Carleton University Cognitive Science Student Conference 2025

Abstract Booklet

Thursday, April 10, 2025

Nicol Building, Carleton University

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WiCSC+ Trainee Pre-Conference Workshop
Networking 101: Build Connections with Confidence
NI 4020

11:00-1145

Panellists: Fraulein Retanal[1], Taeko Bourque[2], Vanessa Cunha[1], Liza Kahwaji[2]

1. University of Ottawa, 2. Carleton University

Ever wondered how to make meaningful connections in your field?

Our WICSC+ trainee panelists will break down what networking really is and share their top tips for making lasting professional relationships. Don't miss out on this opportunity to learn, connect, and grow!

Talks Session 1

NI 4010

12:00-13:30

Mapping the Mind with Light: Can fNIRS Support Functional Localization?

Akshaya Kirithy Baskar, Carleton University

Room No: NI 4010

12:00 – 12:15

Although the language system is primarily left-lateralized in the frontotemporal cortices, it exhibits high interindividual variability. Most neurolinguistic research has focused on commonalities in language representations due to traditional fMRI/fNIRS analysis methods. This study aimed to (1) examine neurocognitive mechanisms underlying individual differences in language processing and (2) explore the link between depressive symptom load and activation within the language network using functional near-infrared spectroscopy (fNIRS).

Eighty native English speakers completed two trial blocks of listening to intact and degraded speech while their brain responses were recorded via fNIRS. The data from the first block of trials was used to identify the language network in each individual. To this end, we identified channels that showed the greatest sensitivity to the contrast intact speech > degraded speech. These channels constituted a language network that was functionally defined in each individual.

Next, using data from the second block, we retrieved magnitudes of oxy-HbOs/deoxy-HbO2 in response to the experimental conditions. This allowed us to characterize the extent of activation of the language network in each individual. Finally, to establish brain-behavior links, we related individual magnitudes of oxy-HbOs/deoxy-HbR to individuals' depressive symptom load as measured by Beck Depression Index (BDI). The results revealed differences in the architecture of the language network associated with depressive symptom load. To our knowledge, this study is the first one to demonstrate that depression has effect not only on linguistic behaviour but also on neural responses underlying this behavior.

Other Authors: Amanda Catherine Schmidt, Olessia Jouravlev

Does one-size fit all? A Profile Analysis

Ayushi Chitranshi, Carleton University

Room No: NI 4010

12:15 – 12:30

Early numeracy skills are critical for students' later mathematics achievement. Although children are often broadly categorized as either strong or weak in math, weaknesses or strengths in specific mathematical skills can develop independently of difficulties in other domains of early math learning. For instance, a student may excel in arithmetic but face challenges with tasks involving spatial reasoning. I will use latent profile analysis (LPA) to examine the heterogeneity in the domain-specific math skill development patterns of students in the beginning of elementary school, when the students have not received much structured instruction in mathematics. A second goal is to explore how the profile membership is associated with mathematics performance when same students are assessed a year later. The dataset includes 1075 Grade 1 students from Alberta (Mage = 6.3 years) who completed the Provincial Numeracy Screening Assessment (PNSA) in Fall of 2021 and again in the Fall of 2022. Measures included in the PNSA test are counting (i.e., highest verbal count and counting dots), number naming, number writing, number comparison, number line estimation, number ordering, and number facts (addition/subtraction) tasks. Understanding the variability in the developmental trajectory of mathematical skills of students will support the creation of better targeted math curricula and interventions for students' mathematical learning in early childhood.

Design Considerations for Intelligent Tutoring System Construction: Counterfactual Explanation through Cognitive Modelling & Impasse-Driven Learning

Danielle Vinson & Spencer Eckler, Carleton University

Room No: NI 4010

12:30 – 12:35

Causal knowledge is fundamental to learning and instruction. When a student learns, they consolidate causal knowledge about the subject; the student has learned "why" something is the way it is or why an action is taken. Teachers support causal learning by providing causal explanations. Such explanations do more than instruct the student on the correct information or procedure. They also inform the student of why that information or procedure is correct by explicating what information or procedure is wrong. This identification of erroneous counterfactual procedures can allow a student to make the correct inferences necessary to achieve some learning outcome. Currently, this feature of learning is largely unexplored in Intelligent Tutoring Systems. We propose a novel extension of the four-component architecture paradigm that accounts for counterfactual causal explanations by unifying impasse-driven learning, model tracing, constraint based modelling, and counterfactual causation.

Other Authors: Spencer Eckler, Margaret H. McKay, Mary Alexandria Kelly

Metacognition as a Domain of Skill

Brendan Conway-Smith, Carleton University

Room No: NI 4010

12:35 – 12:50

This research advances the understanding of metacognitive skill by positioning it as a distinct domain of expertise, analogous to motor and cognitive skill domains. Drawing from frameworks in skill acquisition and dual-process theories of metacognition, it highlights shared principles such as goal-directed action, hierarchical organization, and the interaction between declarative and procedural knowledge. This research outlines how metacognitive skill develops from deliberate, instruction-based actions to automatic, proceduralized responses, emphasizing its gradability in terms of success rates, goal breadth, and adaptability. Additionally, it explores metacognitive subdomains, including attentional control and emotional regulation, demonstrating their alignment with broader skill principles. Through a synthesis of theoretical and empirical research, this work articulates how metacognitive knowledge structures, such as metarepresentations and internal models, guide action selection and control. This framework clarifies the unique characteristics of metacognitive skill and its potential for improvement through targeted training, offering implications for education, therapy, and self-regulation practices. By establishing metacognition as a structured skill domain, this research contributes to a unified theory of metacognition and informs future studies on skill acquisition and cognitive self-regulation.

Ludwig Wittgenstein's Influence on Eleanor Rosch's Categorization Research

Stephane Tremblay, Carleton University

Room No: NI 4010

12:50 – 12:55

During the 1970s, Eleanor Rosch conducted a series of studies which revolutionised the study of categorization. Throughout her career, Rosch had a variety of intellectual influences, including the later philosophical writings of Ludwig Wittgenstein. As it was Wittgenstein who primarily influenced Rosch's work on categorization, the current research aims to analyze how Wittgenstein's philosophy influenced this area of Rosch's research. I explore Wittgenstein's influence on Rosch through discussions of two major topics: the first of these discussions considers Rosch and Wittgenstein's respective views on the structure of concepts and the second involves their respective views on the relationship between language and the world. Following these discussions, I consider how the current research might motivate further investigations into the philosophical influences of Rosch's later work on embodiment, Wittgenstein's continuing relevance to the field of categorization, and Wittgenstein's perspective on the methods of psychology.

Do You 'Give Up' or 'Surrender'? Exploring Phrasal Verb Preferences in Turkish, French, and German Speakers

Lara Russo, Elif Once Buyukerol, Carleton University

Room No: NI 4010

12:55 – 13:00

Phrasal verbs (PVs), once overlooked in linguistic research, have increasingly attracted scholarly attention due to their distinctive semantic and syntactic properties (Wood, 2015). A comprehensive understanding of these properties, along with mastery of high-frequency PVs, is widely recognized as crucial for achieving proficient language use. This highlights the need for research assessing L2 learners' knowledge and usage patterns of these complex lexical items.

This study investigates the preferences of speakers of non-Germanic languages (Turkish and French) and a Germanic language (German) in comparison to native English speakers regarding the use of PVs versus their single-verb equivalents in English. Specifically, our study aims to examine: (1) the extent to which Turkish, French, and German speakers underuse PVs compared to native English speakers; (2) whether Turkish and French speakers exhibit a preference for single-verb equivalents over PVs; (3) how semantic properties (figurative vs. literal) influence the avoidance of PVs among Turkish, French, and German speakers, in contrast to native English speakers; and (4) whether the frequency of PVs and the extent of natural exposure to English impact speakers' preferences in their usage.

To investigate these questions, we are developing a forced-choice fill-in-the-blank questionnaire in which participants will intuitively select either a PV or a single verb to complete given sentences. The PVs included in the questionnaire are drawn from the PhaVE list (Garnier & Schmitt, 2015). While the study is ongoing, we aim to contribute to the growing body of research on PV acquisition, an area that remains relatively underexplored in second language acquisition studies.

References:

Wood, D. (2015). Fundamentals of formulaic language: An introduction. London: Bloomsbury Academic.

Garnier, M., & Schmitt, N. (2015). The PHaVE List: A pedagogical list of phrasal verbs and their most requent meaning senses. Language Teaching Research, 19(6), 645–666. https://doi.org/10.1177/1362168814559798

Comparing the Influence of Various Emotional States on Learning in a Productive Failure and Comparing the Influence of Various Emotional States on Learning in a Productive Failure and Direct Instruction Setting

Zachary Savelson, Carleton University

Room No: NI 4010

13:00 – 13:15

Decades of work in educational psychology have shown that across paradigms, ages, and subjects, students' emotional states influence their learning outcomes. Accounting for this effect becomes more relevant in a paradigm such as Productive Failure (PF), where the typical order of instruction (e.g., lessonà practice) is reversed, so that students are put into a situation where they are intentionally met with a problem they cannot solve. While intuition would suggest that this failure would be met with an overwhelming sense of frustration and hopelessness, that is in fact not the case. These emotions do exist, but there is also evidence of some positively valenced emotion, as well as a diverse range of other emotions. Despite there being evidence of these emotions in Productive Failure settings, a rigorous comparison of the emotions elicited by Productive Failure and Direct Instruction (DI), as well as their effects on learning outcomes, has yet to be done. My work seeks to fill this gap.

In this presentation, I will discuss the methodology used to measure students' emotions at critical stages of the learning intervention (in both PF and DI) and preliminary results of my analysis concerning what emotions were elicited by each intervention, how they changed over time, and finally, if/how they influenced students' learning outcomes.

Talks Session 2

NI 4020

12:00-13:30

Psychopathology Reflected in Language Use: Schizotypy Across Language Background Profiles and Linguistic Domains

Arthur Hamilton, Carleton University

Room No: NI 4020

12:00 – 12:15

Various forms of psychopathology have language-related symptoms or are associated with linguistic deficits. In the case of schizophrenia (SZ), diagnostic symptoms include hallucinations (which are usually verbal) and disorganized speech; furthermore, SZ is associated with a range of linguistic deficits. Small literature explores how the use of a native language (L1) vs. acquired language (L2) impacts presentation of both diagnostic symptoms of SZ and language use in SZ. However, differences may not only be based on the languages' order of acquisition (L1 vs. L2), but other features such as age of acquisition, level of current usage, etc. Considering these features may help illuminate how SZ traits present in multilinguals' different languages. The present study specifically considers how the different aspects of individuals' language background profiles relate to linguistic domains known to be impaired in SZ. To facilitate a large sample, the participants were drawn from the general population and completed a questionnaire on subclinical SZ-like traits, known as schizotypy. They were multilinguals who speak both English and French, as well as a small English-speaking monolingual control group. They also provided information on their languages' order of acquisition, age of acquisition, context of acquisition, current usage, and self-rated proficiency. Findings on which of these variables best capture the relation between schizotypy and differences between English and French performance on the tasks are presented, after which possible implications for the study of schizophrenia and psychopathology are discussed.

Other Authors: Synthia Guimond, Olessia Jouravlev

Distinguishing Effect from Scan Quality: A Neuroimaging Evaluation

Veronica Cramm, Carleton University

Room No: NI 4020

12:15 – 12:30

Imagine you go to take a picture on your phone. While you hit the button, you move slightly, and now your picture is a little fuzzy. The same thing occurs when an individual moves during magnetic resonance imaging (MRI) acquisition. Movement during scanning makes it difficult to distinguish between the different tissues in the brain (grey or white matter). The current standard to navigate this issue relies on exclusion of scans that do not meet an arbitrary visual quality threshold, set at the discretion of the researcher. Unfortunately, children, elderly, and clinical populations are shown to move more during image acquisition, resulting in a larger proportion of these individuals removed from research. This not only causes a systematic bias in the literature, but also makes research findings less generalizable. Furthermore, the artifacts caused by motion are demonstrated to continue to confound data, even after visual quality control has occurred. We aimed to balance scan quality and movement between control and patient groups to control for motion as a confound. To achieve this, we used a post-scanning statistical technique called propensity score matching that matches control and patient populations on scan quality metrics, leading to a more comparable dataset, greater inclusion, and more reliable, generalizable results.

Other Authors: John Anderson

Accommodation is unremarkable

Landon Chenglin Liu, Carleton University

Room No: NI 4020

12:30 – 12:35

The conditional variant of the proviso problem asks what is presupposed and/or accommodated when an presupposition trigger is contained in the antecedent of a conditional (i.e. a sentence of the form A → B[X], where X must be assumed for B to have a denotation.) Sometimes, the semantic presupposition (e.g. as predicted by satisfaction theories) is accommodated; for example, given the assertion (1) "If John flies to Toronto, then he will print his plane ticket", we accommodate "If John flies to Toronto, then he has a plane ticket" (Beaver, 2001; Heim, 2002). However, sometimes the semantic presupposition is strengthened for accommodation; for example, given the assertion (2) "If John flies to Toronto, his sister will pick him up", we accommodate "John has a sister" instead of "If John flies to Toronto, he has a sister". Following (Heim, 2006; Singh, 2007), we propose principles that predict what is accommodated: we propose that presuppositions must be both consistent with the context, and justified in that they can be inferred through a minimal revision on available information present in the antecedent. We propose a conditional's A → B[X] semantic presupposition A → X candidate must satisfy the Ramsey test as defined by Levi (1988) to be justified. If a conditional semantic presupposition is both consistent and passes the Ramsey test (i.e. justified), then it is unremarkable (von Fintel, 2004) and accommodated.

Adaptive Technologies for Aging Populations

Nicolas V. Turcas , Carleton University

Room No: NI 4020

12:35 – 12:50

Adaptive Instructional Systems (AIS) are advanced platforms that leverage technology to personalize learning experiences by dynamically adjusting instructional content, pacing, and feedback to meet the diverse needs of learners. Cognitive aging is characterized by changes in cognition, such as memory, attention, and processing speed, presenting unique challenges for instructional design. Using the Common Model of Cognition (CMC) and Sociotechnical-GOMS (SGOMS) to model how these changes impact tasks, AIS can be tailored to address the needs of aging learners and promote accessibility, inclusivity, engagement, and lifelong learning opportunities. At the micro-adaptive level, this type of model can enable AIS to deliver real-time, task specific interventions. In contrast, at the macro-adaptive level, they support long-term learning through lesson design and simulation. These capabilities ensure that AIS remain effective across varied contexts and learner populations.

Other Authors: John Anderson, Robe West

Embodied Cognition: Effects of Visual Imagery Ability and Reduced Emotional Resonance in L2 on Pupillary Light Response

Dalia Serik, Carleton University

Room No: NI 4020

12:50 – 13:05

Theories of embodied language comprehension propose that during semantic word processing, the sensorimotor system is activated, generating related sensory representations and priming the corresponding motor response. Reading and hearing words associated with brightness or darkness, such as "day" or "night," has been shown to cause pupil constriction and dilation respectively (Mathôt et al., 2017; Mathôt et al., 2019).

This phenomenon, known as the semantic Pupillary Light Response (PLR), is thought to arise from the activation of visual mental imagery during the processing of word meaning. Although the PLR has been demonstrated to reflect the sensory intensity of visual mental imagery during cued visual stimuli visualization (Kay et al., 2022), the phenomenon has never been tested during semantic processing of luminance-evoking words. Additionally, stronger PLR has been shown to high versus low-arousing words (e.g., attack vs. asleep) in participants' first (L1) rather than second (L2) language (Toivo & Scheeper, 2019). The goal of our study is to extend understanding of whether the Pupillary Light Response during semantic processing of lightness and darkness associated words is reflective of visual mental imagery ability and whether it is modulated by the reduced emotional resonance in L2. These extensions to previous pupillometry studies, will serve to provide further support for the significance of the theory of embodied cognition in language processing.

Other Authors: Veronica Chiarelli, Olessia Jouravlev

Beyond the Literal: How Autism Shapes Pragmatic Language Understanding

Fatemeh Maleki, Carleton University

Room No: NI 4020

13:05 – 13:10

Introduction: Pragmatic language understanding extends beyond literal meanings, relying on social norms, context, and Theory of Mind (ToM). Individuals with autism spectrum disorder (ASD) often face challenges in grasping implied meaning, adhering to conversational norms, and making pragmatic inferences. However, whether these difficulties reflect a broad deficit, or selective challenges remains debated. Recent research suggests pragmatic reasoning is composed of distinct components, including social conventions, intonation processing, and causal reasoning. This study investigates which aspects of pragmatic reasoning present the greatest difficulties for autistic individuals.

Method: To explore this, 21 autistic and 386 neurotypical adults completed three tasks assessing different pragmatic abilities: adherence to conversational maxims, interpretation of contrastive prosody, and causal inference. Participants also completed assessments of verbal and non-verbal intelligence, vocabulary knowledge, and psychiatric traits. A non-parametric permutation test was applied to assess pragmatic impairments while accounting for cognitive and linguistic abilities.

Results and Conclusions: Findings indicate that pragmatic impairments in ASD are specific rather than universal. Autistic participants performed comparably to neurotypical individuals on rule-based tasks like causal reasoning and contrastive prosody. However, significant difficulties arose in the conversational maxims task, which relies on social conventions. These results support the cognitive style hypothesis, which suggests autistic individuals favor explicit, rule based reasoning over implicit, socially driven processes. Identifying these selective impairments has important implications for improving clinical assessments and tailoring interventions for individuals with ASD.

Other Authors: Olessia Jouravlev

Neurocognitive Simulation of System Segregation: How Neural Population & Specificity Reductions Lead to Dedifferentiation

Spencer Eckler & Nicolas V. Turcas, Carleton University

Room No: NI 4020

13:10 – 13:25

Neural specificity is the ability to differentiate multiple representations in a neural population such that individual neurons provide some constituent feature of those representations (Park, Carp, Hebrank, Park, & Polk, 2010; Kleemeyer et al., 2017). Two different theories of neural specificity have been developed to explain interregional brain differences that trend with performance loss: neural dedifferentiation (Koen, Hauck, & Rugg, 2019) and system segregation (Chan, Park, Savalia, Petersen, & Wig, 2014; Wig, 2017). Although both estimates demonstrate a significant trend with performance, neither adequately explains the mechanisms by which neural specificity causes performance differences. To identify these mechanisms, we have developed a neurocognitive model in the NengoSPA framework that performs a go/no-go task. To simulate neural dedifferentiation and system segregation, two interventions were performed on the model. This resulted in three simulations: a control simulation, and two intervention simulations. The first intervention was neural population reduction (NPR) in all network regions, while the second intervention was representation localization reduction (RLR) between neural populations in different network regions. Performance in both intervention simulations decreased compared to the control simulation, although in different ways. The NPR simulation demonstrated consistent omission errors, while the RLR simulation demonstrated consistent commission errors. These findings suggest that a reduction in neural population causes the omission errors typical of neural attenuation, while a reduction in neural specificity causes the commission errors typical of neural broadening, both of which are implicated in neural dedifferentiation.

Other Authors: Mary Alexandria Kelly, John A. E. Anderson

Poster Session 1

NI 3020

13:30-14:30

Modeling False Recognition in the DRM Paradigm: An Approach Using Holographic Declarative Memory

Matthew Chung Hay Lo, Carleton University

Room No: NI 3020, Poster Session 1, Poster 1

13:30 – 14:30

Accurate memory discrimination is essential for reliable recall, yet false recognition, such as that elicited by the Deese-Roediger-McDermott (DRM) paradigm, reveals the inherent vulnerabilities in human memory. My research leverages Holographic Declarative Memory (HDM), a model integrating hyperdimensional computing with the ACT-R cognitive architecture, to explore the cognitive mechanisms underlying false recognition and recall in the DRM paradigm.

This model aims to computationally replicate the findings of Roediger and McDermott (1995) while addressing limitations of prior models, including their inability to account for the influence of extensive semantic memory, control processes, and the relationship between multi-list recall and recognition. HDM's capacity to represent semantic relationships in high-dimensional space allows for the incorporation of a semantic memory that may be scaled to a size more characteristic of human memory. The semantic memory of this model is pre-trained and based on the BEAGLE model, of which HDM is a variant of. Furthermore, the use of the ACT-R architecture allows for the simulation of various control processes during recall and recognition.

Overall, this model seeks to capture primacy and recency effects as well as intralist and interlist effects during serial recall. Higher false recognition rates and false recall rates are expected for items that exhibit a high semantic similarity to studied items. In addition, the model aims to identify the role of particular control processes in facilitating false recognition/recall. This work offers a robust computational foundation for studying false memory and may be further expanded to identify additional factors that affect false recognition, such as modality, list distinctiveness, and list length.

Other Authors: Jim Davies

Dimensions of Consciousness in Alzheimer's Disease

Salah Aziz, Carleton University

Room No: NI 3020, Poster Session 1, Poster 2

13:30 – 14:30

The study of alterations in conscious states associated with Alzheimer's disease (AD) has predominantly relied on hierarchical models that categorize states into discrete levels based on unidimensional markers of arousal or awareness. However, these models fail to capture the dynamic and multifaceted nature of the global state of consciousness (GSC)—an individual's overall conscious condition that modulates awareness and cognitive control. This study critiques such models and proposes a multidimensional framework for GSC in AD.

By critically examining hierarchical models, this work synthesizes insights from theoretical and empirical research, focusing on disruptions across cognitive and subjective dimensions—such as sensory content, memory, attention, social cognition, and the sense of self. Rather than a static condition, GSC in AD is dynamic, fluctuating across these dimensions. These variations explain why some individuals experience moments of clarity despite disease progression.

Findings highlight that disruptions in sensory processing, memory, executive function, and self-awareness interact to shape individual differences in GSC. This framework addresses the heterogeneity of consciousness in AD, revealing how fluctuations emerge even in severe stages. By integrating these dimensions, the proposed approach moves beyond hierarchical models to provide a more nuanced understanding of altered states in AD.

This study introduces GSC as a novel perspective, emphasizing its dispositional nature and the interplay of cognitive and subjective dimensions. By bridging theoretical and empirical findings, this framework advances the study of consciousness in AD, with implications for research and clinical interventions addressing cognitive and existential challenges.

Bilingualism and Cognitive Reserve: Examining Neural Efficiency Across Aging

Emma Richard, Carleton University

Room No: NI 3020, Poster Session 1, Poster 3

13:30 – 14:30

Dementia is a global health challenge, impairing cognition and reducing independence, which places strain on healthcare systems and caregivers. Strengthening cognitive reserve—the brain's ability to maintain cognitive performance despite age-related neural anatomical decline—may help mitigate these effects. Bilingualism has been shown to contribute to cognitive reserve, with studies suggesting that bilinguals experience dementia symptoms approximately four years later than monolinguals. However, much of the existing research relies on a binary comparison of monolinguals and bilinguals, often using univariate statistical methods to examine executive function and brain efficiency, defined as better performance with less activation and potentially greater functional connectivity between brain regions. Instead, this study explored bilingualism on a continuum, investigating how second language proficiency (i.e., speaking, reading, and writing abilities) influences executive function (measured via the Flanker task) and brain efficiency across younger and older adults. To examine these effects, twenty-three (n = 23) younger and twenty-four (n = 24) older bilingual adults completed the Flanker task while undergoing a 3T functional MRI scan. This study compared univariate and multivariate analyses to assess age and language effects on brain efficiency in bilingual adults. Univariate analyses identified individual relationships between variables and their independent effects. This method may overlook complex interactions between variables, therefore, multivariate analyses were used to examine these interactions, allowing multiple variables to be considered simultaneously. By doing so, multivariate methods enhance the ability to detect effects, improving sensitivity, and statistical power. Incorporating univariate and multivariate analyses provides a more robust understanding of bilingualism's impact on cognitive aging.

Other Authors: Imola Macphee, John Anderson

The Effect of Spending Power on Children's Saving Ability

Teju Oladipo, Carleton University

Room No: NI 3020, Poster Session 1, Poster 4

13:30 – 14:30

The current study investigates whether the motivation to save influences 3-to-7- year- olds' (n = 122) saving performance. While saving has been extensively studied in adults, less is known about its early development. This study builds upon previous research demonstrating that young children can save and benefit from manipulations such as developing a spending plan or receiving a prompt to save in the context of a token savings task (e.g., Dueck et al., 2024; Jerome et al., 2023). The current study aimed to explore whether the motivation to save, through external factors (i.e., purchasing power of tokens) and internal factors (i.e., child's preference level) influences young children's propensity to save. In the token savings task, children could either spend their tokens immediately on less-preferred prizes or save their tokens for more-preferred prizes later. Participants were assigned to one of three conditions:1-to-1, 1-to-3, and 1-to –5. In the 1-to-3 and 1-to-5 conditions, one token could be used to purchase three or five more- preferred prizes, respectively. Additionally, participants completed the Give-N task to assess whether quantity understanding is related to children's saving performance. The results revealed that neither the purchasing power of tokens nor children's preference levels for the prizes significantly influenced saving performance. Furthermore, quantity understanding was not related to saving performance. Despite these null results, this study contributes to the growing body of research investigating the factors that influence the early development of saving.

Give Me 5: The Development of Quantity Recognition

Leah Marshall, Carleton University

Room No: NI 3020, Poster Session 1, Poster 5

13:30 – 14:30

Children are exposed to multiple representations of number and must learn that number words are abstract and refer to all the representations of a given quantity. Children must also learn that the last number in a count sequence is the quantity of the set, known as the cardinality principle. Children first learn to map number names to the symbolic digits and later develop the quantity to number name mapping. In the earliest form of numerical labelling of quantities, called subitizing, children name small quantities of 1, 2, and 3 rapidly, without counting. Together, these skills reflect the beginnings of symbolic number knowledge and form the foundation for learning about mathematics.

This study examines the relation between children's subitizing skills and cardinality knowledge, as well as their knowledge of finger patterns and digits. Participants were 21 children ages 2.5-4 years recruited from early learning centres in Ottawa, Canada. Children were tested on their cardinality knowledge through the Give-N task, and object count. Quantity recognition and subitizing were assessed through a digital labelling task. Children's performance across labelling heterogenous and homogeneous representations of quantity was also examined in the labelling task.

Children were more accurate at labelling finger patterns than any other representation of number. Children were more accurate on homogenous sets than heterogenous sets. There was no significant difference between labelling accuracy on digits and non-symbolic quantities. Children were more familiar with finger patterns than any other representation of number.

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

Kindergarteners' Number Knowledge Structure Across Performance Levels: A Network Analysis

Philip Di Domenico, Carleton University

Room No: NI 3020, Poster Session 1, Poster 6

13:30 – 14:30

Many studies have shown that early math knowledge is important for later math achievement. Math knowledge can be broken down into 3 subdomains number sense, number knowledge and number operations. However, it is unclear how math achievement should be measured. Some papers suggest using a dimensional approach over a categorical approach as percentile cut-off points vary across studies and appear arbitrary. Furthermore, studies on math achievement tend to focus on low math achievers over average and high achievers. In my thesis, the Early Math Assessment@School (EMA) was administered to 1158 kindergarteners in Alberta, Canada. Each participant did five tasks: three tests measuring their number knowledge and two tasks measuring their number relations. The participants will be split into 4 groups based on the percentile cut-off of their weighted score. The 4 groups will be: a math learning difficulty (MLD) group, a low numeracy competent (LNC) group, an average numeracy competent (ANC) group and a high numeracy competent (HNC) group. These tasks will be analyzed using a partial correlation network analysis and a one-way ANOVA. The partial correlation network analysis will be done to analyze each group's knowledge structure. The one-way ANOVA will be done to analyze task differences between groups.

Early Math Success: The Effect of an Early Math Intervention in Grade One

Skyelar Haines, Carleton University

Room No: NI 3020, Poster Session 1, Poster 7

13:30 – 14:30

Early math interventions can strengthen students' foundational math skills and improve their future math learning. However, there are few grade-specific math interventions that target early number skills. In the current study, I examined the effectiveness of the Early Math Skills Program, a Tier 2 numeracy intervention designed for Canadian grade one students experiencing math difficulties. Grade one students from an Ontario School Board were assessed using the EMA@School numeracy screener. Students who were identified as needing additional support were assigned to either the intervention group or the wait-listed control group. The intervention was delivered to small groups four to five times per week for eight weeks. In each 20–30 minute session, students had explicit instruction in foundational number skills such as number knowledge, number lines, and number operations. Students' math skills were analyzed in a series of 2 (group: intervention, control) x 2 (test time: pre, post) repeated measures ANOVAs. I hypothesized that students in the intervention group would show greater growth in their overall foundational numeracy skills compared to students in the wait-listed control group. The findings from this study may contribute to a greater understanding of the effects of a well-structured targeted intervention on students' math learning.

Other Authors: Heather Douglas, Jo-Anne Lefevre

Comparing Online and Paper Assessments in Arithmetic Performance

Georgia Livingstone, Carleton University

Room No: NI 3020, Poster Session 1, Poster 8

13:30 – 14:30

With the increasing use of digital tools in education, specifically digital testing being chosen over paper and pencil testing, understanding the equivalency of test scores between these formats is crucial. The current study examined differences in math assessment score outcomes using the two different test formats. The moderators investigated in this study are working memory, beliefs about mathematics, and test format preference. The overall aim of this study is to determine whether differences in test scores emerge between the two formats, and which of the examined moderators contributes to these differences.

Key words: *Digital math assessments, Working memory, Beliefs about mathematics, Test score differences*

Other Authors: Jo-Anne LeFevre, Rebecca Merkley

The Impact of Self-Explanation Training on Student Learning with ChatGPT

Deena Sookhai, Carleton University

Room No: NI 3020, Poster Session 1, Poster 9

13:30 – 14:30

This study examines the impact of self-explanation (SE) training on student learning in programming activities involving ChatGPT. Self-explanation, a metacognitive strategy where learners generate inferences beyond instructional material, has been shown to improve comprehension (Chi et al., 1989; Bisra, 2018). Prior research indicates that students can be trained to self-explain effectively, with benefits observed in comprehension, cognitive engagement, and long-term retention (Hodds, Alcock, & Inglis, 2014; Kurby et al., 2012). While large language models (LLMs) like ChatGPT offer new opportunities for personalized learning, prior studies show mixed results—some indicate improvements in task completion and debugging skills (Ma et al., 2024), while others highlight challenges for students with low prior knowledge (Prather et al., 2024).

This research employs a between-subjects experimental design with undergraduate participants (N=45-60), randomly assigned to an SE training group or a control group. All participants will complete a pre-test, receive a programming lesson, and solve coding problems with ChatGPT. The SE training group will receive structured instruction on self-explanation techniques, modelled after prior training protocols (Hodds et al., 2014). Learning outcomes will be assessed via pre- and post-tests, performance on programming tasks, and the quality of self-explanations recorded during think-aloud sessions.

Data analysis will employ both Null Hypothesis Significance Testing (NHST) and Bayesian statistics to compare learning gains across conditions. Findings will contribute to understanding whether SE training enhances learning with ChatGPT, offering insights into the extent to which students engage in deeper reasoning versus copying ChatGPT outputs. This research has implications for optimizing LLM-based learning environments in programming education.

Other Authors: Kasia Muldner

It's About Time – Dynamics Mediate Breathing's Impact on Emotion and Cognition

Josh Goheen, Carleton University

Room No: NI 3020, Poster Session 1, Poster 10

13:30 – 14:30

Background: There is strong phenomenological evidence that breathing modulates the mind, however, the empirical features through which the breathing signal shapes emotion and cognition are poorly understood. We hypothesized that breathing dynamics, that is, breathing's intrinsic patterns of activity over time, are key to understanding how breathing relates to emotion and cognition

Methods: Partial least squares correlation (PLSC) was used to generate sets of orthogonal latent variables (LVs) that maximize the relationship between two sets of data, breathing and behaviour (i.e., working memory performance and anxiety levels). The significance of each LV was assessed by comparing the obtained result to a null distribution built with 1000 permutations. The reliability of the contributions of each of the variables to the LV was assessed with 1000 bootstrap repetitions, which were used to estimate standard errors.

Results: Our findings from the PLS analysis between breathing and anxiety levels identified two key LVs (p's<0.05) that explained 49.6% and 33.9% of the cross-block covariance, respectively. The first LV showed breathing signal complexity and entropy scores correlated most strongly and positively with levels of anxiety. Our findings in the PLS analysis between breathing and working memory performance identified one significant LV which explained 68% of the total cross-block covariance. The LV showed higher breathing signal variability scores correlated most strongly and negatively with working memory performance regardless of task difficulty.

Conclusions: Our findings suggest that breathing's impact on emotion and cognition is mediated, in part, by the breathing signal's intrinsic dynamics.

Other Authors: Yasir Catal, Imola MacPhee, Tyler Call, Cameron Carson, Reem Ali, Rabeaa Khan, Kareen Weche, John A.E. Anderson, Georg Northoff

Examining Learning from Text by Perceived Human or AI Authorship

Ian Darragh , Carleton University

Room No: NI 3020, Poster Session 1, Poster 11

13:30 – 14:30

In the current world of education, teachers are concerned with the use of generative AI like ChatGPT. Some students use ChatGPT and other generative AI to summarize educational content or write essays for them, which has the potential to limit how much students really learn by outsourcing information processing to an external source. Perceptions of AI-generated content may affect if and how students use these tools, in terms of how they process and study information from them. In this study, we investigate how perceived content authorship affects learning from an instructional text. Participants read an AI-generated text on the cognitive neuroscience of sleep and were randomly assigned to two conditions. In one, participants were told that the text was authored by ChatGPT, while in the other, that it was from a textbook. After reading the text, participants were asked to answer a series of multiple choice and short answer questions. We report on how belief in the source of the materials (ChatGPT, human) influenced post-test performance and time on task.

Other Authors: Kasia Muldner

When Words Weigh Heavy: The Impact of Depression on the Brain's Language Architecture

Amanda Catherine Schmidt, Carleton University

Room No: NI 3020, Poster Session 1, Poster 12

13:30 – 14:30

Depression significantly affects individuals worldwide, influencing how people think, act, and communicate. Research has shown that the disorder leads to widespread impairments across multiple brain regions. However, despite considerable progress in understanding the neural basis of major depressive disorder (MDD), most studies have focused on specific brain regions and their connectivity, with less attention given to its broader impact on the neural architecture supporting language processing. This study examines how depression reshapes the brain's language network using functional near-infrared spectroscopy (fNIRS). A sample of 20 university students was randomly selected and screened for depressive symptoms using the Beck Depression Inventory. Based on their scores, participants were categorized into two groups: those with high trait depressive symptoms and those with low trait depressive symptoms. To identify key brain regions involved in language processing, the study employed the Language Localizer Task developed by Fedorenko et al. (2010). This task presents participants with sentences and nonword-based sentences to activate brain regions associated with lexico-semantic and combinatorial (syntactic and semantic) processing. By comparing neural activation patterns between the two groups, this research offers valuable insights into how depression alters the functional organization of the brain's language network.

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

Resting-State Effective Connectivity Biomarkers for Synesthesia

Mitchell Ross, Carleton University

Room No: NI 3020, Poster Session 1, Poster 13

13:30 – 14:30

Synesthesia is a rare cognitive phenomenon in which the stimulation of one sensory modality triggers a response in another sensory modality. There are many recognized forms of synesthesia, however, most synesthesia research focuses on grapheme-colour synesthesia and sound-vision synesthesia since these are the most common types. Synesthetes can be further distinguished into two groups: associators and projectors. Associators experience their concurrents "in their heads," whereas projectors experience their concurrents "in the external world." This project contributes to growing bodies of research into the neural substrate of synesthesia and neural support for the associator/projector distinction. More specifically, this project sought to determine whether variations in resting-state functional connectivity within and/or between the default-mode network (DMN) and the visual network (VN) could differentiate controls from grapheme-colour synesthetes and/or associators from projectors. For these purposes, functional rs-fMRI data for 25 controls and 86 grapheme-colour synesthetes (51 associators, and 10 projectors) were obtained from the Mapping the Connectome of Synesthesia dataset available at openneuro.org, along with behavioural data in the form of scores on an associator/projector questionnaire (APQ)(https://openneuro.org/datasets/ds004466/versions/1.0.2). Two multivariate regression analyses were then performed in CONN-Toolbox: one with all groups, and one with synesthete groups only. Next, the z-score matrices were imported to SPYDER, wherein two Partial-Least Squares analyses were performed: A hypothesis-driven mean-centered PLS (mcPLS) with all three groups, and a hypothesis-driven behavioural PLS (bPLS) with synesthetes only. The results of the bPLS analysis were non-significant ($p = 0.16$). However, the results of the mcPLS were significant ($p = 0.0002$) and show that synesthetes display higher within-network modularity than controls. This finding is significant since it challenges neural models of synesthesia that posit some form of hyperconnectivity.

Language Learning Aptitude: Does Multilingualism Matter?

Irina Smirnova-Godoy, Carleton University

Room No: NI 3020, Poster Session 1, Poster 14

13:30 – 14:30

Aptitude for learning languages has been of interest to many second language acquisition researchers who sought to explain widely varying individual results of language learning achievement in the same instructional context. Language aptitude research is yet to establish clearly whether this aptitude is stable in individuals or can be enhanced by some factors such as prior language learning experience of the learner. Bilingual or multilingual status of the language learner has not been addressed as a separate factor in language aptitude studies. The present study aimed to fill this gap by collecting 108 participants' scores on language aptitude tests and their multilingual status, analyzed the interplay between.

Other Authors: Olessia Jouravlev, Marina Panfilova

Anxiety, Depression, and Working Memory Performance Using Hierarchical Drift Diffusion Modeling (HDDM)

Kareen Weche, Carleton University

Room No: NI 3020, Poster Session 1, Poster 15

13:30 – 14:30

Introduction: Anxiety and depression are linked to cognitive impairments, particularly in working memory (WM) and decision-making. However, the mechanisms remain unclear. This study examines their effects on WM performance across cognitive load conditions using traditional linear mixed models and the Hierarchical Drift Diffusion Model (HDDM).

Method: Twenty-seven undergraduates completed a 3-back WM task, with reaction time and accuracy recorded. Participants were categorized into high- and low-anxiety/depression groups using median splits of Beck Anxiety Inventory (BAI) and Beck Depression Inventory (BDI-II) scores. Linear mixed effects models assessed the effects of anxiety, depression, and cognitive load, while HDDM estimated drift rate, decision threshold, non-decision time, and bias.

Results: Cognitive load significantly impacted reaction time and accuracy ($p < .01$). However, anxiety and depression did not show significant effects in traditional analyses. HDDM revealed that high-anxiety individuals had lower drift rates (slower evidence accumulation), suggesting impaired cognitive processing. No meaningful differences were found in other HDDM parameters for anxiety. Depression did not yield significant differences in any HDDM parameters, and its effect on drift rate remained inconclusive. A larger sample may help clarify subtle effects.

Conclusion: While traditional models found no significant effects, HDDM identified subtle differences in high-anxiety individuals. These findings highlight the value of computational modeling in studying cognitive impairments, suggesting anxiety affects decision-making strategies rather than overt task performance.

Keywords: Anxiety, depression, working memory, cognitive load, decision-making, HDDM

Other Authors: Josh Goheen

Exploring Brain System Segregation as a Neural Mechanism of Cognitive Reserve in Bilingualism

Tyler Call, Carleton University

Room No: NI 3020, Poster Session 1, Poster 16

13:30 – 14:30

Bilingualism is associated with a delay in the onset of Alzheimer's dementia symptoms of approximately four years. Thus, it is hypothesized that bilingualism provides reserve, i.e., resilience to age-related and pathological brain degeneration. While bilingualism does have significant effects on brain structure, these measures do not fully explain individual differences in cognitive performance. The construct of cognitive reserve is intended to capture this unexplained variance. Recently, the search for neural mechanisms of cognitive reserve has focused on the connectivity of functional brain networks. One functional connectivity metric, brain system segregation, has been shown to predict cognitive performance independent of age. Brain system segregation also declines with age, and this decline is strongly correlated with age-related cognitive decline. One recent study has demonstrated two intriguing findings: first, that higher levels of education are associated with preserved brain system segregation longitudinally; and second, that preserved brain system segregation predicts clinical dementia outcomes over and above structural and pathological measures. However, brain system segregation has not been used to investigate the neural mechanisms of cognitive reserve in bilingualism. In this poster, we explore the relationships between bilingualism, brain system segregation, and cognitive outcomes using data from the Alzheimer's Disease Research Initiative. Bilingualism is assessed in terms of self-reported proficiency data, and brain system segregation metrics are derived from resting-state functional magnetic resonance imaging data.

The Reduction of Embodied Cognition Between Accented vs. Non-Accented Speech

Annie Rattray, Liam K. Wallace, Malka S. Bortman, Sadia Naureen, Carleton University

Room No: NI 3020, Poster Session 1, Poster 17

13:30 – 14:30

Language embodiment theory suggests that language comprehension is grounded in sensory and motor experiences. However, processing accented speech may introduce cognitive challenges, requiring additional resources to understand unfamiliar phonetic and rhythmic patterns. This study investigates whether accented speech reduces embodied cognition by comparing response times and accuracy in a sentence-picture verification (SPV) task. Participants are presented with spoken sentences, either in a native or non-native English accent, and must determine whether an accompanying image matches the sentence content. Prior research (e.g., Zwaan et al., 2002) has demonstrated that perceptual simulations facilitate language comprehension, while Norman and Peleg (2022) found reduced embodiment in second-language processing. Additionally, Engen and Peelle (2014) showed that accented speech increases cognitive load, affecting comprehension. By building on these findings, our study examines whether listeners exhibit longer response times and lower accuracy when processing accented speech, reflecting a reduced embodiment effect. As data collection is ongoing, anticipated results are expected to show a mismatch effect for accented speech, where increased cognitive demand interferes with sensory-motor integration. These findings will contribute to our understanding of linguistic variability in cognitive processing and have broader implications for communication in multicultural societies.

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

The Effects of ADHD Traits on Visuospatial Working Memory Tasks Using fNIRS

Naomi Brake, Carleton University

Room No: NI 3020, Poster Session 1, Poster 18

13:30 – 14:30

Attention Deficit Hyperactivity Disorder (ADHD), being one of the most common disorders, is often misdiagnosed or overlooked in psychological assessments. Brain imaging technologies are not currently used for diagnostic assessments but may bring more accurate identification of ADHD upon further research. Using fNIRS in combination with self-reported behavioral and psychological data, we examined whether a neurotypical population with a high load of ADHD traits would perform worse on a visuospatial working memory task. In previous studies which examined ADHD patients compared to control groups, researchers typically found lower accuracy in responses and a decrease in activation in the Dorsolateral Prefrontal Cortex, Ventrolateral Prefrontal Cortex. We hypothesized that our results would be consistent, with no/low load trait individuals having increased activity in the Prefrontal Cortex, while high load trait individuals would exhibit a decrease in activation during the task, similar to ADHD results. Our results will be presented.

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

The Effect of Autistic Trait Load on Executive Functioning Networks in the Brain

Aahana Uppal, Carleton University

Room No: NI 3020, Poster Session 1, Poster 19

13:30 – 14:30

In the past few decades, autism spectrum disorder (ASD) has increasingly been understood as a true spectrum, accounting for the diverse experiences and presentations of those with ASD. Various neuroimaging techniques have been used to quantify biomarkers of ASD, including functional near-infrared spectroscopy (fNIRS), which has been increasingly used because of its various advantages over other methods. These include its non-invasiveness, portability, low cost, and ease of use in more naturalistic settings, allowing for generalizable results. Evidence supports its use for clinical populations, including ASD, because of its low sensitivity to motion artefacts.

Data collection is ongoing with participants being recruited from an introductory cognitive science course at Carleton University through the SONA recruitment system. Participants are asked to fill out a questionnaire with measures for various neurodevelopmental disorders, namely the Adult Autism Spectrum Quotient (AQ) for this study. After completing this, participants attend an fNIRS session in which they complete a visuospatial working memory task (MD Network Localizer) using a montage targeting frontal areas.

For analysis, from the 50 total AQ questions in the questionnaire, two groups will be separated by lower and higher autistic trait loads. FNIRS data will be preprocessed and analyzed using the open-source software MATLAB and Homer. From this, relevant hemodynamic responses will be extracted and compared for both groups to determine whether there is a difference. Results will be presented on a poster at the Spring Conference.

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

Navigating The Digital Age: The Impact of Screen Time on Social Cognitive Embodiment

Mazzy Beasley, Katie Broadhurst, Nadine Murad, and Marcus Minn, Carleton University

Room No: NI 3020, Poster Session 1, Poster 20

13:30 – 14:30

As digital communication increasingly replaces face-to-face interactions, it raises critical questions regarding how screen time may influence cognition and social perceptions. However, if physical experiences with the environment shape our cognitive processes, what happens when digital interfaces mediate an increasing amount of our experiences? This study explores whether individuals with high screen time exhibit spatial-emotional mappings in digital interactions similar to those observed in physical space. Participants will complete an online study via Qualtrics on SONA, documenting their screen time, handedness, and general background. We will then present them with 16 vignettes, eight of which depict online interactions and eight of which depict in-person interactions. We hypothesize that individuals who spend a significant amount of time in front of a screen will strongly prefer to associate positively valenced vignettes with online contexts with their dominant hand, while the opposite will be true for negatively valenced vignettes with online contexts. By analyzing these associations, this study aims to uncover how digital environments reshape the interplay between emotion, spatial cognition, and embodied experience. The findings may illuminate the cognitive consequences of screen saturation, offering insights into technology's role in shaping social perception, mental health, and adaptive behaviour in an increasingly virtual world.

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

The Effect of ADHD Trait Load on Learning from Worked Examples

Rana Ali, Raquel Daniel, Phillip Weiss & Louis Fleurent-Wilson, Carleton University

Room No: NI 3020, Poster Session 1, Poster 21

13:30 – 14:30

Worked examples are commonly used in educational settings to support learning, particularly in domains like programming. However, their effectiveness may vary depending on individual cognitive traits, such as those associated with ADHD. This study aimed to investigate the relationship between ADHD traits and learning outcomes from worked examples in a Python programming context. In this study, participants completed an ADHD trait questionnaire before engaging in a worked example lesson using Python coding. Pretest and posttest scores were analyzed to assess learning gains. We found* a significant difference in posttest scores between participants in the ADHD and non-ADHD groups, with the non-ADHD trait group demonstrating greater improvement. Additionally, a negative correlation was found* between ADHD trait scores and posttest performance. These findings would have suggested that traditional worked example instructions are not equally effective for all learners—particularly those with high ADHD traits. This research highlights the importance of considering individual cognitive differences when designing instructional materials and emphasizes the need for adaptive approaches in programming education.

Note: data for this project was fabricated to showcase a hypothetical outcome. We therefore do not put these results forward as definitive evidence for the proposed claims.

Other Authors: Zachary Savelson

The Influence of Negative Emotional Affect on the Conceptual Understanding of Psychology

Val Hussain, Suban Hussein, Jack Bradley & Zainab Al-Maksousi, Carleton University

Room No: NI 3020, Poster Session 1, Poster 22

13:30 – 14:30

Emotions play a critical role in learning, influencing motivation, engagement, and retention. While research has explored how emotions affect learning in STEM fields, little is known about their impact on conceptual learning in psychology. This study examined whether negative emotional affect, specifically frustration, leads to better conceptual understanding compared to happiness or a neutral state. Participants were randomly assigned to one of three emotional conditions (frustration, happiness, or neutral) using film clips as an emotion induction method. They then watched a 20-minute lecture on episodic and semantic memory before completing a post-test measuring conceptual understanding. Results* showed that participants in the happiness condition scored significantly higher than those in the frustration and neutral conditions, while frustration did not improve learning outcomes. These findings would have suggested that positive emotional affect enhances conceptual learning, whereas frustration would not necessarily promote deeper understanding.

Note: data for this project was fabricated to showcase a hypothetical outcome. We therefore do not put these results forward as definitive evidence for the proposed claims.

Other Authors: Zachary Savelson

Poster Session 2

NI 3020

14:30-15:30

Leaving a Mark on the Body: Exploring Adverse Childhood Experience and Emotional Body Mapping

Georgia Livingstone, Skyelar Haines, Maia Najm, Carleton University

Room No: NI 3020, Poster Session 2, Poster 23

14:30 – 15:30

The current study examined the effects of Adverse Childhood Experiences (ACEs) on emotional processing. It aimed to bridge the gap between cognitive and embodied emotional processing in individuals with ACEs, hoping to contribute to a deeper understanding of the long-term impacts of early adversity. The hypotheses posed in this study were that those with high ACEs will experience atypical body maps, and additionally, that they will have lower accuracy when identifying emotions. This study used static facial images to elicit emotional responses and an embodied emotional response tool to measure the bodily mapping of emotions. The Adverse Childhood Experience Questionnaire for Adults was used to measure adversity in childhood and Beck's Depression Inventory was used to account for depression as a covariate. The findings reveal that individuals with high ACE scores exhibit higher accuracy when identifying happy faces and report abnormal bodily mapping of evoked happiness. No significance was found for either accuracy or correlation when observing sadness or neutrality. The current study allows for a deeper understanding of how emotional processing is impacted by adverse experiences in childhood, contributing to the development of stronger interventions and treatments to address these implications.

Key Words: Adverse Childhood Experience, Topographical Body Mapping, Emotional Processing, Emotional Recognition, Depression

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

One Size Does Not Fit All: A Functional Localization Approach to Language ERPs

Nayna Kirubakar, Carleton University

Room No: NI 3020, Poster Session 2, Poster 24

14:30 – 15:30

Human brains share a broadly similar functional organization (e.g., Hakin et al., 2021). However, they also exhibit individual differences in function and anatomy. For example, the neural correlates underlying language are variable across individuals (e.g., Amunts et al., 1999). ERP studies often overlook this variability by averaging the activity of the same electrodes across individuals. To address this, fMRI research has recently used the functional localization method (e.g., Fedorenko et al., 2010). They use a localizer task to identify functional regions of interest (fROIs) for a specific cognitive function in every individual. The goal of this research was to adapt the fROI method to the ERP modality.

We used a language localizer task to identify functional channels of interest (fCOI) in each participant. In this task, participants read sentences or lists of nonwords, and channels showing greater activity for the Sentences > Nonwords contrast were identified as language-relevant. Participants then completed a sentence reading task where semantic plausibility was manipulated. The N400 magnitudes for semantically plausible vs. implausible words were retrieved using both the fCOI and the traditional methods.

N400 magnitudes were higher using the fCOI method compared to the traditional approach. This highlights its sensitivity to capture individual variability in language-network across individuals. This is the first demonstration that the functional localization approach can be applied to the ERP modality and may be helpful in capturing the small individual differences that the traditional method overlooks.

Other Authors: Olessia Jouravlev

Productive Failure and Collaboration

Madison Millar, Carleton University

Room No: NI 3020, Poster Session 2, Poster 25

14:30 – 15:30

Productive Failure (PF) is a learning paradigm where students problem solve first, and only afterwards is a lesson given on the subject matter. PF has been shown to increase learning over the typical form of instruction (lesson then problem solving). Despite this, collaboration, which has been shown to increase learning outside of PF, does not have as clear an effect in PF, with some prior work arguing for the necessity of collaboration, while others suggest that collaborating decreases learning gains. To address this gap, I conducted a study using a 2x2 design varying instructional methodology (PF vs Direct Instruction) and collaboration (work individually or in a pair) to directly capture the effects of both instructional order and collaboration on learning. To measure overall learning, I used a posttest designed to measure the knowledge students gained from the intervention. I will present results that show whether instructional order and/or collaboration influenced learning.

Other Authors: Zachary Savelson, Kasia Muldner.

Questions for Baker (2014)

Chester Leopold, Carleton University

Room No: NI 3020, Poster Session 2, Poster 26

14:30 – 15:30

In this presentation, I critically engage Baker's (2014) discussion of "implicit arguments" as it plays a role in his dependent case theory. I focus on his discussion of Shipibo constructions that contain ergatively marked subjects that lack an overtly pronounced direct object. I claim that Baker could be correct that the syntax of these constructions always contain an "implicit" direct object (Baker, 351). Thereby, the ergative marker may only appear in Shipibo transitive constructions that have two NPs competing for case. The ergative marker cannot appear in intransitive constructions that contain only one NP. However, I consider alternate proposals based on Preminger's (2012) and Bruening's (2007) discussion of Basque unergatives and Pietroski's (2018) discussion of the "argument flexibility" of English verbs (Pietroski, chapter 6). Maybe at least some intransitive constructions in Shipibo and other languages can take ergatively marked subjects. This might be mediated by particular verbs in the lexicon in line with Preminger's (2012) discussion of Basque and Davison (1999, 2004).

Building from Bárány and Sheehan (2022), I claim that this latter approach may be a profitable alternative to the "strongest form" of dependent case theory (Bárány and Sheehan, p.1). This is namely, that dependent case theory can account for case assignment in all natural languages. I conclude that an alternate picture of case assignment whereby the functional heads, "T" and little v can assign case to arguments directly may better be able handle ergatively marked intransitive constructions (Legate 2008; Assmann et al 2015).

Decoding Syntax and Semantics: ERP Insights into Neural Processing in Language and Code

Mary Nehmé, Carleton University

Room No: NI 3020, Poster Session 2, Poster 27

14:30 – 15:30

Introduction: While natural language processing in the brain has been extensively studied, much less is known about the neural mechanisms underlying programming language comprehension. Recent research suggests that programming and natural languages share some cognitive and neural processing mechanisms (Prat et al., 2020). However, the extent of their overlap remains debated. This study investigates the neural correlates of syntactic and semantic processing in both natural and programming languages, using event-related potentials (ERPs). Specifically, we examine the N400 effect, an index of semantic processing difficulty (Kutas & Hillyard, 1983), and the P600 effect, associated with syntactic reanalysis and repair (Gouvea et al., 2010).

Method: Participants, all native speakers of English and proficient in Python, read English sentences and lines of Python code. In the natural language condition, sentences were semantically plausible vs. implausible or syntactically correct vs. incorrect. In the programming language condition, participants processed correct and incorrect lines of Python code. Incorrect code contained either semantic anomalies or syntactic errors. Participants performed acceptability judgments to assess real-time brain activity in response to these violations while their ERPs were recorded.

Results: Semantic violations in both natural language and programming code elicited increased N400 amplitudes, reflecting greater cognitive effort in meaning integration. Syntactic violations, on the other hand, generated P600 effects, indicative of reanalysis and syntactic repair processes. However, the magnitudes of effects were reduced in the programming vs. natural language.

Conclusions: Differences in magnitudes of the ERP effects for the programming language are likely due to (a) the more rigid and less ambiguous nature of programming syntax and (b) due to the fact that variable names and identifiers do not inherently carry meaning in the same way as natural language words.

Other Authors: Olessia Jouavlev, Masih Zaamari

Detecting Foreign Contrasts and Coarticulatory Violations: Monolingual and Bilingual Differences

Marina Panfilova, Carleton University

Room No: NI 3020, Poster Session 2, Poster 28

14:30 – 15:30

Infants exhibit a remarkable ability to discriminate between speech sounds of foreign languages. In monolingual infants, this ability declines as they reach toddlerhood, whereas in bilingual toddlers, it is preserved. This bilingual advantage in phonological processing led to the Perceptual Wedge Hypothesis, which proposes that exposure to multiple languages keeps the doors of perceptual attenuation open. While a single input language during acquisition tunes perception to that language's sounds, exposure to two languages allows for broader phonological sensitivity.

All prior research on the Perceptual Wedge Hypothesis has focused on infants and toddlers. However, it remains unclear how long this perceptual advantage lasts and whether it extends into adulthood.

In two ERP experiments, I investigated phonological processing differences between English monolinguals and bilinguals exposed to another language from birth. Both experiments used an auditory adaptation paradigm to elicit the MMN ERP component. Participants heard a series of speech sounds, with the final sound either matching or mismatching the preceding ones.

In experiment 1 I examined participants' sensitivity to coarticulatory cues using cross-spliced English words presented in a sequence with the last item either being the same or cross-spliced. Experiment 2 examined participants' ability to differentiate a Russian vowel contrast absent in English.

While behavioural differences between monolinguals and bilinguals were minimal, ERP analyses revealed significant group differences in MMN magnitude. These results suggest that early bilingual exposure enhances sensitivity to phonological distinctions not commonly encountered in one's native language.

Other Authors: Aya Amer, Olessia Jouravlev

A Modular Agentic Artificial Intelligence Workflow for Automated Compliance Query Resolution

Samer Al Assafin, Carleton University

Room No: NI 3020, Poster Session 2, Poster 29

14:30 – 15:30

This project introduces an interactive tool that utilizes agentic artificial intelligence (AI) workflow for the purpose of automating the resolution of compliance related queries based on a set of documents. This tool leverages the capabilities of large language models (LLM's) in addition to other advanced natural language processing (NLP) techniques to provide an automated and customized response to compliance queries. The framework consists of several key components: 1) extracting text from PDF document, provided by the user based on their provincial jurisdiction, 2) an agent planning a list of sequential sub-tasks to resolve the compliance query asked by the user, 3) an agent executing sub-tasks and promptingthe user to provide more details and 4) a third and final agent consolidating the outputs of sub-tasks into a final precis, data-driven answer. This architecture provides a robust modular approach that emphasizes transparency and traceability throughout the decision-making process. In addition, this framework highlights the potential for integrating human input into automated reasoning, thereby improving the quality and efficiency of compliance decision-making.

The Effects of Migraine Status on The Magnitudes of The N400 Component

Stephanie Oxales, Carleton University

Room No: NI 3020, Poster Session 2, Poster 30

14:30 – 15:30

This study explores the impact of migraine status on the N400 event-related potential (ERP) component during a semantic processing task. Previous research has demonstrated that migraineurs may exhibit altered cognitive patterns, including deficits in attention, working memory, and semantic processing, which may influence language processing abilities, particularly under cognitively demanding conditions (Eck et al., 2011; Coppola et al., 2009; Gil-Gouveia et al., 2014). Although much of the migraine literature focuses on sensory processing, pain, and memory, there is a growing interest in understanding how migraine history affects language processing (Bahra et al., 2001; Vuralli et al., 2018). This study builds on these findings by examining the N400, a neural marker for semantic processing, in individuals with a history of migraines or frequent headaches. EEG recordings were collected to measure N400 magnitudes during a semantic task, in the absence of an active migraine episode. The study compared migraineurs with individuals who do not experience migraines or frequent headaches, with the hypothesis that migraine history would be associated with significantly altered N400 magnitudes. Given the potential lasting neural effects of migraines, the results may shed light on how migraine history impacts semantic processing, suggesting that migraineurs may exhibit differential neural responses during language tasks (Burstein et al., 2015; Gil-Gouveia et al.,2014). This research enhances understanding of how cognitive and neural changes in migraines affect language processing, particularly under cognitive load, and may inform tailored interventions and strategies for migraine sufferers.

Keywords: migraine, N400, semantic processing, EEG, cognitive load, language processing

Other Authors: Nayna Kirubakar, Olessia Jouravlev

Decoding Thought: EEG Analysis of Language vs Imagery Processing Pathways

Yammam Mohammed, Masih Zaamari, Carleton University

Room No: NI 3020, Poster Session 2, Poster 31

14:30 – 15:30

This purpose of the study was to examine neural responses elicited by mental images vs language using the decoding of electroencephalographic (EEG) signals. Participants (N = 18) were English-speaking undergraduate students at Carleton University. Participants received training to establish a connection between an arbitrary auditory cue (beep of certain frequency) and an animate or inanimate object. In the mental imaging task, participants listened to an auditory cue and came up with a mental representation of the item linked to the cue. In the language generation task, participants silently named the object upon hearing the auditory cue. The results corroborated the idea that neural responses during mental imagery and language decoding tasks show modality-specific patterns. The activation of magnitudes of the N400 during mental imagery and language decoding tasks differed based on the nature of the stimuli (animate vs. inanimate objects) and type of task (mental imagery vs. word production). This research enhances our understanding of neurocognitive processes supporting mental imagery and language.

Other Authors: Nayna Kirubakar, Olessia Jouravlev

Hippocampal Substructure and Hearing Acuity Using MRI Measures in Adults

Imola MacPhee, Carleton University

Room No: NI 3020, Poster Session 2, Poster 32

14:30 – 15:30

Background: The hippocampus is best known for its role in memory formation, however, the structure may also be critical for audition. Recent evidence links hearing loss to cognitive decline, and animal studies demonstrate auditory activation of the hippocampus. Despite containing sub-regions with unique functional properties, the hippocampus is typically described as a singular complex. Thus our aim is to use HippUnfold, an automated, machine-learning segmentation technique to explore subfield changes related to hearing impairment.

Methods: Twenty-six young (18-30 yrs) and 24 older (60+ yrs) cognitively healthy adults were assessed using pure tone audiometry, speech-in-noise (QuickSIN), cognition (MoCA and Shipley-2), and 3T structural MRI (T1 weighted). Multiple linear regression was used to assess gross anatomical volumes and Multiple Factor Analysis (MFA) was used to relate brain and behaviour elements in the multivariate space.

Results: Total hippocampal volumes decreased as expected with increasing age and hearing difficulty. Dimension one of the MFA explained 24.8% of the variance, and was associated with the subiculum, CA1 and CA4 and driven by hearing in noise. Age and cognition loaded most strongly in the second dimension (13% of variance), along with CA2 and CA3. Our findings identified, for the first time, an association between the subiculum, CA4 and CA1 hippocampal subfields with select hearing measures. Ultimately, this work may provide a framework to assess the efficacy of intervention in those with hearing loss.

Other Authors: John Anderson

Exploring Cognitive AI-Driven Computational Dynamics of Simple Zero-Sum Games

Nicholas Kassabri, Carleton University

Room No: NI 3020, Poster Session 2, Poster 33

14:30 – 15:30

This research builds on the work of Dr. Robert West, who used cognitive architectures to model dynamic interactions of simple zero-sum games. While his work has demonstrated the viability of cognitive models in simulating agent interactions, the underlying dynamic structures of these interactions have not been systematically examined. This study addresses that gap by using a computational approach to systematically investigate the dynamic interactions between agents while mapping the dynamic space, providing insights into emergent effects of simple zero-sum games. A computational modeling framework inspired by ACT-R was used to replicate the cognitive models from prior work while enabling systematic parameter manipulation to explore how different adjustments influence the dynamic interactions. The findings confirm that the computational model successfully replicates previous cognitive models while also revealing new results, demonstrating that previously unexamined parameters can generate unique and complex emergent effects. These new findings suggest that the computational dynamics of simple zero-sum games are more intricate than previously assumed, highlighting the value of this systematic approach in revealing potential human cognitive processes involved in gameplay.

Other Authors: Robert West

Effects of Depression Load on Magnitudes of the N400 ERP Component

Lilah Krause, Carleton University

Room No: NI 3020, Poster Session 2, Poster 34

14:30 – 15:30

Language is known to be compromised in many neurodevelopmental and psychiatric conditions. One of the most prevalent psychiatric conditions in the current world is depression.Whereas individuals with depression often report having difficulty communicating with others, the extent of impact of depression on linguistic abilities has not been examined. The purpose of this study is to determine whether language comprehension skills are impaired in those with depression. To this end, I examined brain responses of individuals with low vs. high depressive trait loads. All participants read semantically plausible or implausible sentences as their brain responses were monitored using electroencephalography (EEG). I predict that the magnitudes of the N400 ERP component will differ as a function of depressive load. This study will provide evidence that depression impairs linguistic comprehension skills.

Other Authors: Nayna Kirubakar, Olessia Jouravlev

Staying Alert in Autopilot: The Effects of Trust in Automation and Attentional Capacity on Situation Awareness in Senior Drivers

Alexia M. D. Bierlaire, Carleton University

Room No: NI 3020, Poster Session 2, Poster 35

14:30 – 15:30

Introduction: Senior drivers constitute the most at-risk driver group when accounting for distance travelled. Advanced driver assistance systems (ADAS) can improve senior driver safety by assuming driving-related tasks, thereby reducing drivers' cognitive load. However, adequately calibrated trust is essential for appropriate use of these systems. Furthermore, the effect of trust in automation and attentional capacity on drivers' situation awareness remains unclear. **Method:** Forty senior drivers will participate in this ongoing study. Participants complete two sessions comprising four experimental drives in a simulator equipped with an advanced cruise control system, while wearing a 14-channel EEG headset and while oddball tones are playing in the background. After each drive, participants are queried regarding their situation awareness, workload, and trust in automation. In session 1, the system functions as intended, and participants do not experience any system failures (high trust condition). In session two, participants experience system failures during their first two drives (low trust condition) and no system failures during their last two drives (trust re-building condition). **Findings:** Preliminary results indicate the effectiveness of the trust manipulation, as trust scores significantly decrease in the low trust condition. Additionally, differences in event-related neural activity associated with attentional capacity are expected to be observed in the EEG data. It is anticipated that trust and attentional capacity have a combined effect on situation awareness. Results will provide valuable insights into the effect of individual factors on older driver safety in semi-autonomous vehicles and inform the design and development of future ADAS.

Other Authors: Chris Herdman, Kathleen Van Benthem

When Words Make You Wince: The Influence of Priming on Disgust Embodiment Among Bilinguals

Brianna J. Pratt, Jordan P. Lipson, Maya Shaban, and Prudence

P. Rivero, Carleton University

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14:30 – 15:30

Whereas numerous prior studies have analyzed the effects of discrete emotions on lexica processing in monolinguals (Briesemeister et al., 2011; Ferré et al., 2018; Ferré et al., 2017; García-Palacios et al., 2018), their impact on bilingual performance remains underexplored. The goal of our project was to examine whether English-French bilinguals process French disgust-related words differently after being exposed to their first (L1) vs. second (L2) language. English-French bilinguals watched a movie in English or French and, then, completed a French lexical decision task (LDT). The critical items were disgust-related words. Monolinguals are known to take longer to process such stimuli, allegedly due to the fact that disgust-related words are likely to evoke corresponding mental imagery more so than neutral words. Here, we explored whether this processing disadvantage could be detected in bilinguals' L2. We hypothesized that response times for disgust-related words will be slower than for neutral words, which is consistent with previous findings on emotion processing (Briesemeister et al., 2011; Ferré et al.,2018). Moreover, we predicted that priming participants into L2 mode (via L2 movies) will improve their processing in the lexical decision task, in general, and on disgust-related words, in particular. These findings will enhance our understanding of bilingual lexical processing, the role of discrete emotions in semantic embodiment, and the degree to which priming can affect emotional word processing in an L2.

Keywords: Bilinguals, discrete emotions, priming

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

Evaluating Natural Language Inference Models on Conditional Inference and Presupposition

Tara Azin, Carleton University

Room No: NI 3020, Poster Session 2, Poster 37

14:30 – 15:30

Natural Language Inference (NLI) is the task of determining whether a sentence pair represents entailment, contradiction, or a neutral relationship. While NLI models perform well on many inference tasks, their ability to handle fine-grained pragmatic inferences, particularly presupposition in conditionals, remains underexplored. NLI models often struggle with complex pragmatic inferences like presupposition, especially when embedded in conditional sentences. We introduce a novel dataset designed to evaluate NLI models' performance in conditional inference. Our dataset consists of 18,000 sentences of five different types of conditionals. Using our dataset, we assessed the performance of four NLI models, including two pre-trained models, RoBERTa and DeBERTa, to examine their generalization to conditional reasoning. Additionally, we evaluated Large Language Models, including GPT-4o, LLaMA, Gemma, and DeepSeek-R1, in zero-shot and few-shot prompting settings to analyze their ability to infer presuppositions with and without prior context.

Our findings indicate that NLI models struggle with presuppositional reasoning in conditionals, and fine-tuning on existing NLI datasets does not necessarily improve their performance. Based on the results of our experiments, advancing NLI requires datasets with more diverse linguistic structures and finer control over inference types. Training models on datasets like ours can help enhance their ability to handle conditional inference. The dataset, experimental framework, and results will be made publicly available to encourage ongoing research in enhancing models' capabilities for pragmatic and conditional inference within NLI tasks.

Other Authors: Daniel Dumitrescu, Diana Inkpen, Raj Singh

Embodied Cognition & Word Recall: Why We Remember Concrete Words Better

Greta Racicot, Nabila Ambrin, Philip Albert, Taylor Lemoyre, Carleton University

Room No: NI 3020, Poster Session 2, Poster 38

14:30 – 15:30

Embodied cognition suggests sensory and motor representations shape cognitive processes, including language comprehension and memory. While a significant amount of research has explored the effects of concreteness on embodiment and demonstrated that reading elicits deeper sensory-motor engagement, research concerning embodiment on linguistic processing from sentence recall remains underexplored. This study examines how word concreteness (concrete vs. abstract) and lexical class (nouns vs. verbs) influence recall latency and accuracy. To achieve this, we have established four conditions in a sentence-based recall task, where the participant is to recall a critical word matching the test condition: condition 1 consists of concrete nouns, condition 2 is abstract nouns, condition 3 is concrete verbs, and condition 4 is abstract verbs. 50 participants will be recruited via SONA and word latency (ms) and accuracy (%) will be measured. Through the Dual Coding Theory and Embodied Cognition Theory, we hypothesise that concrete nouns (condition 1) will result in reduced latency and greater accuracy due to the empirical associations with concrete words, with the highest latency and lowest accuracy happening with abstract verbs (condition 4). Results are anticipated to reveal the main effects of word concreteness and lexical class, supporting the role of embodiment in language processing and memory retrieval.

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

A Cognitively Constrained 3D Spatial Language.

Rebecca Henry, Carleton University

Room No: NI 3020, Poster Session 2, Poster 39

14:30 – 15:30

Humans are capable of imagining three dimensional scenes and spaces, a skill which can be useful for planning, navigating, and problem solving. Although an imagined scene is informed by memory, a scene generated by the mind is not an exact replica of a real life scene. There are cognitive constraints which limit the ways spaces are encoded, recalled, and imagined. For example, a scene might be stored egocentrically, meaning it is viewer dependent and aligns with a subject's heading and position, but a scene could also be stored allocentrically, solely dependent on the external environment. Landmarks, spatial boundaries (such as a window, wall, or door), and the geometry of a space tend to be encoded and recalled more strongly than small, unimportant objects. When recalling an object's location people tend to remember it being more centered than it really is. These few examples of cognitive constraints on spatial memory and imagination highlight the way a 3D scene exists in our minds. As a step toward modelling 3D scene generation computationally, a cognitively-constrained spatial language is proposed. The language is composed of key-value pairs which detail the shape, boundaries, and landmarks of the space; the objects that are imagined; and the objects' locations, spatial relationships, and all cognitively-imaginable details (such as colour or size).

Other Authors: Jim Davies

Examination of Mental Representations Between Generations

Hailey Saunders, Naya Jakmiri, Natalie Gomez Quezada, Tamaya Murray, Carleton University

Room No: NI 3020, Poster Session 2, Poster 40

14:30 – 15:30

According to theories of embodied cognition, mental representations arise from stimulation derived from the environment through various senses such as sight, smell, touch, hearing, and taste. We plan to assess if generational experiences within their environment would impact reaction time to image stimuli specific to particular generations. Because embodied cognition states that mental stimulation aids in stimulus comprehension, the association between label and object may get stronger if the connection is directly or indirectly experienced early in life and cemented through consistent exposure. Therefore, we hypothesize that generationally relevant artifacts (i.e., a rotary phone or smartphone) will be recalled faster during the decoding process compared to unfamiliar artifact's of different generations (i.e., modern or old). We believe this effect will occur due to the frequency and familiarity of the stimuli. The participants will be tasked with responding to image word pairings with a match or mismatch effect. Their reaction time will be measured using a Qualtrics test. Images unrelated to a specific generation will serve as the control. Our two groups will consist of individuals born between 1995 and 2006 (18-30 year olds) and individuals born between 1920 and 1955 (70-100 year olds). We are currently recruiting participants for our 1995 to 2006 age group through SONA and we are recruiting our 1920 to 1955 age group through a voluntary sign up process at a local retirement home. Once the recruitment process is complete we will begin data collection and analysis. The study will be complete by the deadline of April 10th, 2025.

Other Authors: Akshaya Kirithy Baskar, Olessia Jouravlev

Cognitively Modelling Visual Imagination in 3D Space

Joshua Yanowitz, Carleton University

Room No: NI 3020, Poster Session 2, Poster 41

14:30 – 15:30

AI art models, used to generate imagery from prompts, are one of the most discussed types of generative AI model and a frontier of evolution in the field of AI model design. However, despite this innovation, popular AI image generation models such as DALL-E and StableDiffusion tell us little about the process of imagination or how human artists imagine and design scenery, seeking only to mimic the art styles of existing images. The process of visually imagining a real-world 3D space relies upon and recruits two significant aspects of human cognition: imagination and spatial cognition. I propose a new model, one that seeks to be both neuraly plausible in design, as well as plausible in output, generating 3-D imagined scenes that are convincing to the human eye as the product of a living person's imagination, which will be based on prior models of human visual imagination as well as integrating a model of spatial reasoning. In my presentation, I will provide background for the design principles of this new model, designated as SOILIE v5, and describe the task that this model will be designed to accomplish, propose this new model's design and set out a means of evaluating it.

Neural Correlates of Rote Memory Recall: Investigating Pre-Semantic Processing and Working Memory Capacity in Phonetic Recital

Marwa Alkhalaf, Carleton University

Room No: NI 3020, Poster Session 2, Poster 42

14:30 – 15:30

Rote memory plays a critical role in cognitive development and academic learning, yet its neural mechanisms remain understudied, particularly in contexts where phonetic recitation precedes semantic processing. This study examines the neurophysiological correlates of rote memory encoding in children and young adults, utilizing event-related potentials (ERPs) to investigate developmental differences in memory retention and recall. We analyze collected EEG data from participants who memorized foreign language text, allowing us to isolate the effects of phonetic recitation from semantic comprehension. A primary focus is the P300 component, a well-established marker of attentional resource allocation and memory encoding, alongside heatmap analyses of neural activation patterns. This research offers insight into the developmental trajectory of rote memory processing. Our findings contribute to the broader understanding of neural plasticity in memory systems and have implications for educational practices and second language acquisition. We emphasize the generalizability of rote memory mechanisms across different learning environments. These findings inform cognitive training strategies for populations with memory deficits and enhance pedagogical approaches that rely on recitation-based learning.

Other Authors: Amedeo D'Angiuilli

A Study on Expanding on the Capabilities of Productive Failure outside of STEM

Alex Wilson, Kiranjot Hans & Joyce Chan, Carleton University

Room No: NI 3020, Poster Session 2, Poster 43

14:30 – 15:30

Productive failure is a learning paradigm that experiments with typical classroom instruction order by asking students to attempt problem solving prior to learning the typical methods for doing so. Many studies have been conducted using this intervention, but they have been biased towards specific subject matter. Most productive failure studies focus on the domains of mathematics, biology, physics, medicine, or chemistry, and the efficacy of productive failure in other contexts not well researched. We conducted a two-condition (PF vs control group) study to investigate whether learning gains in productive failure as compared to direct/traditional instruction are similar in a non-STEM domain (cognitive science).

Note: data for this project was fabricated to showcase a hypothetical outcome. We therefore do not put these results forward as definitive evidence for the proposed claims.

Other Authors: Zachary Savelson

Effects of Group Size on Learning to Program in a Productive Failure Setting

Theo Pana, Ashley Navas, Helen Awaju & Zam Onwusah, Carleton University

Room No: NI 3020, Poster Session 2, Poster 44

14:30 – 15:30

Productive Failure (PF) is an instructional approach that forces students to attempt a problem-solving task before receiving direct instruction. The trial-and-error nature of this paradigm aims to foster critical thinking and deeper conceptual understanding. While PF is widely recognized for its potential to enhance learning outcomes in various individual and collaborative learning environments, the influence of group size on learning outcomes from this paradigm remains underexplored. Given that collaborative learning methods generally promote knowledge sharing and cognitive load distribution, understanding whether this relation holds for PF is beneficial for improving on the paradigm's design. This study measured the difference in learning outcomes between dyads and triads both of whom participated in a PF intervention. Participants collaborated in groups of two or three to solve a complex programming problem, followed by an instructional video and finally an independent test assessing conceptual understanding.

Keywords: productive failure, collaborative learning, group size

Note: data for this project was fabricated to showcase a hypothetical outcome. We therefore do not put these results forward as definitive evidence for the proposed claims.

Other Authors: Zachary Savelson

Panel Discussion

Room No: NI 4010

15:30-16:30

Brains, Bots, and Big Questions: Is CogSci the Ultimate Generalist? will explore how experts from different areas of Cognitive Science integrate their knowledge, collaborate across disciplines, and engage with industry and education. The discussion will focus on both theoretical contributions and real-world applications.

Cognitive Science professors Dr. Jo-Anne LeFevre, Dr. Myrto Mylopoulos, Dr. John Anderson, Dr. Kasia Muldner, and Dr. Raj Singh will share their unique perspectives.