PsychoShorts
University of Ottawa
February 24-25, 2017

Friday February 24

12:00 p.m. – 12:05 p.m.       Opening

12:05 p.m. – 2:00 p.m.       ERP Poster Session
* Lunch will be provided

2:30 p.m. – 4:00 p.m.       Session 1: Talks
2:30-3:00 p.m.
Jean-Christophe Leclerc, Michele Burkholder, and Laura Sabourin
University of Ottawa
Naturalistic exposure influences on lexical access

3:00 p.m. – 3:30 p.m.
Carla Fernandez, Sarah Grey, and Janet van Hell
Pennsylvania State University
The neural correlates of foreign-accented speech comprehension in immersed native listeners

3:30 p.m. – 4:00 p.m.
Daniel DiGiovanni\textsuperscript{1}, Roxana-Maria Barbu\textsuperscript{2}, Georg Northoff\textsuperscript{3} and Ida Toivonen\textsuperscript{2}
\textsuperscript{1}MNI, \textsuperscript{2}Carleton University, \textsuperscript{3}Ottawa Hospital Research Institute
Neural signatures of the argument-adjunct distinction in transitive verbs

* 20 minute talks + 10 minutes discussion

5:00 p.m.       Conference Reception
Location TBD

Saturday February 25

9:00 a.m. – 10:30 a.m.       Session 2: Talks
9:00 a.m. – 9:30 a.m.
Ali Alamry and Laura Sabourin
University of Ottawa
The effect of the L1 on acquisition of L2 gender agreement in Arabic

9:30 a.m. – 10:00 a.m.
Yoriko Aizu
University of Ottawa
Knowledge and processing of Japanese passives by heritage speakers and L2 learners

10:00 a.m. – 10:30 a.m.       Coffee break

10:30 a.m. – 11:45 a.m.       Keynote Lecture
Dr. Janet van Hell (Pennsylvania State University)
Code-switching in bilingual speakers: Behavioral and electrophysiological studies

11:45 a.m. – 2:00 p.m.       Lunch (Catered Pizza Lunch)
Poster Session
2:00 p.m. – 3:30 p.m.  **Session 3: Talks**

2:00 p.m. – 2:30 p.m. **Angeline Sin Mei Tsui**¹, Maxine Berthiaume¹, Alia Chamberlain¹, Hector Almendradas¹, Lucy Erickson²,³, Erik Thiessen³ and Christopher Fennell¹

¹University of Ottawa, ²University of Maryland, College Park, ³Carnegie Mellon University

*How bilingualism influences success of a dual-input statistical learning task and attentional processes*

2:30 p.m. – 3:00 p.m. **Michèle Burkholder**

University of Ottawa

*The mixed DP asymmetry: Psycholinguistic evidence for a Distributed Morphology account*

3:00 p.m. – 3:30 p.m. **Nancy Azevedo**¹,², Eva Kehayia¹,², Ruth Ann Atchley³

¹McGill University, ²Centre for Interdisciplinary Research in Rehabilitation (CRIR) - Jewish Rehabilitation Hospital, ³University of Kansas

*Processing neighbourhood density (N): Disentangling the effects of age and language background*

3:30 p.m. – 4:00 p.m. **Coffee Break**

4:00 p.m. – 4:45 p.m. **Invited Student Lecture**

Santa Vīnerte

University of Ottawa

*Exploring cognitive control in young adult bilinguals*

4:45 p.m.  **Closing**
Investigating the role of linguistic and attentional processes in lexicality judgements in Alzheimer’s disease

Alzheimer’s disease (AD) is mainly characterized by memory impairments; yet, language difficulties are often observed, even early in the course of the disease. One aspect of language processing that behavioural studies suggest may be susceptible to alteration in AD is processing lexicality, i.e. determining whether a letter-string has a lexical status. With age, time taken to distinguish words from word-like stimuli increases. However, individuals with AD are not only slower, but may also exhibit a deficit in processing word-like stimuli. Drawing from behavioural results, we used an event-related potential (ERP) paradigm eliciting the P3 component to explore changes in processing lexicality in healthy aging (n=17) to early AD (n=10). Lexicality judgements can be performed within an ERP oddball task and this paradigm is known to elicit the P3 component for rare trials. However, since oddball tasks rely on attention, tasks measuring attentional processes can help elucidate whether deficits observed in the ERP lexical decision tasks are primarily due to an attentional deficit, a linguistic deficit, or both.

**Methods:** A combination of ERP lexical decision tasks and an attention screening were used. The latter comprised two attention tasks: number Stroop and Useful Field of View (UFOV). The lexical decision oddball task, consisted of four blocks of infrequent stimuli (20%) among frequent stimuli: words among nonwords (W-Nw); words among pseudowords (W-Ps); nonwords among words (Nw-W); pseudowords among words (Ps-W).

**Results:** Mean A’ score in the number Stroop was 0.98 for older adults and 0.95 for those with AD. For the UFOV, when compared to norms for age and education, one older adult and three with AD had a three-test total score below norms. Older adults showed a P3 (500-650 ms window, Pz electrode) in blocks contrasting words and nonwords (W-Nw: p=0.01; Nw-W: p<0.01). Those with AD showed a P3 only in blocks where words were the frequent trials (Ps-W: p=0.02; Nw-W: p=0.08).

**Discussion:** Results show that groups behaved differently regarding P3 component elicitation and suggest that older adults are sensitive to the orthography/phonology of the stimuli early in the course of lexical processing while those with AD no longer showed this sensitivity. Although an attenuation of P3 amplitude can occur due to a possible disturbance in attention, the absence of a P3 component cannot be explained by such a deficit since results from the attention screening suggest that neither group showed a marked deficit in this domain. We propose that a linguistic deficit, likely an alteration in early orthographic/phonological processing, underlies the P3 results observed in the individuals with AD.
Émilie Courteau¹, Karsten Steinhauer² and Phaedra Royle¹
¹Université de Montréal, ²McGill University

**Création d’une étude de potentiels évoqués sur le développement de la compréhension verbale chez les jeunes avec et sans trouble primaire de langage**

Les jeunes avec un trouble primaire de langage (TPL) présentent un développement hétérogène de la compréhension verbale, qui varie en fonction des sphères langagières étudiées. La technique des potentiels évoqués (PÉs) permet d’investiguer de façon formelle les processus sous-tendant la compréhension verbale et ses aspects morphosyntaxique, syntaxique et lexical. Les études de PÉs effectuées à ce jour ont démontré des différences entre le portrait développemental des jeunes neurotypiques et de ceux avec un TPL. Le développement lexical des TPL serait semblable à celui des jeunes typiques, avec un retard temporel, tandis que le développement syntaxique et morphosyntaxique serait atypique, bien que peu étudié (voir Royle & Courteau, 2013, pour une revue). Toutefois, les recherches effectuées sur ce sujet comportent fréquemment des biais expérimentaux, autant sur le plan des stimuli que sur les analyses des PÉs, ce qui nous empêche de considérer ces résultats de manière fiable. Suite à une courte revue de ces études et de leurs failles, nous présenterons notre étude de PÉs qui investiguera la compréhension du langage chez les jeunes typiques et ceux avec un TPL de 10 à 12 ans, avec le paradigme de l’extraterrestre apprenant (Labelle et Valois, 2003). Notre projet étudiera les processus sous-tendant la compréhension de la dyade nom-adjectif à l’intérieur d’un protocole équilibré, sur les conditions suivantes : manipulation de 1. la morphosyntaxe : l’accord en genre (p. ex. la chaise *vert), 2. la syntaxe (p. ex. la *verte chaise), 3. la sémantique lexicale (p. ex. entendre la chaise verte, et voir une image de FOURCHETTE verte) et 4. une condition grammaticale avec image congruente (p. ex. la chaise verte avec une image de CHAISE verte). Nous émettrons des prédicitions sur les résultats attendus relativement aux jeunes typiques et ceux avec un TPL, en fonction de chaque condition expérimentale et en lien avec notre étude précédente sur le développement typique des PÉs chez les enfants francophones (Courteau et al, 2015).
It is commonly assumed that a metaphor consists in giving one thing a name that belongs to something else. For example, when we utter a sentence like my lawyer is a shark, ‘shark’ stands for something like ‘aggressive’. How, precisely, does this metaphoric reading emerge? One competing cognitive model assumes that metaphors are first identified as anomalous on a literal reading, which prompts the search for something contextually salient. This model is supported by evidence from ERP studies showing metaphor processing exerts greater costs relative to the processing of more literally used expressions (indicated by N400). Despite the effortful processing required, using and understanding metaphors is commonplace and intuitively effortless for native (L1) speakers of their language. However, non-native (L2) learners struggle to achieve mastery of metaphor understanding in their target language, and this difficulty impacts perceptions of fluency and native-likeness in an L2 speaker. Furthermore, studies have shown that competence in using figurative language is inadequate in typical classroom language learners even after four or more years of second language learning. The challenge raised by these findings is to explain what the L2 learner is missing that would help them compute metaphorical interpretations as routinely as they would in their L1, and use this knowledge in a pedagogical setting to help L2 learners master their second language. Evidence from monolingual sentence processing suggests that literal meaning of metaphorical sentences is activated in the construction of the figurative meaning of the sentence. However, does the L2 addressee translate the literal meaning of the L2 sentence into the L1 equivalent, and then carry out the multi-step procedure for computing metaphors introduced above? Or does the L2 addressee carry out the entire procedure in the L2 itself? To address this issue, I propose an ERP method combined with a masked priming paradigm: Participants will be native speakers of French who are L2 learners of English. Participants will read and respond to a list of metaphors presented in English (e.g., my lawyer is a shark). The critical word (e.g., shark) is primed with a property associated with its literal meaning in the participants L1 (e.g., ailette, meaning ‘fin’ in English). If the N400 at shark is reduced because of the L1 prime, this would indicate that L2 learners are translating into their L1 (because ailette primes shark). Difficulties with metaphor might be due to translation difficulties, suggesting that translation procedures should be targeted in the classroom. If the N400 at shark is not reduced, this would indicate that priming was unsuccessful and thus that L2 learners are doing their interpretation in the L2 itself. Their difficulties with metaphor in L2 might be due to lacking conceptual background needed to properly reinterpret a nonsensical literal meaning, suggesting that word learning should be targeted in the classroom.
Is deep level processing possible for novel language sounds?

In previous linguistics studies regarding the acquisition of foreign language sounds, with phonemic vowel lengths in particular, researchers have mostly focused on perception using AX tasks which have led to very depressing findings. Previous work by Tsukada and colleagues (2012; 2014) on Japanese and Arabic speakers have shown that one’s L1 seem to have no effect, positive or negative, on one’s ability to distinguish and acquire novel phonemic language sounds, even if both languages have phonemic vowel length contrasts. Chladkova et al. (2013) found similar results to Tsukada where L2 learners were only successful in discriminating native phonemic sounds but not novel phonemic sounds. Lehnert-Lehouillier (2010) also found that different L1 groups performed equally poorly with regards to distinguishing and acquiring novel language sounds. For my study, I wish to go one step further and use an online task to see if participants will show a brain response to learning novel language sounds even if they are unable to consciously perform accurately on experimental tasks.

For my proposed experiment, I have also decided to work with Japanese vowel lengths as Japanese speakers are an accessible population for me to use as my control group; my experimental group will be functional monolingual speakers of English. My experiment will consist of 3 tasks. I will begin my experiment with a perceptual AX task just to ensure that participants are able to perceive the differences between the novel language sounds: Japanese vowel lengths. The second task is a training task where participants will be taught nonsense words paired with pictures of everyday items to learn the new language sound contrast where the stimuli will be presented both visually and auditorially. The last task will be an ERP task where participants’ brain waves will be recorded via EEG as they are presented with the same items from task 2 in an oddball paradigm where 80% of the pictures and sounds match while 20% are deviant. The expected result is that the control group will be able to distinguish the vowel length contrast and show a N400 for the deviant ERP trials (Luck, 2014), and the experimental group will show a less robust N400 if they were able to learn the novel vowel distinction.
This abstract describes a research proposal for a master thesis. The Complementary System Theory (CST; Davis & Gaskell, 2009) proposes that word learning entails two memory networks. Novel words are initially encoded as episodic memory traces by the hippocampal learning system. After a subsequent period of consolidation, a shift towards more systematic, lexicalized coding of the memory representation in a distributed neocortical network occurs. Previous research on CST and consolidation mostly focuses on learning new word forms, without explicitly taking semantics into account. Recently researchers have started investigating the role of word meanings. For example, in an ERP study by Bakker et al. (2015), participants learned novel printed words paired with novel meanings. Indexed by N400 and LPC components, Bakker et al. found that novel word forms had been lexicalized after a 24-hour consolidation period, whereas the semantic integration process has started but was not yet completed.

For my Master's thesis research, I propose to further examine the role of meaning by manipulating the amount of semantic overlap between to-be-learned L2 words and their L1 translations. Specifically, some new L2 words will share all semantic features with the semantic features of their L1 translations, whereas semantic features of other L2 words will only partially overlap with those of their L1 translations. In addition, the novel words will be learned via two types of training: by associating the new L2 word with a definition or with a picture. After training, a semantic priming task will be administered and EEG responses will be recorded on three occasions: immediately after exposure, 24 hours later and 7 days later. Both adults (Experiment 1) and children (Experiment 2) will be tested. Given children's relatively short attention span, further adjustments will be decided upon on the basis of the results obtained from adults. From a language development prospective, children are still developing their mental lexicon in their first language. A recent study on implicit word learning revealed that children's expressive vocabulary size correlates positively with overnight consolidation as evidenced in the lexical competition effect (Henderson et al., 2015). However, to our knowledge no research has been published that examined this relation in the consolidation of explicitly learned words.
Attentional control processes in working memory: the role of aging and bilingualism

Evidence for cognitive adaptation due to second language experience has been shown across many executive control (EC) tasks, but studies of working memory (WM), an important component of EC, have surprisingly produced more varied results. Selective attention is required for both WM and the process of language selection, and therefore may underlie when language group differences in WM appear. It has been proposed that bilinguals should outperform monolinguals on tasks of WM that require greater attentional control, especially nonverbal ones (Sullivan et al., 2016; Bialystok et al., 2014). The present study manipulated the modality (verbal vs. non-verbal) and attentional demands of a WM task while ERPs were recorded to investigate the neural correlates of processing differences in WM between younger and older adult bilinguals and monolinguals. Participants performed a verbal and nonverbal version of a running memory procedure (based on Watter et al., 2010), which allows for activity to be time-locked to item-by-item memory encoding and during retrieval. A yes/no response was made under one of three study conditions: maintenance (remember the first 3 items), update (remember the last 3 items), and baseline (look for a set of 3 items). The maintenance condition allows for a measurement of the neural correlates of maintaining a set number of items in WM and requires moderate attention. The update condition assesses the neural processes of re-encoding/incorporating new information into WM, while disregarding previously relevant information, and requires high attention. Language group effects are predicted such that complex conditions that require more attentional control and that are nonverbal should be performed better by bilinguals, with stronger effects in older age. At the neural level, we predict smaller mean amplitudes with aging for a central parietal P300-like and late positive slow wave effect associated with problems at encoding and a longer latency at retrieval in terms of the old-new effect, involving a frontal N400 for verbal stimuli and a late positive component (LPC) from 500 – 700 ms for verbal and spatial stimuli. Younger bilinguals are predicted to show larger mean amplitude at encoding and faster latency at retrieval (i.e., more efficient) than younger monolinguals. Older bilinguals are expected to show a neural signature that resembles younger adults, which may represent a compensatory effect for nonverbal WM.
Santa Vinerte and Laura Sabourin
University of Ottawa

An ERP investigation of bilingual cognitive control: the Stroop task

A body of literature suggests that bilingualism positively affects cognitive control skills, i.e., abilities such as attention, inhibition, and task-switching (e.g., Bialystok et al., 2012), but arguments against the bilingual advantage view point out that when examining results across studies, evidence for bilingual benefits is inconsistent (Paap & Greenberg, 2013). These comparisons between monolinguals and bilinguals, however, have been largely done via behavioural measures that look at the end-state of processing (e.g., reaction time of a button press), without much attention to possible differences in processing leading up to the response. The aim of the current pilot study is twofold: first, to explore the underlying neural processes in a bilingual Stroop task, and second, to compare this processing in monolingual English and bilingual English-French participants. While processing in the two groups may look similar on the surface, the underlying pathways may be vastly different.

The Stroop task consists of colour-word stimuli presented in either colour-congruent (e.g., the word RED written in red) or colour incongruent (e.g., RED written in green) conditions. A control condition consisting of high-frequency words (e.g., HOUSE) is also included. While this paradigm has been used extensively in behavioural studies, only four known studies (Kousaie & Phillips, 2012; Naylor et al., 2012; Coderre & van Heuven, 2014; Heidlmayr et al., 2015) have used the task and event-related potentials (ERPs) to examine the underlying processes of cognitive control. These studies have identified four components of importance— the N450, which has been called the "Stroop component" and reflects conflict detection and resolution; the Sustained Potential (SP), which follows incongruent trials; the N200, which indexes attention and conflict monitoring; and the P300, which has been said to reflect strategic response to the environment. Looking at bilinguals, when behavioural measures have shown no between-group differences in the Stroop task, an examination of ERP components has revealed some differences between monolingual and bilingual (e.g., Kousaie & Phillips, 2012), although the picture is far from clear.

The current project will present a proposal for an ERP Stroop study which focuses on the amplitude and latency of the four aforementioned components. The nature of the Stroop task, the experimental design employed in the current study, and the predicted outcomes for bilinguals in the Ottawa-Gatineau area will be discussed. This study hopes to add to the limited bilingual Stroop ERP literature, and to determine what, if any, effect bilingualism has on cognitive control.
Michele Burkholder and Laura Sabourin
University of Ottawa

What can native-like L2 processing tell us about underlying competence? An ERP investigation of grammatical gender and late L2 learning

To investigate a potential sensitive period in L2 acquisition, researchers have often conducted studies examining whether late L2-learners process morphosyntactic violations involving L2 features not present in their L1 similarly to native speakers. However, even if such learners do demonstrate native-like processing (e.g. Foucart & Frenck-Mestre, 2011), this does not entail that they acquired that feature in a native-like way; late-learners may employ general learning mechanisms to detect and proceduralize morphosyntactic rules (Ullman, 2005), whereas early-learners may exploit innate features (Chomsky, 1965; 2005). Ultimately, both types of learners may process violations automatically.

The proposed study seeks to investigate the relationship between native-like processing and underlying competence by focusing on how L1-speakers of English process and assign gender to nouns in L2-French. The methodology will build on that of van Berkum and colleagues (2005), who used ERPs to demonstrate that L1-speakers of Dutch use discourse context to anticipate upcoming nouns. Crucially, they found that when there was a gender mismatch between a preceding adjective and the expected noun, the adjective elicited an early positivity, indicating that the gender feature of that noun had been pre-activated. Foucart and colleagues (2014) used a similar task with late French-Spanish bilinguals and found that they also pre-activated the gender of the predicted noun in their L2, as evidenced by an N400 effect to a preceding determiner whose gender mismatched that of the expected noun. Hopp (2016) used eye-tracking to demonstrate that late L1-English learners of German also use gender predictively, but only if gender representations are stable.

In light of this, Experiment 1 of this proposed study aims to replicate the findings of van Berkum and colleagues for L1-French speakers, and extend it to late L2-learners. Based on Hopp (2016), it is hypothesized that the learners will show native-like ERP responses if they have stable gender representations. Experiment 2 will then investigate whether these results hold with newly-learned French pseudo-nouns. It is hypothesized that L1-speakers will show similar ERP effects as with known nouns because they immediately license newly-learned nouns under a gender feature, leading to stable gender representations. In contrast, it is expected that the L2-learners will not elicit these ERP effects because stable gender representations only emerge after repeated exposure leads to proceduralization. Because this task tests the path to stable gender representations, as opposed to the end result, better inferences can be made regarding the relationship between native-like processing and native-like competence.
Early exposure to a second language tends to lead to native-like processing and joint lexical stores (Sabourin et al., 2014). However, we propose that some late bilinguals can also attain this type of lexical organization, under the condition that they get a significant amount of L2 exposure in a naturalistic setting. On the other hand, some bilinguals learn their L2 in a more formal manner, giving us our two groups for Manner of Acquisition (MoA): a naturalistic exposure group and a formal exposure group (Sabourin et al., 2016). The Ottawa-Gatineau region offers a suitable participant pool for testing this type of grouping variable, as L1 French, L2 learners of English are naturalistically immersed in an English dominant environment. Conversely, L1 English, L2 learners of French are usually formally exposed to French in a school setting or in immersion programs, which tend to be more formal than chatter at the grocery store, for example.

Participants were tested using a masked priming lexical decision task paradigm, both behaviorally and with ERP's. RT and ERP data from an L1 French experiment and from an L1 English experiment will be presented. We predicted that L1 French late learners of English would show faster RTs when words were preceded by a translation prime, as well as a reduced N400 component, as a consequence of being naturalistically immersed to their L2. In contrast, L1 English late learners of French should not show these reductions, if they were formally exposed to their L2. These results would support our initial hypothesis that naturalistic exposure is similar to the simultaneous bilingual learning experience (or L1 learning experience) and that it should be a deterministic factor, along with Age of Acquisition, for bilingual brain organization.
Foreign-accented speech can challenge language processing and comprehension. Although behavioral studies show that listeners adapt quickly to foreign-accented speech (e.g., Bradlow & Bent, 2008; Clarke & Garrett, 2004), Event Related Potential (ERP) studies have shown distinct electrophysiological consequences for processing foreign accented relative to non-accented speech (Goslin, Duffy, & Floccia, 2012; Hanulíková, Van Alphen, Van Goch, & Weber, 2012; Romero-Rivas, Martin, & Costa, 2015; 2016), particularly for listeners with limited exposure to the foreign accent (Grey & Van Hell, 2017).

In an auditory ERP study, we examined whether increased exposure to a foreign accent affects the ERP correlates of semantic and grammatical processing during sentence comprehension of foreign-accented speech. A group of 40 American citizens living and studying in Beijing, China listened to Chinese-accented and American accented speakers producing English sentences that contained semantic errors (“Kaitlyn traveled across the ocean in a cactus to attend the conference”) or grammatical errors (e.g., ”Thomas was planning to attend the meeting but she missed the bus to school”), and corresponding correct sentences. ERP analyses show that Chinese-accented speech modulates semantic and grammatical processing relative to American-accented speech. Specifically, we find a significant N400 effect and a P600 effect for semantic violations in non-accented speech and a wider N400 effect for Chinese-accented speech. In terms of grammatical processing, we find a P600 effect for non-accented speech and a frontal negativity (Nref) for Chinese-accented speech. These immersed listeners’ data differ from related work testing non-immersed listeners in the US with limited exposure to Chinese-accented speech (Grey & Van Hell, 2017).

Taken together, our results indicate that increased exposure to foreign-accented speech affects the neurocognitive mechanisms of sentence comprehension in native listeners. Time-frequency analyses are currently being conducted and will be presented along with the ERP results.
The argument-adjunct distinction is well-established, but much of the research is based on introspective judgements, and electrophysical evidence confirming the behavioural findings is scarce (e.g., Friederici & Frisch, 2000). The current study uses ERPs to examine the argument-adjunct distinction in transitive verbs.

We recorded ERPs from Canadian English speakers (n=21) using a 64 channel EEG Neuroscan system. Participants heard a total of 640 sentences (512 experimental and 128 fillers). Experimental sentences were divided across the following conditions:

i) well-formed argument (e.g., The student ate yogurt.)
ii) semantically infelicitous argument (The student ate baggage.)
iii) well-formed adjunct (e.g., The student ate quickly.)
iv) semantically infelicitous adjunct (e.g., The student ate tightly.)

ERPs were time-locked to the onset of the target word (bolded). We analysed ERP comparisons of (1) well-formed and infelicitous arguments, (2) well-formed and infelicitous adjuncts, and (3) well-formed arguments and adjuncts. All effects were reliable ($p < 0.001$).

**Well-formed and infelicitous arguments:** Infelicitous arguments elicited a bi-phasic effect with an anterior negativity (N400; 300 – 400 ms) followed by a posterior positivity (P600; 550 – 600 ms), consistent with argument structure violations (e.g., Friederici & Frisch, 2000).

**Well-formed and infelicitous adjuncts:** Well-formed adjuncts elicited an early left anterior negativity (ELAN; 100 – 200 ms) when compared to infelicitous adjuncts. Traditionally, ELAN is associated with word category violations (Friederici, 2002); however, in both conditions speakers heard an adverb, suggesting that other linguistic factors may elicit ELAN.

**Well-formed arguments and adjuncts:** Here we were interested in whether there is an overall effect of argumenthood. Indeed, well-formed adjuncts elicited a greater early positivity, reminding us of P50 (50 – 100 ms). Alternatively, this early ERP component may be an artefact caused by the difference in syntactic category between the target arguments and adjuncts, as the adjuncts investigated ended with “-ly.”

Further analysis including a power law analysis comparing the argument blocks to the adjunct blocks using the mean Power Law Exponent (PLE) and time/frequency analyses were also conducted and are consistent with an argument-adjunct distinction. Overall, these findings replicate existing data and provide novel electrophysiological evidence that arguments and adjuncts are processed differently.
Previous research in second language acquisition has revealed that grammatical gender is one of the most difficult structures that non-native learners need to acquire. There are two views on gender acquisition: (i) gender features cannot be acquired in adulthood unless L2 learners have similar features in their L1, and (ii) L2 learners can acquire gender features regardless of age or L1. The first view supports Hawkins and Chan’s (1997) Failed Functional Features Hypothesis (FFFH), which states that linguistic features that are not present in L1 fail feature checking in L2 acquisition. In contrast, (ii) supports the Full Transfer/Full Access hypothesis (FTFA) (Schwartz and Sprouse, 1994, 1996), which claims that L2 learners have full access to Universal Grammar (UG) and have the same ability as L1 learners to acquire L2 features. All studies agree that L1 transfer has an effect in the initial stages of acquisition. The difference lies in their claims regarding the final outcome that L2 learners can expect to achieve.

The present study investigates the acquisition of subject-verb gender agreement in advanced L2 learners of Arabic. There were two groups: native speakers of Arabic serving as a control group (n=15), and L2 learners group (n=22). The L2 learners were divided into two subgroups, -Gender and +Gender, based on whether or not their L1 has grammatical gender. Examples of L1s in the +Gender group (n=9) are Urdu and French; examples in the –Gender group (n=12) are English, Chinese and Tajik. The reason for having these two groups was to determine how the native language could positively or negatively affect L2 gender acquisition, and thus shed light on the role of UG in L2 acquisition.

Participants performed a Grammaticality Judgment Task (GJT) with matched and mismatched subject-verb gender agreement. In addition to grammaticality and gender, the task was also controlled for animacy. The results revealed that the Arabic learners performed significantly worse than the native speaker control group in all task variables (over all accuracy, p<.001). There was also a significant difference between the L2 learners’ subgroups. Interestingly, the –Gender group outperformed +Gender group in all task variables (over all accuracy, p = .032). These results support the FTFA rather than FFFH model, as it appears that the –Gender group was able to reset their L1 gender parameter according to the L2 gender values. As for L1 transfer, the results suggest that while this effect may be found at the initial stages of acquisition, it disappears as the learners reach the intermediate and advanced proficiency levels. The outperformance of the –Gender group over +Gender group could be result of effect of proficiency in L2 as the former group obtained a better score on the proficiency task, or it could be that +Gender group had a negative transfer from their L1s. Although the learners in this study are advanced, they did not perform as well as the native speakers, which is inconsistent with both the FTFA and FFFH hypotheses. However, as they are still learning the language we can assume that they have not yet reached their final state of acquisition.
The general aim of this study is to investigate the similarities and differences in knowledge and processing of Japanese passive constructions by heritage speakers and second language (L2) learners of Japanese. I tested the two different types of passives: the type that involves the syntax-semantics-discourse interface (indirect passive and ńi-direct passive), and the one that does not involve that interface (niyotte passive). It has been found that advanced heritage speakers and L2 learners have difficulties with structures involving different structural levels, especially structures at the interface with discourse (Laleko & Polinsky, 2013; Montrul & Polinsky, 2011, among many others), as the interfaces involving an external cognitive domain (e.g., syntax-discourse) require more processing resources than linguistic internal interfaces (e.g., syntax-semantics) (Sorace, 2011). While such representational and processing difficulties have been reported for several languages, previous studies on the acquisition of Japanese passives by both L1 and L2 learners have found the opposite, and affective passives, passive type that is pragmatic dependent, is acquired earlier than pragmatic independent niyotte passive. These results may be attributed to more complex syntax derivation of niyotte passive.

Examining the knowledge and processing of Japanese passives allows us to analyse the factors that play a crucial role in determining the difficulty of acquisition. In order to investigate these factors, I used two experimental tasks, an acceptability judgment task (AJT) and a self-paced listening task (SPL). The former investigated heritage speakers’ and Japanese as a foreign language (JFL) learners’ knowledge of each type of Japanese passives. The latter allowed us to test whether there are any differences in the processing of the two types of passives; specifically, whether the passives with an external interface are more difficult for JFL learners and heritage speakers to process.

The results of the AJT was contrastive between the heritage speakers, which suggested that different manners of input lead to different acquisition outcomes. Furthermore, neither group demonstrated knowledge of the low frequency niyotte passive, indicating that input frequency, appear to be critical for the acquisition of Japanese passives. With respect to the SPL, the speakers’ performance was native-like in the case of the heritage speakers but non-native with the JFL learners, indicating that early age of exposure has an effect on language processing. Taken together, the results from the both tasks showcase the importance of both implicit and explicit manner of input, especially in the case of low frequency structures, as well as the early age of acquisition of a language.
A unique feature of bilingual speech is that bilinguals often produce utterances that switch between languages, such as “I ate huevos para el desayuno” [eggs for breakfast]. The large majority of psycholinguistic and neurocognitive studies examining switching between languages have focused on the processing of a series of single, unrelated items (e.g., unrelated words, numbers, or pictures) rather than switching between languages in a meaningful utterance (e.g., a sentence). However, an emergent body of studies seek to examine the cognitive and neural correlates of language switching in more naturally occurring situations: language switching within meaningful sentences. I will present recent psycholinguistic and electrophysiological studies that examined intra-sentential code-switching in production and comprehension. What are the mechanisms that drive bilinguals to switch into the other language when interacting with other bilinguals? Furthermore, in comprehension, reading or listening to code-switched sentences incurs increased processing demands when compared to single-language sentences. I will also discuss evidence showing that switching direction (switching from the first language to the second language, or vice versa) and accented speech modulate switching costs when bilinguals read or listen to code-switched sentences. Together these studies attest to the value of integrating psycholinguistic and neurocognitive approaches to gain more insight into the neural and cognitive mechanisms of intra-sentential code-switching in comprehension and production.
Poster Session (Saturday) 11:45-2:00pm

Roxana-Maria Barbu and Ida Toivonen
University of Ottawa

Argument structure in high functioning ASD: an auditory ERP study

**Introduction.** Autism is correlated with language and communication challenges. Most evidence for these challenges comes from pragmatics and social communication problems, and other aspects of language have received less attention. This project investigates the processing of argument structure in individuals with autism. Previous work on argument structure in autism is limited to two studies (Ambridge *et al.*, 2015; Janke & Perovic, 2015), both suggesting impairment in argument structure in autistic individuals. Specifically, Ambridge *et al.* showed that autistic individuals show less of a dispreference for sentences such as *He fell the cup* than non-autistic individuals. Janke and Perovic showed that autistic and non-autistic individuals performed similarly on one- or two-argument verbs; however, in the case of three-argument verbs, autistic individuals omitted the third argument while non-autistic individuals did not. This study uses an auditory ERP method to investigate processing of arguments in autism.

**Methods.** Twenty high functioning autistic and twenty age-matched controls will be recruited. Speakers will be exposed to sentences in two conditions (see stimuli below). Two factors will be crossed: argument type (optional vs obligatory; a1 vs b1 and a2 vs b2) and absence (a1 vs a2 and b1 vs b2).

**Predictions.** We expect to see a difference between expressed optional and obligatory arguments in both autistic and non-autistic arguments (ie., a1 vs b1). With respect to absent optional and obligatory arguments (a2 vs b2), we expect autistic individuals to process the silence differently than non-autistic individuals. Specifically, we expect autistic individuals to have difficulty with both silences, not only the ones corresponding to obligatory arguments, while non-autistic individuals should have no difficulty processing a missing optional argument. In terms of ERP expectations, it is hard to make a prediction, as to the best of my knowledge, no one has previously compared a lexical item with a corresponding silence.

**Conclusion.** This study will provide ERP evidence as to whether there is a mismatch between autistic and non-autistic individuals’ grammar.

Example stimuli (ERPs were time-locked at the left edge of the bolded word)

a1) Sarah ate a pizza with Chris. (optional argument, provided)
a2) Sarah ate (silence inserted) with Chris. (optional argument, missing)
b1) Sarah made a cake with Chris. (obligatory argument, provided)
b2) Sarah made (silence inserted) with Chris. (obligatory argument, missing)
Production benefits recall of novel words with frequent, but not infrequent phonotactic probabilities

Previous research shows that production facilitates the recall of words containing familiar phonemes. Coined the production effect, participants have greater recall of words that are produced aloud during training than words that are heard-only, mouthed, or silently read (Macleod et al., 2010; Forrin et al., 2012). The production effect is robust when words contain familiar phonemes, but reversed when words contain unfamiliar phonemes (Kaushanskaya & Yoo, 2011). Thus far, the production effect has only been investigated between a native language and languages containing unfamiliar phonemes (Baese-Berk et al., 2016; Forrin et al., 2012; Kaushanskaya & Yoo, 2011). Within a language, the role of production may pattern similarly or distinctly to the way it patterns between languages. The current study looks to investigate how the production effect manifests within a language by using non-words containing phonemes that vary in phonological frequency. If differences in the rate of recall are attributed to phonological frequency, this may indicate that uncommon native sounds are treated similarly to non-native sounds within the mental lexicon.

The study involves a training phase and a test phase. During training, participants listen to non-words containing either frequent or infrequent English sounds (e.g., high frequency stimuli includes /bom/ and /nɪs/; low frequency stimuli includes /dʒɔf/ and /tʃɔb/). Participants are either instructed to repeat the non-word aloud (produced condition) or remain silent (heard-only condition). At test, participants verbally recall as many non-words as possible and the frequency of accurately recalled non-words is compared during analysis.

A significant interaction between training condition (produced or heard-only) and phonological frequency was observed. The production of items during training facilitated the recall of non-words with frequent sounds, but had no effect on the recall of non-words with infrequent sounds. The findings are consistent with the production effect and the results of previous studies. However, the reverse production effect was not found for non-words containing infrequent sounds. The findings suggest that although infrequent sounds pattern differently than frequent sounds, they are not treated in the same way as non-native sounds within the mental lexicon. By testing both frequent and infrequent sounds within a language, this study contributes to the knowledge on the production effect and exhibits its distinctive link in short-term memory. The findings may also have future implications on the understanding and application of word learning pedagogies among adults.
Background. One way in which monolingual children learn new words is through shared book reading (Sénéchal & Cornell, 1993). However, many children are raised learning more than one language. There are different ways in which bilingual children can be exposed to storybooks in their two languages (Ernst-Slavit & Mulhern, 2003). The current study sought to assess whether the format of a bilingual story affects word learning in bilingual children. We also compared performance in children’s dominant and non-dominant languages across books formats.

Procedure. Twenty-four French-English bilingual five-year-olds were randomly assigned to one of two conditions, single-language book reading or bilingual book reading. Children in the single-language book condition were read an original story twice: once in French and once in English (order counterbalanced). Children in the bilingual book condition were read the same story with complete translations provided on each page. Five novel objects and their labels were presented throughout the story. The novel labels were dissimilar-sounding across languages and all words were monosyllabic. Each object was presented twice in each language to further ensure word learning. Children were then tested on their novel word learning in each language separately through a pointing task. Children were asked to identify the named object from a two-by-two matrix containing four object images. Identifying the correct object indicated successful word learning. Testing was blocked by language to avoid additional language mixing.

Results. Children in the single-language book condition learned novel words in both their dominant language ($M = 2.42$) and their non-dominant language ($M = 2.75$). Children in the bilingual book condition were also successful at learning novel words in their dominant language ($M = 2.83$) and their non-dominant language ($M = 2.75$). A repeated measures analysis of variance showed no interaction between book format and language dominance, $F(1,23) = 1.092$, $p = .788$. No significant difference was found between book formats, $F(1,23) = .013$, $p = .912$ nor between languages within subjects, $F(1,23) = .081$, $p = .778$ (See Figure 1).

Discussion. These findings demonstrate that reading to bilingual children in both of their languages supports word learning, either by reading single-language books or bilingual books. Moreover, they are equally adept at learning words in their dominant and non-dominant languages. Together, these findings suggest that bilingual children are flexible word learners across both of their languages, and that a variety of reading strategies can promote bilingual word learning.
Myriam Ducos¹, Ray Therrien¹, Henny Yeung² and Tania Zamuner¹
¹University of Ottawa, ²Simon Fraser University

AV Prime: a speech perception study

From infancy, learners use auditory information to acquire language (1). Previous research shows that at 6 months, infants can correctly associate a word to an image (e.g. when they hear word ‘feet’, they will look towards the correct image (2)). In developmental linguistics, current studies increasingly focus on the role of visual and auditory speech cues and how these are integrated in language development (3, 4, 5). A crucial question is whether learners can identify a word based solely on visual information available during pronunciation (i.e. lip-reading). Although motor activities and sensory perception allow an infant to learn about and improve their abilities in interpreting linguistic information, the use of these cues and how a learner’s knowledge of these cues develops over time is still largely undetermined(6). Specifically, we have yet to understand the effects of strictly visual (henceforth V, i.e. visible movement of speech articulators), when compared to strictly auditory (A, i.e. heard only), or audiovisual information (AV, i.e. both auditory and visual cues).

This pilot study aimed to determine whether children benefited more from an A or V information. A decrease in performance was predicted according to the following scale: AV stimuli would trigger optimal processing of speech cues, while A stimuli would lead to less accurate reactions, and consequently, performance with V stimuli would be the lowest. Participants were English monolingual children between 2 and 12 years. They were divided into two groups, both of which were first exposed to AV stimuli; one group was then exposed to A stimuli and the other to V stimuli. Half of the targets began with /b/ (e.g. ‘ball’), visually easy to perceive thanks to the place of articulation (bilabial), while the other half started with the /k/ (e.g. ‘cow’), also with visual cues, though less salient than labial cues. Using an eyetracking methodology, the goal was to see whether children could successfully associate a given stimulus to its target picture under AV vs. A or V conditions. Preliminary results with 10 children were in line with the predicted results. The results of this psycholinguistic study will allow us to better comprehend the evolution of children’s association of a visual speech gesture to a sound — and, in a more general fashion, the subtle interactions between sound, vision and movements throughout language acquisition.
Isabell Hubert and Juhani Järvikivi  
University of Alberta 

*Extralinguistic information in language comprehension: the influence of individual personality differences*

The fields of linguistics and psycholinguistics have traditionally averaged over individual differences and extra-linguistic information to make inferences about a population. In line with an emerging trend, this present study investigates whether a listener's personality traits or political beliefs, instead of treating them as “noise” [11], systematically influence language comprehension. 

Prior research suggests that an individual’s personality influences their language use [7] and offline processing of errors [2]; ERP research additionally suggests that mood [10] and both the listener’s [9] and the speaker’s perceived identity [8] systematically influence neural responses to violations. High empathizers responded more strongly to socially contradictory information [11], presumably because they engage in more stereotype-based prediction, and hence experience more surprisal at clashing information. 

We analyzed response times (RT’s) to three kinds of violations in a self-paced listening paradigm: Morpho-syntactic ("I constantly wears my watch [critical segment], even [post-critical segment] at night [final segment]"), semantic/pragmatic ("Cats frequently hunt bricks around their homes"), and identity clashing ("I always enjoy knitting in my free time", spoken by a male), while also assessing the participants’ personality via the standardized Big Five [5,6], Interpersonal Reactivity Index [3], and Empathy Questionnaire [1]. 

Results from linear mixed effects modelling (\(t \geq 2\) and \(p \leq .05\)) indicate that RT’s were significantly slower in the critical segment in response to morpho-syntactic errors, and influenced by a number of personality scores (faster the higher the Extroversion and Openness scores; slower the higher the Distress scores). 

While semantic errors caused a significant delay in the final segment, participants scoring highly on the Conscientiousness, Openness, Extroversion, EQ, and Perspective-Taking scales responded to them faster than baseline. This hints at individuals with these traits remaining practically unaffected by semantic errors. Conversely, high Distress scores compounded the delay, suggesting that easily distressed individuals have a harder time coping with semantic errors. 

An interaction was observed in the final segment between the speaker's gender and high-strength identity clashes: RT’s were significantly longer when the clash was produced by a male as compared to a female, suggesting an effect of the speaker’s perceived identity. 

While the direction of some personality effects conflicts with some prior research [8,9,10,11], results still suggest that both a listener's personality and a speaker's perceived identity influence language comprehension early on (cf. [4]). Further plans for this project include an ERP study to investigate the effects in greater detail.
One of the tools often used in psycholinguistic research is the Stroop task, developed by J.R. Stroop in 1935 to research the effect of two types of stimuli being processed simultaneously: In this timed task, a list of colour words are printed in incongruent ink colours; participants are asked to say aloud the ink colour of each list item. This tool aids in researching the degree of automaticity of language processes.

The results of this task as conducted by Stroop (1935) noted that participants consistently erred by naming the word rather than the ink colour. These results provided evidence for the argument that language processes are more automatic because participants had difficulty controlling this behaviour. Furthermore, Stroop (1935) and others (Golden, 1974; Greene and Gynther, 1995; Rich, 1977) found that colour-naming tasks such as this revealed a significantly faster reaction time in female participants, which was originally attributed to their more common practice of colour-related hobbies, such as aesthetics or fashion. However, more recent studies of the male and female brain have found differences in the neural pathways of both, suggesting that females are faster for another reason (Ingalhalikar et al., 2014).

According to Ingalhalikar et al. (2014), the male brain contains a higher concentration of neural connections intrahemispherically, while the female brain exhibits stronger bilateral connections. Additionally, studies from Hinojosa et al. (2001) suggest that the brain stores open-class lexical items bilaterally, even though language processes have been found to be lateralized to the left hemisphere. This suggests that if females have stronger connections bilaterally, they may be capable of processing and disregarding linguistic information particularly faster than males, whose language processes are more strongly lateralized. In this presentation we intend to show, through results from our own research data, that the differences in processing time between the two sexes can be better explained by the characteristics of the neural pathways than by cultural tendencies.

Participants from the Ottawa-Gatineau area were collected to perform a series of Stroop tasks progressively decreasing in strength of the interfering linguistic stimuli. Additionally, participants were asked to complete a questionnaire indicating any colour-related hobbies they pursued. The answers retrieved from these questionnaires provide counter-evidence to the cultural argument, as males on average listed more hobbies than did females. The results of the task were also consistent with previous studies, however the tasks with weaker linguistic stimuli revealed increasingly similar results between sexes.
Complex predicates (CPs) are constructions containing a light verb, i.e. a semantically bleached verb (Wittenberg et al., 2014). For example, comparing non-light construction (NLC) “Sara took a book” with light construction (LC) “Sara took a walk”, the event characteristics of the later case, is not fully determined by the main predicate “take”; the bulk of the meaning stems from the de-verbal element “walk” (Goldberg, 2003). Theoretically, these types of constructions have attracted a vast array of research, because they display a lack of correspondence between semantic and syntactic argument structures (Hale and Keyser, 1993). An important part of understanding these constructions is understanding the lexical representation of the verbs that engage in both LC and NLC. The processing of LCs has received increasing attention in the psycholinguistics literature because of their special characteristic of lying somewhere between non-compositional idioms and fully compositional structures (Wittenberg et al., 2014).

There are two main approaches regarding the representation of light verbs in the mental lexicon and consequently regarding their processing (Wittenberg and Piñango, 2011). One approach considers two separate entries for the light versus non-light versions of a verb. This approach implicitly predicts less processing cost (and faster retrieval) for the light verb constructions mainly based on the higher frequency use of LC compared to their non-light counterparts. The other approach proposes that dual verbs are originally semantically underspecified and the lexical retrieval of the non-verbal element triggers either the light or non-light version of the verb. When the non-verbal element triggers light specification, an increased processing cost is expected as a result of real-time composition of “joint predication” between the light verb and the non-verbal element that imposes extra syntactic-semantic computation for the non-canonical light constructions (Wittenberg and Piñango, 2011).

Persian CPs have been widely investigated from theoretical perspectives with little consensus among researchers on their characteristics. Two main approaches in the literature, through different reasoning, converge on a similar conclusion: Persian NLCs are retrieved and processed faster than their non-light counterparts (Folli et al., 2005, Wittenberg at al., 2014).

The present study will be an attempt to examine the processing of Persian CPs in both monolingual and bilingual participants. Monolingual Persian participants and Persian-English bilingual participants will be tested in a behavioral study. The task will be a self-paced reading task. Because manipulation of the sentences might make them both grammatically or semantically odd, participants will be asked to judge the neutrality of the sentence in Persian. The dependent measures will be both reaction time and accuracy of the responses. Stimuli will be sentences containing verbs with a. non-light sense (Sara be Sue kado dad. Sara to Sue gift gave. “Sara gave a gift to Sue”), b. light sense (e.g. Sara be Sue ta’lim dad. Sara to Sue gave education. “Sara educated Sue”), and c. fully idiomatic sense (Sara be Sue gush dad. Sara to Sue gave ear. “Sara listened to Sue) and d. anomalous sentences manipulating both verbal and de-verbal elements of each group. Monolingual group will be exposed to sentences in Persian, and the bilingual group will be exposed to sentences in their two languages in different blocks. Performance of the bilingual group on English sentences will be compared to performance of a monolingual English speaker group who do the same task in English. The initial prediction is that idiomatic constructions will be processed the fastest, because they are stored as a unit in the lexicon.

Light verb constructions will pose a processing cost and will be the slowest, based on the underspecification approach (Wittenberg and Piñango, 2011). If the predictions are true, it will be argued that a one-to-whole theoretical solution for Persian CPs cannot give us a clear picture. Instead Persian CPs should be treated in a categorical manner, based on their degree of idiomaticity. The addition of a bilingual group will allow us to generalize the previous findings to bilingual processing. This study will serve as the first step in determining the nature and time course of Persian CPs.
Sadaf Pour Iliaei and Krista Byers-Heinlein  
Concordia University  
*How bilingualism affects infant cognitive control*

**Background:**
Bilinguals show cognitive advantages relative to monolinguals (Bialystok, 1988), but there is much controversy about how and when such cognitive advantages originate. Many theorists argue that bilinguals have enhanced cognitive abilities because they must constantly inhibit one language while speaking the other language (Meuter & Allport, 1999). Yet, new evidence suggests that bilingual cognitive advantages are not necessarily linked to production. Two studies have reported cognitive advantages even in preverbal bilingual infants (Kovacs & Mehler, 2009a, 2009b). There is also some evidence for cognitive advantages in bilingual infants as they begin to speak (24-month-olds; Poulin-Dubois et al., 2011). The goal of the proposed research is to replicate and extend these findings. We plan to compare 7- and 20-month-old monolingual and bilingual infants on a response inhibition task that is appropriate for both ages. Our approach will provide further evidence concerning the age at which bilinguals show a cognitive advantage, and address whether the nature of the bilingual advantage changes as infants begin producing language.

**Methods and procedures:**
Participants will be 40 French or English monolingual infants and 40 French-English bilingual infants. Half will be aged 7 months, and the other half will be aged 20 months. Infants will sit on their parent’s lap in front of an eye tracker. During 9 training trials, infants will see a visual cue (a colourful shape), followed by a visual reward on one side of the screen (a bright animation, for example on the right side). Infants are expected to learn that the cue predicts the reward, and anticipate its appearance by looking towards the trained side (right) even before the reward appears. At test, the reward will switch sides (e.g., begin appearing on the left). To successfully anticipate the reward, infants will need to inhibit the previously learned response (looking right when seeing the cue) and produce a new response (begin looking left when seeing the cue). We will measure infants’ success about orienting to the new side at test, and will compare monolinguals and bilinguals at both ages.

**Research contribution:**
The proposed research will inform the developmental trajectory of cognitive advantages in bilingual infants as they move from the preverbal to the verbal stage. It will also expand our understanding of whether bilingual cognitive advantages originate specifically from producing or more generally from processing two languages.
Background: In everyday real life, we receive auditory and visual information that should either be acted upon immediately or kept in memory for later actions. Information that has to be kept available for ongoing task performance is thought to be kept in working memory (WM). However, the limited capacity of WM \([1,2,3]\) imposes restrictions on the processing, storage, and retrieval of information. A few previous studies \([4,5,6]\) have examined the role of working memory resources in following spoken instructions in participants’ first language (L1). However, very little is known about the extra WM load added by processing input in a non-dominant language (L2) by late but fluent adult bilinguals. Can individual differences in WM capacity predict performance?

Method: 30 Persian-English bilinguals (15 males) and 37 native speakers of English (31 females) participated in an experiment consisting of four tasks. The participants were randomly assigned to listen to 12 sequences of 5 auditory instructions, and either perform or verbally recall them in the correct serial order. We tested bilinguals in two separate sessions with a one-week interval. To assess the participants’ phonological and general WM capacity, we used the non-word repetition and the automated operation span tasks. The latter task combined arithmetic operations and memory for words to assess the simultaneous processing and storage capacity in working memory. We used both Persian and English versions of the operation span task for the bilinguals. A self-reported language background questionnaire was used to assess bilinguals’ language history, functional proficiency, language use, dominance and preference in both languages.

Results: There was a significant main effect of task (recall vs. performance), \(p< 0.0001\). Participants recalled fewer instructions verbally compared to performing them. For the bilinguals, there was a significant main effect of language, \(p<0.001\), with advantage for the tasks presented in the bilinguals’ dominant language. The ability to follow the spoken instructions was significantly correlated with the results of the operation span task. Subjects with higher working memory capacity performed better in acting and recalling the instructions. The correlation between L2 complex memory span and bilinguals’ performance in L2 tasks was higher than those in L1. There were no significant differences between bilinguals’ WM capacities in L1 and L2. However, the reading times were significantly longer in the tasks presented in the second language.

Conclusion: The results reveal that working memory is burdened when the instructions in bilinguals’ non-dominant language have to be followed. Despite syntactically simple instructions used in the tasks, the trade-off between processing and storage was more evident when the tasks were presented in bilinguals’ L2. Thus, processing input in a non-native language is demanding and appears to consume bilinguals’ internal cognitive resources. The results of the complex span tasks are consistent with the findings of other studies that WM capacity depends on the proficiency level and might be the same in L1 and L2 in proficient L2 learners \([7, 8, 9, 10]\). However, larger working memory capacity can compensate for the extra load when bilinguals have to carry out tasks or responsibilities in their non-dominant language.

Key Words: Working memory, complex span task, language processing, bilingualism
Studies with adults have found that a robust production effect in which producing the words out loud creates a distinctive link in the short-term memory when compared to other training conditions such as silent reading, writing, hearing-only, or mouthing words silently (MacLeod et al., 2010; Forrin et al., 2012; Zamuner et al., 2016). The Production Effect refers to participants’ increased recognition and recall abilities of these words. Studies of the production effect in children have found contradictory results. Children at age 5;0 show a production effect for known items (Icht & Mama, 2015). However, a reverse production effect has also been found when using non-word stimuli (Zamuner et., 2016). In a preferential looking procedure, children (ages 4;6 to 6;0) looked longer to non-word targets that were heard-only at training compared to produced. This may be due to the difficulty of the task where producing the non-word resulted in a processing overload and decreased recognition ability in children.

The current study looks to ameliorate the possible task effects found by Zamuner et al., (2016) and to replicate the results of Icht and Mama (2015) by using real-word stimuli as opposed to non-words. Children ages 2;6 to 6;0 are trained to repeat, listen-only, or look-only to known images. Chosen items are words known to at least 80% of children at age 2;6 and are verified by parental questionnaire. The three training conditions correspond to three training images (mouth, ear, eye). Children are presented with the target and the training images on a computer screen. Training performance is recorded for offline coding and trials in which children make training mistakes (e.g. saying the name of the image on a heard-only trial) are excluded. After a short distraction task, children are asked to recall as many items as possible and the number of accurately recalled words is analyzed.

Removing the word-learning aspect of studies using non-word stimuli should simplify the training task leading to the traditional advantage of produced over heard-only words. Preliminary results (n=16) suggest greater recall for items produced at training compared to listen-only or look-only items. This replicates the results of previous studies with both children and adults. Further analyses will be carried out to determine the course of development of the production effect comparing younger children with older children.
The Stroop task has enjoyed over 80 years of popularity in research. This simple task presents participants with two types of colour-word stimuli: colour-congruent (e.g., the word RED written in red font) or colour incongruent (e.g., RED written in green font), and participants need to name the colour of the text as quickly as possible. Because participants must inhibit the interfering information from the written word and attend to the relevant information to correctly name the colour, the Stroop task has been used to investigate cognitive control abilities in bilinguals. Results of these studies are inconsistent, leading to debate among researchers regarding the existence of bilingual advantages.

The Stroop task itself is not a standardized paradigm and a number of variations across studies exist. For example, studies may include or exclude a control condition, use different languages, and different response modalities. Apart from task differences, results of previous bilingual Stroop studies have been mixed. While some show smaller Stroop interference for bilinguals, others show faster overall reaction times. This makes it difficult to specify what, if any, advantages are conferred by bilingualism. As such, the current meta-analysis aims to determine, while taking into consideration within-task differences, whether bilingualism has any effect on Stroop performance.

Our meta-analysis will provide a quantitative and clear answer of how bilingualism impacts performance of Stroop task. First, with its cumulative effect of summarizing multiple studies, our meta-analysis will generate an average effect size for power analysis of future studies. Importantly, we rigorously control the between-task effects by including multiple moderators and identify important factors that explain how bilingualism (e.g., participants’ age of acquisition of the second language, language proficiency, the language used in the Stroop task) influence the Stroop effect. Finally, we will conduct publication bias tests, which provide implications to replications and reliability of the Stroop task.

In sum, our study provides a model of task performance that assess how the common-used Stroop task measures cognitive control ability in bilinguals. Our model will investigate how different linguistic factors in bilingualism influence the cognitive control ability, providing a powerful and quantitative test on the theory of bilingual control advantage (e.g., Bialystok et al., 2008). Furthermore, it provides a basis for comparison with other cognitive control experimental methods. This will offer a richer picture of the reliability and converge validity of cognitive tasks and facilitate researchers to design a good experiment in future.
Session 3: Talks (Saturday)

2:00-2:30pm
Angeline Sin Mei Tsui¹, Maxine Berthiaume¹, Alia Chamberlain¹, Hector Almendrades¹, Lucy Erickson²,³, Erik Thiessen³ and Christopher Fennell¹
¹University of Ottawa, ²University of Maryland, College Park, ³Carnegie Mellon University
How bilingualism influences success of a dual-input statistical learning task and attentional processes

Statistical learning, the ability to track statistical properties of the input, has been hypothesized to be a crucial mechanism for early language acquisition (e.g., Saffran, 2003). To date, most studies have examined statistical learning using a single input language. Given the global prevalence of bilingualism, it is important to investigate how learners track the statistical regularities of two input languages. The few studies conducted thus far have shown that adults only succeeded in segmenting words from two artificial languages when supported by strong contextual cues that separate the language at the individual level (e.g., the two languages associated with individuals of different genders; Weiss, Gerfen & Mitchel, 2009). However, in natural settings, two distinct languages can be spoken by one individual (i.e., one individual code-switching). Further, prior research focused exclusively on monolinguals and none has examined what attentional processes may enable the separation of two input streams. The latter issue is relevant in our study, as bilinguals may have enhanced executive functioning, resulting from experience separating and switching between languages (Bialystok, Craik, Luk, 2012). Thus, our goal was to extend these studies to a bilingual population, important in the context of examining attention, and to explore whether contextual cues in a single individual’s speech (accent cues) can facilitate adult segmentation of two artificial languages.

We exposed 23 English monolinguals, 23 simultaneous French-English bilinguals and 23 sequential French-English bilinguals to two artificial languages spoken by a single individual in either a Canadian English or French accent. Our results showed that participants successfully segmented one of the languages (t(68)=5.224, p<0.001), suggesting accent is sufficient for language separation but is not a strong enough cue for successful acquisition of both languages. Importantly, we found simultaneous bilinguals significantly outperformed monolinguals (p=0.025) and sequential bilinguals (p=0.019). We also tested participants in the Attentional Network Task (Fan et al., 2002) and the Color-Shape Switching Task (Prior & MacWhinney, 2010) to explore what attentional processes may contribute to this bilingual advantage. These tasks measure alerting (alert state to prepare for sensory input), orienting (selecting information from input), executive control (monitoring information conflicts), and switching (shifting between mental sets). Surprisingly, our results suggested that orienting attention was negatively related to the bilinguals’ success (p=0.05). We suggest that dual-input segmentation is a complex task and thus limited orienting attention may actually facilitate learning by making the task more implicit, lending support to the “less is more” hypothesis (Newport, 1990).
In studies investigating the grammar of language mixing, a well-known puzzle that researchers have endeavoured to explain is the Spanish-English Determiner Phrase (DP) asymmetry: the claim that it is grammatical to switch between a Spanish determiner and an English noun (e.g. *la casa), but not between an English determiner and a Spanish noun (e.g. the casa). Taking a Minimalist (Chomsky, 2005) perspective, MacSwan (2005) and others have argued that this asymmetry is essentially a consequence of the fact that Spanish has grammatical gender whereas English does not. In contrast, however, Norwegian-English data reported by Alexiadou et al. (2015) suggest that there is no DP asymmetry in this pair, despite a similar underlying gender asymmetry. As such, the role that gender plays appears more complex than originally thought.

The current study thus has two primary objectives. The first is to provide an account of why the mixed DP asymmetry appears to exist in Spanish-English, but not Norwegian-English. Using the theoretical perspective of the Distributed Morphology framework (Halle & Marantz, 1993; Kramer, 2015), I propose that it is not gender alone that is the source of the Spanish-English asymmetry, but the interaction between gender and declension class. Importantly, this interaction does not impact Norwegian-English.

The second objective is to provide experimental evidence supporting the predictions of this account for French-English. Because French does not have declension class, it is hypothesized that French-English DPs should exhibit no asymmetry. Participants were 14 native speakers of French with high proficiency in and early exposure to English, and who reported mixing these languages. They performed a self-paced reading task with mixed language sentences, and provided acceptability ratings. Critical trials manipulated three variables: Determiner Language (French/English), DP Type (mixed/unmixed) and Determiner Gender (masculine/feminine). Reading times (RTs) to critical nouns and global acceptability ratings were analyzed.

Results for RTs (consistent with those for ratings), indicated that participants processed unmixed DPs more quickly than mixed DPs (F(1,12)=19.213, p=.001), but crucially, they had no preference for switches involving a French determiner and an English noun (interaction: p=.468), supporting the hypothesis. While the three-way interaction was not significant, a pattern emerged whereby the results for ratings suggested participants preferred assigning analogical gender to English nouns, but results for more subconscious RTs suggested they preferred assigning masculine default gender. Further testing is ongoing. If these patterns are statistically robust, this has interesting implications for how translations are stored in the bilingual lexicon.
3:00-3:30pm
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*Processing neighbourhood density (N): Disentangling the effects of age and language background*

Processing lexicality is known to be influenced by many factors, including the number of lexical neighbours an item has. In young adults (YAs), neighbourhood density (N) has a paradoxical influence on a person’s ability to make lexicality judgements, called the N effect; a large lexical neighbourhood will facilitate word access (fast reaction times (RTs) and low error rate) but be inhibitory for pseudowords (slower RTs and higher error rate) in English. Data from a visual lexical decision task investigating changes in how N is processed in healthy aging showed two interesting findings. 1) While YAs showed the predicted N effect for words and pseudowords, older adults (OAs) showed an N effect for pseudowords only. 2) YAs made significantly more errors to high-N pseudowords than OAs (but not to low-N pseudowords nor to high- or low-N words). While these differences were attributed to age differences between the groups, it is possible that they may have been related to differences in language background between groups. YAs were all monolingual English-speaking but OAs, while dominant English-speaking, were bilingual or multilingual. As a first step in investigating whether language background may be influencing performance on the lexical decision tasks, we are running the experiment on a group of YAs who have a similar language background to the OAs.

**Methods:** Simple lexical decision task probing three stimuli types: *words* (n=160: 80 nouns and 80 verbs); *pseudowords* (n=80), each controlled for length and number of lexical neighbours; and *nonwords* (n=80). Word stimuli had a moderately high frequency of use in English (mean= approximately 10 occurrences/million). Words and pseudowords were divided into low versus high neighbourhood density groups. Stimuli with 0 to 2 neighbours comprised the low-N group while stimuli with 5 to 18 neighbours made up the high-N group, nonwords had 0 lexical neighbours.

**Participants:** While data collection is on-going, to date 21 dominant English-speaking bilingual/multilingual YAs (13F, age 19-28) have participated.

**Preliminary Results and Conclusions:** Thus far, we observe 2 main findings: 1) As was observed for monolingual YAs (but in contrast to results for OAs), bilingual/multilingual YAs made a high number of errors to high N pseudowords (mean: 19%, 95% CI: 14%-23%) which suggests that over-accepting high-N pseudowords is related to age rather than to language background. 2) As was observed for the OAs (but in contrast to results for monolingual YAs), bilingual/multilingual YAs showed an N effect for pseudowords (97 ms inhibition) but no N effect for words (8 ms facilitation) which suggests that the difference in processing N is likely related to language background.
Invited Student Lecture (Saturday)

4:00-4:45pm
Santa Vīnerte
University of Ottawa
Exploring cognitive control in young adult bilinguals

While early views of bilingualism were often negative, it is now clear that knowing more than one language has considerable communicative, social, and professional advantages. However, what is less clear is whether these advantages extend to general cognitive control abilities, which include, but are not limited to, processes such as paying attention, ignoring irrelevant information, task switching, and multitasking. The aim of the current study is to explore how these abilities are affected by bilingualism for young adults.

A bilingual's two languages are active in parallel in any given situation, and consequently, the bilingual must use cognitive control processes to attend to the language of discourse and manage interference from the language not in use. The same general processes are recruited for both language and domain-general cognitive control, and because of extensive use in managing language, cognitive control skills may be improved for bilinguals (Bialystok et al., 2012).

Indeed, a number of studies report cognitive control advantages for bilinguals relative to monolinguals in both linguistic and non-linguistic tasks. However, bilingual cognitive control has also generated heated debate in recent literature. Despite some studies showing positive effects, other studies' results are inconsistent (Hilchey, Saint-Aubin, & Klein, 2015), leading some to question whether a bilingual advantage truly exists. Still, when found, the effects of bilingualism on cognitive control are generally positive (Valian, 2015). It is therefore important to investigate what specific factors contribute to observed bilingual effects, or the lack-thereof.

In previous studies, earlier bilingualism has been linked to greater cognitive benefits (Yow & Li, 2015), but Green and Abutalebi's (2013) Adaptive Control Hypothesis (ACH) suggests that the bilingual environment also plays a role. The role of Age of Immersion (AoI) and the bilingual environment will be the focus of the current talk, which presents behavioural data from a linguistic Stroop task and non-linguistic Attention Network Test completed by young adult bilinguals in the National Capital Region of Canada and in Japan.