes. I will compare and contrast how the theory differs from Transformational Generative Grammar. I will also present some of my questions for the HPSG approach.

The Language of the Gettier Paradoxes

Katie Van Luven, Carleton University

Poster Session 1, Poster 11

13:00-14:00

Gettier (1963) is concerned with the proposal that knowledge is justified true belief (or true belief accompanied by a rational account), which was first formulated and rejected in Plato's *Theaetetus*. Gettier summarizes the proposal as follows:

- (1) S knows that P IFF
- a. P is true.
 - b. S believes that P.
 - c. S is justified in believing that P.

Gettier argues that (1) “is false in that the conditions stated therein do not constitute a sufficient condition for the truth of the proposition that S knows that P” (p.121). He presents two scenarios in which he claims that the conditions in (1) “are true for some proposition, though it is at the same time false that the person in question knows that proposition.” These cases have come to be known as Gettier paradoxes.

Gettier's cases do not, in fact, show that (1) is false. Putting the justification condition aside, we will argue that none of the Gettier cases constitute a true belief, and they are therefore irrelevant to the justified true belief analysis of knowledge. Gettier's examples rely on problematic linguistic analyses of the sentences under consideration. A careful examination of the semantics and pragmatics of the sentences he uses shows that they are compatible with multiple scenarios. In each of the two Gettier cases, the beliefs are attached to scenarios that are different from the actual scenarios. Either (1a) fails to hold, or (1b) fails to hold, or it would be more proper to describe Jones as having a justified false belief than a justified true belief.

Other Authors: Raj Singh, Ida Toivonen

The Effects of Language Modality on Embodied Cognition

Larkin Kitsemetry, Ruth Nobossi, Amanda Schmidt, Aahana Uppal, Carleton University

Poster Session 1, Poster 12

13:00-14:00

Research on embodied cognition suggests that embodiment is flexible and affected by several factors, including language proficiency and sentence structure differences. However, there is no published research on the effects of visual and auditory stimulation on embodied cognition in the same language task, even though evidence suggests that there is a difference in the embodiment of visual and spoken language. It is known that visual and auditory processing involve distinct mechanisms within the brain, and that the speed of reading is slower than the speed of hearing speech. Additionally, evidence of an interaction between linguistic processing and sensory simulation contributes to our understanding of embodied cognition, however there is limited research that explores this in depth. In the present study, we aim to explore the effect of language modality on embodied cognition by comparing visual language processing to auditory language processing. We will do so by using a sentence-picture verification (SPV) task to compare reaction times of participants when presented with visual and auditory sentences. A two-way between-subjects ANOVA will allow us to analyze the interaction effects of language modality on reaction time and the effects of match and mismatch conditions on reaction time. Our results, combined with demographic information we collect to account for possible confounding variables, will be analyzed to evaluate the significance of language modality on embodied cognition.

Poster Session II

14:00-15:00



Causal Selection Tasks in ACT-R

Spencer Eckler, Carleton University

Poster Session 2, Poster 13

14:00-15:00

Peter Wason (1968) developed a card selection task to test logical reasoning. His results demonstrated the difficulty participants have solving puzzles that require contrapositive inference, evidencing a confirmation bias. Cosmides and Toobey (1992) presented alternative versions of the Wason Card Selection Task that relied on social context. They demonstrated how participants could solve puzzles that relied on contrapositive inference when those puzzles relied on social context. They suggested this was due to cognitive resources exclusively unique to social situations, as outlined in social exchange theory. Nonetheless, all their Wason Task alternatives can be solved using another kind of reasoning that would still struggle with the original Wason Task version: causal reasoning. I propose that Cosmides and Toobey's alternative tasks rely on causal reasoning, while the original Wason Card Selection Task does not; this difference explains their findings, without claiming some additional social resource is necessary. This is not to say that inferences using social information are not important, but rather that causal reasoning is both necessary and sufficient for these tasks and explains the inconsistency of contra- positive inference use among participants. To demonstrate this, several models will be built in the ACT-R cognitive architecture using only causal knowledge. Social knowledge about cheating behaviour and external agents will not be included. We expect the agent in each of these models to solve each task in a manner similar to that of the participants of each study, while also making the same inference errors.

Other Authors: Robert West, Mary Alexandria Kelly

Identifying At-Risk Drivers with Sensor-Based Methods

Tal Friedman, Carleton University

Poster Session 2, Poster 14

14:00-15:00

There are many issues with current testing procedures for aging drivers. One immediate problem is the lack of objective measures in testing protocols. Without accurate methods for determining driver risk, older drivers may not accurately assess their driving ability, putting themselves and others at risk on the road. Using vehicle sensor data to objectively measure driving ability on an ongoing basis would allow for significant improvements in risk assessment and facilitate the difficult decision making that currently surrounds driving retirement. To progress towards a more robust risk detection system, I will create risk prediction models to identify drivers using vehicle sensor data alone. These algorithms will identify individual driving profiles, based on key variables like reaction time and speed control. Furthermore, the models will classify drivers by age, a risk factor which is highly related to both cognitive decline and driving ability. Microsoft Azure will be used to create the machine learning pipelines and to train and test a variety of multi-class algorithms. Data gathered from an age-friendly driving simulation environment will be used to construct the algorithms which will then be validated using real-world data from a closed-course testing track. I expect the algorithms to classify specific individuals and age groups accurately, at a rate significantly above chance. Particular attention will be paid to model sensitivity and specificity to ensure overall accuracy. The ability to classify drivers based solely on objective performance has proven to be a challenge, and represents significant progress in the field of aging driver assessment.

Other Authors: Chris Herdman, Kathleen Van Benthem

Optimizing Encoder Selection and Implementation for Enhanced Retrieval-Augmented Generation Performance in Natural Language Processing Tasks

Samer Al Assafin, Carleton University

Poster Session 2, Poster 15

14:00-15:00

This research introduces a novel methodology for optimizing the encoding process in Natural Language Processing (NLP) tasks, with a particular emphasis on retrieval-augmented generation (RAG). The goal is to boost performance by meticulously selecting and implementing the encoder that best fits the unique needs of RAG tasks. Traditional encoder selection methods, often based on heuristic evaluation or trial and error, do not guarantee optimal outcomes. This proposed approach evaluates encoders against specific criteria crucial for RAG, such as semantic accuracy, context retention, and large dataset processing efficiency.

An extensive experimental setup assesses various encoders' performance on RAG benchmark tasks, employing metrics like accuracy, computational speed, and resource utilization. The study aims to provide insights into encoder selection strategies, offering potential applications across a wider range of NLP tasks and leading to advancements in machine learning model efficiency and effectiveness. By underscoring the importance of a strategic approach to encoder selection, this research paves the way for substantial improvements in NLP task performance, contributing to the development of more sophisticated and efficient machine learning solutions.

Imagine a Room:

Procedural Generation of 3D Indoor Scenes as Depiction of Human Visual Imagination

Isil Sanusoglu, Carleton University

Poster Session 2, Poster 16

14:00-15:00

How do humans create scenes when they are imagining? Although there are some artificial intelligence applications that create images and scenes from natural language descriptions, they lack many aspects of human imagination, such as belief system and common sense. With the improvements in SOILIE 3D, I tried to create an “imagination engine” that learns from the real life RGB-D (Red, Green, Blue, and Depth) datasets to create psychologically plausible 3D scenes using Blender. While previous versions of the code are intended to work on only one dataset, I implemented another dataset to the code and altered the code to be compatible with most 3D RGB-D datasets. The dataset I worked with includes tabletop scenes that will allow SOILIE 3D model to learn the placement of objects on top of another in a psychologically plausible way and includes cognitive constraints to rotation, weight, vividness, and item limit. It is expected now that SOILIE 3D will create scenes that are more similar to actual human imagination.

Evaluating the Utility of Notional Machine Representations to Help Novices

Learn to Code Trace

Veronica Chiarelli, Carleton University

Poster Session 2, Poster 17

14:00-15:00

Code tracing involves simulating at a high level the actions the computer takes when executing a program. Given that students experience difficulties learning this fundamental skill, research is needed on how to effectively teach it. We report on two studies that investigate the pedagogical utility of various notional machine representations used to explain the mechanics of program execution. In study 1 ($N = 44$), we compared instruction using a concrete computer representation to an abstract table representation. In study 2 ($N = 50$), we tested if fading between representations improved learning over only providing one representation. The instruction in both studies was embedded in basic tutoring systems we implemented that served as testbeds for the present research. On average students did learn in each study, as evidenced by pretest to posttest gains, but the type of representation did not significantly affect learning; Bayesian statistics provided substantial evidence for this null result. We discuss potential explanations for our findings and suggest future research directions. This work was recently presented at the 2023 ACM Conference on International Computing Education Research.

Other Authors: Nadia Markova

Student Annotations of ChatGPT Output for Programming Code-Traces

Abbey Gandhi, Carleton University

Poster Session 2, Poster 18

14:00-15:00

ChatGPT and other Large Language Models (LLMs) can be powerful tools for students learning to program. However, ChatGPT's output can often be missing important concepts or may contain errors. Furthermore, there is limited research on how students learn from ChatGPT and, by extension, whether there are pedagogical strategies that help to promote its use as a learning aid. To begin filling this gap, we developed a qualitative study of student annotations on ChatGPT output in the context of learning to program. Grounded in previous work on student self-explanation of worked examples and spatial strategy use during notetaking, we developed an in-situ classroom worksheet activity which prompted students to annotate and explain, in the format of their choice, all elements of a given ChatGPT output of a code tracing problem. Two coding schemes were then applied to the student worksheets: a novel coding scheme developed to determine to what extent students construct meaning by filling in the missing information of ChatGPT outputs, and another which categorized student spatial strategy use (such as words, lists, or flowcharts) in their annotations. Student annotation construction scores and spatial strategy use types were then correlated with learning. Descriptive statistics and preliminary results for this study will be discussed.

Other Authors: Kasia Muldner

ChatGPT and Human Morality:

Exploring the Dynamics of Individual and Group-Based Actions

Martha Roblin & David Stavin, Carleton University

Poster Session 2, Poster 19

14:00-15:00

Previous research on large language models (LLMs) has demonstrated that LLMs exhibit reasoning abilities akin to those of humans. However, the domain of moral reasoning in LLMs remains largely unexplored. This study aims to compare moral reasoning between humans and ChatGPT, specifically examining potential differences in reasoning about individual actions versus group actions. Additionally, it investigates whether the dominant moral belief systems of human participants (e.g., deontology, consequentialism, virtue ethics) influence their moral judgments concerning individual versus group actions. A total of 146 Carleton University students completed the Preference for Precepts Implied in Moral Theory Questionnaire and were randomly assigned to evaluate the morality of actions in ten individual-action scenarios or ten corresponding group-action scenarios. The same scenarios about individual and group action were used with OpenAI's ChatGPT-4 language model, with default settings, to generate 100 ChatGPT datapoints. A 2 x 2 between-subjects ANOVA was performed to determine differences in moral judgement between humans and ChatGPT when reasoning about individual versus group action and a 3 x 2 between-subjects ANOVA was performed to determine whether differences in human judgement about individual action versus group action depend on the dominant moral belief system. The findings are discussed in the context of the practical significance of recognizing biases in moral reasoning within artificial systems and the potential for artificial intelligence to substitute humans in context-sensitive settings, such as court juries.

Enhancing Programming Education: Investigating Learning Gains and Student Engagement with Artificial Intelligence and Traditional Materials

Marie Blais, Carleton University

Poster Session 2, Poster 20

14:00-15:00

To investigate the potential impact of large language models on student learning of introductory programming, we conducted an experimental study testing traditional instructional materials and the Chat GPT platform. The target domain was programming activities, namely code tracing. Code tracing involves reading a code and predicting how the program runs. This also includes inferring the output of the result. In this study, novice programmers were tasked to generate code traces of Python programs with access to either ChatGPT or traditional instructional materials that corresponded to an interactive web page that includes the material covered in the instructional video from the beginning. All participants received immediate feedback on their responses to the exercises. Learning was measured by pretest to posttest gains. We hope to find a statistically difference between the learning group that used ChatGPT and traditional materials. ChatGPT is a tool used in a variety of diverse ways, especially by students, and we hope to discover whether that usage helps or hinders their learning process. Our research contributes valuable insights into effective pedagogical strategies for introductory programming education and underscores the transformative potential of AI in shaping the future of learning.

Other Authors: Kasia Muldner

Dimensionality of Distress

Josh Goheen, Carleton University

Poster Session 2, Poster 21

14:00-15:00

Background: Distress is universal; however, symptoms vary greatly. An understanding of latent factors in questionnaires that measure distress may be useful for further understanding distress symptomatology.

Methods: Confirmatory factor analysis (CFA) based on (Schouten et al. 2020) was employed in a diverse sample of 120 individuals to assess the fit of our data with two bifactor solutions of “general distress”. Model1 assessed whether data supported two factors: anxiety, and depression. Model2 measured general distress split into somatic and cognitive factors. Distress was measured using the Beck Anxiety and Depression Inventories (BAI|BDI). Somatic and cognitive distress were measured using both questionnaires.

Results: Confirmatory factor analysis did not support a good fit of our data to a model of distress measured by somatic and cognitive subdimensions measured by the BAI and BDI (CFI = 0.661, RMSEA = 0.09). The model performed slightly better when distress was measured on dimensions of anxiety and depression (CFI = 0.710, RMSEA = 0.09). A follow-up exploratory factor analysis was performed due to these poor fits, revealing 9 latent factors in our data, capturing 59% of the total variance. The first latent factor explained 33% of the variance and comprised BDI questions.

Conclusions: Our findings indicate that individuals experience and display signs of distress in highly varied ways. This variety may be more significant than what current theoretical models suggest. Our findings suggest an underlying latent factor of depression potentially drives interindividual differences in distress as measured by dimensions of the BAI and BDI.

Other Authors: Cameron Carson, Angelika Wolman, Rabeaa Khan, Reem Ali, John A. E. Anderson, Georg Northoff

**Preserved Retrieval of Episodic Memory Sequences
Post-Chemotherapy in Women with Breast Cancer**

Defne Oksit, University of Ottawa

Poster Session 2, Poster 22

14:00-15:00

The retrieval of episodic memory sequences, a hippocampus-dependent cognitive process, enables the chronological recall of precise past events. Nevertheless, the neurotoxic effects of chemotherapy, a prevalent breast cancer (BC) treatment, on the hippocampus may contribute to observed long-term memory impairments in cancer survivors. This side effect is known as chemotherapy-induced cognitive impairment. The current study investigates the effects of chemotherapy on the retrieval of episodic memory sequences in women treated for BC. A visual episodic memory task was used to analyze the retrieval sequence of central details from episodic memories. Women aged 30 to 65, including 15 BC survivors at least 6 months post-chemotherapy and 22 without a BC history were recruited. They visually encoded 40 film clips of everyday events, mentally retrieving half of the clips immediately, and the other half 7 days later. The results suggest no significant group effect on sequential episodic memory retrieval during both sessions ($p=.452$). Yet, a significant time-dependent decrease was observed in the sequential retrieval of central details in all participants after 7 days ($p<.001$). This suggests that chemotherapy might not significantly impact the structure related to temporal sequences, including time-dependent forgetting in episodic memory. Identifying memory aspects less affected by chemotherapy may guide healthcare professionals customize interventions aimed at preserving cognitive function in this specific population.

Other Authors: Meenakshie-Bradley Garcia, Chloé Cateux, Hamed Neveu Karimpour, Annick Tanguay, Melanie Sekeres

Decoding the Dual-Coding:

An EEG Study on the Neural Pathways of Language and Mental Imagery

Masih Zaamari & Grace Yee, Carleton University

Poster Session 2, Poster 23

14:00-15:00

Language and mental imagery are fundamental cognitive processes that shape our understanding of the world. Their relationship, however, has been a subject of debate, with theories such as Paivio's dual-coding theory suggesting they could be either deeply interconnected or distinct. This study delves into this complex relationship. We employed EEG decoding to scrutinize the brain's reactions during the creation of language and mental images. Our hypotheses were twofold: (1) successful decoding of words from mental images would indicate separate neural pathways for these processes, and (2) the decoding timeline would expose their convergence. We used four stimuli: images and words of a "car" and a "cat". Participants were conditioned to link a beep with a stimulus. In the EEG session, participants either generated mental images or silently verbalized words in response to the beep across two distinct trial blocks. Each trial's outcome was assessed by verifying the image or word produced by the participants. To analyze the data, we employed advanced machine learning algorithms to decode the EEG signals. These algorithms were trained to recognize patterns in the EEG data that corresponded to the generation of language and mental images. The decoding accuracy served as a measure of the distinctness of the neural pathways for these two processes. Furthermore, we analyzed the time-course of the decoding process to identify any points of convergence between the two processes, which would suggest an interaction between language and mental imagery. Our discoveries could shed light on the cognitive and neural foundations of language and mental imagery, potentially enriching cognitive theories and contributing to the creation of interventions for cognitive disorders.

Other Authors: Olessia Jouravlev

**Functionally Localizing Language-Sensitive Electrodes
in Individual Participants with EEG/ERPs**

Nayna Kirubakar, Carleton University

Poster Session 2, Poster 24

14:00-15:00

Traditionally, in EEG studies for identifying functional brain areas, researchers have averaged the activity of the same electrode across multiple individuals. This method assumes that the electrodes have a similar position and are measuring activation from similar brain regions across all participants. However, although human brains are broadly similar in their functional organization, there are significant individual variations in skull shapes, underlying brain anatomy and brain function. Because the traditional method does not account for individual differences, it introduces noise into the data. To account for this, researchers have more recently used the method of functional localization, in which the regions involved in a particular cognitive function for a particular individual are identified using a localizer task. Localizer tasks help researchers identify a region of interest (ROI) which typically shows more activation than other regions of the brain for a particular task. Then, the activity within these specific ROIs is observed while participants complete other relevant tasks. In the current study, participants completed a localizer task where they were presented with lists of words, non-words, sentences, and jaberwocky sentences to isolate electrodes that showed most activation. Then they completed syntactic and semantic processing tasks while their brain activity was collected with EEG. Pilot data from 12 participants was analysed to see if there was a difference in when activity of language sensitive electrodes was measured for relevant tasks as compared to when the data was analyzed by averaging over the same electrode for every participant. The findings and their implications for EEG research on language processing are discussed.

Keynote Address

Room 1: RB2220 & RB2224

15:00-16:30

Cognitive Science Past (at Carleton) and Future (A Unified Theory of Cognition?)

Andrew Brook

Chancellor's Professor of Cognitive Science and Philosophy Emeritus.

This talk will have two parts. In the first, I will sketch the remarkable history of cognitive science at Carleton, reviewing its progress from one faculty member (Brook) to having the second-largest number of majors in FASS. In the second, I will make some fairly inconclusive and puzzled remarks about the idea that cognitive science needs a grand unified theory of cognition, that it needs its own Newton -- or Chomsky. I find myself not sure any longer what this claim even means.

Andrew Brook chaired the founding cognitive science committee at Carleton from its creation in 1991 and directed the programme for its first fifteen years. Among other things, he has been President of both the Canadian Philosophical Association and the Canadian Psychoanalytic Society, the only person ever to have been president of both. He has about 130 publications in philosophy and cognitive science, consciousness, Kant, Freud, philosophy of mind, and environmental ethics.