

Journée scientifique
Scientific Day



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Recueil de résumés
Abstracts booklet



Université du Québec à Montréal
pavillon Sherbrooke
(SH-4800)

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CRLEC
Centre de recherche sur le langage,
l'esprit et le cerveau
FACULTÉ DES SCIENCES HUMAINES
Université du Québec à Montréal

Mot d'ouverture,
Denise Klein, directrice du CRBLM
Opening remarks,
Denise Klein, CRBLM Director

10:15 – 10:30
Amphithéâtre (SH-2800)

Conférence d'honneur
Distinguished Lecture

10:30 – 12:00
Amphithéâtre (SH-2800)

BioMusicology and the Evolution of Human Musicality. Tecumseh Fitch, Department of Cognitive Biology, University of Vienna

Like language, human music seems to have a biological basis, sometimes termed our "musicality". Comparisons with nonhuman species show that some components of our own musicality are shared with other species, whether close relatives like great apes (drumming) or distant relatives like birds or whales (singing). Such comparisons also help us understand the neural mechanisms underlying these abilities, and provide a way to test hypotheses about why such abilities evolved.

Lunch

12:00 – 13:00
Salle polyvalente (SH-4800)

Séance d'affichage
Poster session

13:00 – 16:00
Salle polyvalente (SH-4800)

01. Attending to visual cues to perceive a speaker's "feeling of knowing". Yondu Mori (McGill University), Marc Pell (McGill University)

Evidence suggests that observers can accurately perceive a speaker's "feeling of knowing" (FOK) or confidence in what they are saying, by only assessing their visual cues. For example, changes in gaze direction, facial expressions, head movements, and posture can reveal a speaker's FOK in the content of their speech, when answering factual questions. However, it is unclear which visual cues are most salient to observers as they attend to

and evaluate a speaker's confidence level. In this study, speakers produced utterances encoding different confidence levels by responding to trivia (general knowledge) questions ranging in difficulty, while their face and upper body were video recorded. Then a second group of participants watched muted videos of these utterances, rated the speaker's confidence level (scale 1-5) and identified the face/body area(s) that they attended to perceive the speaker's confidence level. Results showed that ratings of a speaker's perceived confidence level from their visual cues corresponded to trivia question difficulty and the speaker's subjective

confidence level. In general, participants reported attending to a wider array of visual cues to identify that speakers were low vs. high in confidence. Muted utterances perceived as high in confidence were associated with increased attention to the speaker's posture, whereas utterances low in confidence involved increased attention to the speaker's facial expression and changes in gaze direction. Our results point to different visual cues that likely contribute to how observers' implicitly decode a speaker's mental (FOK) state, and possibly inferences about a speaker's credibility or trustworthiness.

02. Intact pitch discrimination is related to non-verbal cognitive abilities in autism spectrum disorder. Rakhee Chowdhury (Université de Montréal), Megha Sharda (Université de Montréal), Esther Germain (Université de Montréal), Nicholas Foster (Université de Montréal), Ana Tryfon (McGill University), Krista Hyde (Université de Montréal)

Autism spectrum disorder (ASD) is often characterized by atypical sensory perception and cognitive profiles. Previous literature examining simple and complex auditory perception in ASD and typical development (TD) has found mixed evidence regarding the nature of auditory profiles of both groups; some highlighting better performance in ASD and other reporting no differences between groups. Similar discrepant findings have been reported in terms of verbal and non-verbal cognitive abilities as well. In the current study, we examined auditory perception as well as cognitive skills in 17 individuals with ASD and 19 TD participants, matched on age and IQ. Participants performed a low-level pitch direction task and a higher-level pitch processing global-local task. Verbal and non-verbal cognitive abilities were measured using the verbal and non-verbal components of the Wechsler Abbreviated Scale of Intelligence (WASI). There were no differences between groups on performance on either auditory task, or between verbal and non-verbal abilities. However, better auditory perception was associated with non-verbal rather than verbal skills in both groups. These findings provide evidence for preserved auditory abilities in school-age children of average IQ diagnosed with ASD. These findings also motivate a deeper examination of perceptual-cognitive phenotypes in a broader sample of individuals with ASD with varying symptomatology and IQ.

03. Large-scale Brain Network Alterations in Children with Autism Spectrum Disorder. Megha Sharda (Université de Montréal), Nicholas Foster (Université de Montréal), Ana Tryfon (Université de Montréal), Alan Evans (McGill University), Krista Hyde (Université de Montréal)

Autism Spectrum Disorder (ASD) is characterized by difficulties in social communication, as well as atypical brain connectivity. Previous studies have implicated widespread alterations in brain systems underlying speech, language, social functioning and cognitive development in ASD. However, brain network architecture in ASD remains poorly understood. Developments in anatomical correlation-based approaches to map structural covariance networks (SCN) offer an alternative for studying such networks in-vivo. The objective of the present study was to identify large-scale SCNs of gray matter in children with ASD versus typically developing (TD) children. Participants were 46 ASD and 50 TD males, matched on age (mean=12.8 years) and with IQ>70. The ASD group was diagnosed using standard diagnostic tests. Cortical thickness maps of all participants were obtained by processing their MR scans using the CIVET pipeline. To study network covariance, SCNs were seeded from 8 loci in core hubs including salience, executive function, language and the default mode network in both TD and ASD groups. While SCNs for controls reflected the canonical intrinsic connectivity networks described in earlier studies, the networks for the ASD group showed widespread alterations. These alterations were most apparent for the speech and language network, the executive function network and the salience networks, known to be consistently affected in most ASD phenotypes. However, there was also significant variability in these results particularly within the ASD group likely reflecting the inherent heterogeneity of the ASD phenotype. This work has important implications for understanding brain architecture in ASD and its relation to clinical outcomes.

04. Autism symptom severity modulates the coupling between global and regional cortical structure. Nicholas Foster (Université de Montréal), Megha Sharda (Université de Montréal), Krissy Doyle-Thomas (University of Toronto), Ana Tryfon (Université de Montréal), Evdokia Anagnostou (University of Toronto), Alan Evans (McGill University), Krista Hyde (Université de Montréal), NeuroDevNet ASD Imaging Group

Brain imaging has revealed differences between individuals with Autism Spectrum Disorders (ASD) and Typical Development (TD), both in global (e.g., mean cortical thickness; CT) and regional structure. Global differences may reflect genetic or environmental influences acting across the brain in neurodevelopment. Here, we examined how global CT drives regional CT differently in children with ASD. Participants were 48 ASD and 50 TD boys aged 6-18 years. Groups were age-matched and had IQ>70. ASD was diagnosed using ADI-R and ADOS. CT was calculated from T1 MRI using CIVET. Correlation of regional CT with global CT was calculated within groups. Group differences in correlation were assessed via Fisher transformation. Interaction analyses then tested modulation by symptom severity (SRS, ADI-R, ADOS) of correlations in the ASD group. While the global-regional correlations were strong in both groups, the strength was diminished overall in ASD. After FWE correction, regionally specific correlation decrease was found in right inferior frontal gyrus (IFG) in ASD, an effect that was modulated by symptom severity (SRS). The more localized nature of structural variability in ASD is consistent with the idea that brain differences in ASD result from a complex interaction of genetic factors. These results are important from a functional perspective because of the IFG's role in core social features of ASD. This work offers a new approach to examine brain structural variability in special populations, and highlights the importance of accounting for global and local factors in brain structure.

05. Music improves social communication in Autism Spectrum Disorder – a randomized control trial.

Carola Tuerk (Université de Montréal), Megha Sharda (Université de Montréal), Kevin Jamey (Université de Montréal), Nicholas Foster (Université de Montréal), Rakhee Chowdhury (Université de Montréal), Esther Germain (Université de Montréal), Aparna Nadig (McGill University), Krista Hyde (Université de Montréal)

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder characterized by pronounced difficulties in social and communication abilities. However, many individuals with ASD demonstrate enhanced perceptual skills, especially in the auditory domain. Music therapy has been suggested as a promising approach to improve social communication in ASD. However, there is limited empirical evidence supporting its clinical use. This study aims to evaluate the effects of a music-based intervention on language and

social communication in children with ASD using a randomized control trial (RCT) design. Fifty children with ASD (6-12 years) participated in an ongoing trial of music therapy. Here, we report data from 18 children who have completed the trial. Participants were randomly assigned to 12 weekly sessions of individual music (MT, n=9) or non-music (NM, n=9) control therapy. Participants underwent extensive behavioral assessment before and after therapy on naturalistic and standardized measures of social communication. Data were analysed using repeated measures ANOVA. Compared to NM, more children in the MT group showed an improvement over time on measures of social communication, but not on receptive vocabulary and social responsiveness. Findings suggest that compared to non-music interventions, music therapy may lead to specific improvements in social communication in ASD, particularly in terms of interests, initiation and nonverbal communication. Results from this preliminary analysis provide support for the use of music as a therapeutic tool for children with ASD. This work will provide insight into both behavioural and neural mechanisms mediating response to music-based interventions in children with ASD.

06. Intact Musical Abilities In Children With Autism Spectrum Disorder.

Kevin Jamey (Université de Montréal), Nicholas Foster (Université de Montréal), Megha Sharda (Université de Montréal), Carola Tuerk (Université de Montréal), Rakhee Chowdhury (Université de Montréal), Esther Germain (Université de Montréal), Aparna Nadig (McGill University), Krista Hyde (Université de Montréal)

Autism spectrum disorder (ASD) is a complex neurodevelopmental condition characterized by socio-communication difficulties and atypical sensory perception, particularly in the auditory domain. Despite these impairments, individuals with ASD often have preserved or even enhanced musical skills. Music perception is therefore useful for studying auditory processing in ASD but it remains poorly understood and underexplored in ASD. This study aimed to evaluate musical perception abilities in children with ASD versus typically developing (TD) children on a variety of musical tasks including pitch and rhythm discrimination as well as melodic memory. Based on the Enhanced Perceptual Functioning model, we expected children with ASD to perform similar to or better than TD. Participants were 28 children with ASD and 24 TD children aged 7-13

years old, matched on age and IQ. Children with ASD were diagnosed using the ADOS. Exclusion criteria were IQ<85 on the WASI or any hearing impairment. Musical ability was measured using the MBEMA, a music battery with three subtests: melodic pitch, rhythm, and musical memory. Performance accuracy was calculated for all subtests as well as a global score. Children with ASD performed similarly to TD on melodic pitch, rhythm and memory perception tests. Both ASD and TD performed better on the rhythm subtest than on the melodic pitch or musical memory subtests. These findings show that music perception abilities are intact in children with ASD and of average IQ, and increase our knowledge on auditory and sensory processing in ASD.

07. Effect of silence, stimulating and relaxing background music on cognitive control. Justin Bouvier (Université de Montréal), Paola Leal (Université du Québec à Trois-Rivières), Morgane Bertacco (Université du Québec à Chicoutimi), Gabriel Pelletier (Université de Montréal), Barbara Tillmann (Université de Lyon), Nathalie Gosselin (Université de Montréal)

Most students listen to music while doing schoolwork. Yet, the effect of background music (i.e., presented during task completion) on cognition is still misunderstood. It has however been shown that the impact of background music on mood and arousal, prior to performing a cognitive task, increases performance. The present study's objective is to better understand the effect of background music on cognition. This study aims in particular to explore the effect of the arousal level induced by music on the ability to reach a goal in the presence of distractions or competing automatic responses (i.e., cognitive control). To this end, three groups of participants will perform the Stroop task, during which they will identify the font color of a word designating a congruous (e.g. RED written in red) or incongruous (e.g. RED written in green) color, while listening to stimulating or relaxing music, or in silence. Stroop interference (slowing of reaction time for incongruous trials compared to congruous trials) will be compared between groups. It is expected that Stroop interference will be decreased by stimulating background music compared to relaxing background music or to silence.

08. The perceived effect of background music on cognition. Elise Cournoyer Lemaire (Université de Montréal), Alexia Létourneau (Université de Montréal)

Past studies have shown that background music (BM) listening is particularly frequent during the performance of cognitive tasks (e.g. studying; Calderwood, Ackerman, & Conklin, 2014). Moreover, many persons perceive that BM helps them concentrate better on cognitive tasks (Kotsopoulou, & Hallam, 2010). However, science has yet to demonstrate this effect (Kämpfe, Sedlmeier, & Renkewitz, 2010). This raises several questions regarding the actual effect of BM on cognition. To help guide future research, the current study aimed to specify the perceived emotional (e.g. stress, mood) and cognitive (e.g. attention, memory) effects of BM on the performance of cognitive activities. We also examined the preferred musical characteristics (ex. arousal levels, familiarity) to be paired with the performance of cognitive compared to non-cognitive activities (e.g. cleaning). Preliminary analyses show that adults perceive little direct impact of BM on cognition (e.g. memory). However, they report beneficial effects of BM on mood, stress and motivation to complete a task. Moreover, the preferred characteristics of BM differ according to the nature of the activity. Participants prefer relaxing, familiar, instrumental BM while completing cognitive tasks whereas they prefer stimulating, familiar and lyrical BM when performing non-cognitive tasks. Thus, the arousing properties of BM seem to be tailored to the nature and difficulty level of the co-occurring activity. These results show that the perceived effect of BM on cognitive activities is mainly emotional. It is possible that the emotional effects of BM listening, such as improved mood and decreased stress, are responsible for its self-reported influence on cognitive performances.

09. Isolating the Neural Response to Music, Singing and Speech: An fMRI study. Jocelyne Whitehead (McGill University), Jorge Armony (McGill University)

The parallels between music and voice have stimulated controversy over the underlying neural circuitry involved in processing these closely related acoustic domains. The debate in the current literature is motivated by, on the one hand, findings of neural sharing and, on the other, of functional segregation. Recently, our group has proposed involvement of domain-preferred neurons that respond to both categories, only to different degrees. In light of this work, we incorporated singing as an intermediate between music and voice, predicting to observe neural sharing with the two domain-preferred regions. This response continuum could reveal domain-specific attributes that help explain the functional preference of

discrete neuronal populations in processing select acoustical information. To investigate these questions, we employed a functional magnetic resonance imaging (fMRI) passive listening paradigm that used a fast (TR=529ms), high-resolution (8mm³ isotropic) multiband sequence to maximize temporal and spatial resolution. Unlike most previous studies, we used a diversified stimulus set to generalize our findings across music and voice. Our results confirmed neural sharing, as singing activated music-preferred regions, particularly within the anterior superior temporal gyrus (aSTG), as well as voice-preferred areas, along the length of the superior temporal sulcus (STS). Additionally, we identified that the acoustic attribute pulse clarity (an underlying rhythmic or metric pulsation), which is more robust in music, exhibited a significant positive correlation with the BOLD response in music-preferred regions. These findings provide a neuroanatomical link between music and speech, in which domain-specific attributes may contribute to the degree of recruitment of multifunctional neuronal populations.

10. The superior temporal gyrus is associated with both dance and music. Falisha Karpati (McGill University), Chiara Giacosa (Concordia University), Nicholas Foster (Université de Montréal), Virginia Penhune (Concordia University), Krista Hyde (McGill University)

Individuals with specialized training, such as dancers and musicians, provide an opportunity to investigate human brain plasticity and the interaction between the brain and behaviour. While the neural correlates of music training are well-investigated, the brain structural correlates of dance are less understood. No studies have yet compared the gray matter structural correlates of dance versus music training. This study aims to examine the specificity of long-term dance versus music training on gray matter structure and behaviour. We used magnetic resonance imaging (MRI) to measure cortical thickness (CT) and gray matter concentration (GMC) in 20 expert dancers, 19 expert musicians and 20 untrained controls. Participants were tested on music- and dance-related tasks, including dance imitation, rhythm synchronization and melody discrimination. Statistical analyses were performed to test for group differences in CT and GMC, and regions where CT or GMC are correlated with task performance. Both dancers and musicians showed greater CT than controls in the right superior (STG) and middle temporal gyri. CT in the left STG was correlated with performance on all

three tasks. GMC in the STG and IFG was correlated with performance on the dance task. These results suggest that dance and music training affect gray matter structure in an overlapping manner, specifically in temporal regions. These findings are consistent with previous work implicating the STG in dance- and music-related skills. This work advances understanding of the specificity of the neural correlates of dance and music training, and may have potential applications in therapies for motor disorders.

11. Processing of Musical and Vocal Emotions through Cochlear Implants. Duha Ahmed (McGill University), Anthony Zeitouni (McGill University), Sebastien Paquette (Université de Montréal), Isabelle Peretz (Université de Montréal), Alexandre Lehmann (McGill University)

ABSENT

12. Saliency of vowels features in neural responses of cochlear implant users. François Prévost (Université de Montréal), Alexandre Lehmann (McGill University)

We investigated how combined variations of spectral components along two orthogonal dimensions can maximize neural discrimination between two vowels, as measured by mismatch negativity. Adult cochlear implant users and matched normal-hearing listeners underwent event-related potentials recordings in an optimum-1 oddball paradigm. A standard /a/ vowel was delivered in an acoustic free field along with stimuli having a deviant fundamental frequency (+3 and +6 semi-tones), a deviant first formant making it a /i/ vowel, or combined deviant fundamental frequency and first formant (+3 and +6 semi-tones /i/ vowels). Speech recognition was assessed with a word repetition task. An analysis of variance between both amplitude and latency of mismatch negativity elicited by each deviant vowel was performed. The strength of correlations between these parameters of mismatch negativity and speech recognition, participants' age, the number of active electrodes and duration of both deafness and cochlear implant use was assessed. Amplitude of mismatch negativity was weaker in cochlear implant users but was maximized by variations of vowels' first formant. Latency of mismatch negativity was later in cochlear implant users and was particularly extended by variations of the fundamental frequency. Speech recognition correlated with parameters of mismatch negativity elicited by the specific variation of the first formant. The number of active electrodes and the

cochlear implant manufacturer modulated parameters of mismatch negativity. This non-linear effect of acoustic parameters on neural discrimination of vowels has implications for implant processor programming and rehabilitation.

13. Modification of the adult rat tonotopic map through passive sound exposure improves performance on a tone discrimination task. Maryse Thomas (McGill University), Etienne de Villers-Sidani (McGill University)

After maturation, the rat auditory cortex exhibits a stereotypical tonotopic map that remains stable throughout life. However, housing adult rats in broadband white noise has been found to have a profound plasticity-inducing effect on this map. The current study used a behavioral paradigm to test the hypothesis that passive noise exposure can be used as a tool to improve learning in adult rats. First, we showed that a two-week exposure to noise followed by a one-week exposure to 7kHz tone pips was sufficient to produce an overrepresentation of the 7kHz frequency region in the tonotopic map of a group of adult rats. Next, we trained one group of exposed and one group of non-exposed rats on a tone discrimination task where the target tone was 7kHz. In previous paradigms with this design, learning was associated with an overrepresentation of the target tone in the tonotopic maps of trained rats. Thus, our expectation was that exposed rats would have an advantage on this task because of the induced early overrepresentation of the target tone. We found that exposed rats responded to the target tone at the same rate as non-exposed rats, however they were able to suppress their response to the non-target tone within fewer training sessions, allowing them to reach training criterion and higher levels more quickly. These results suggest that passive exposure to noise can be used to selectively improve behavioural performance and will hopefully contribute to the development of non-invasive approaches to promoting learning and memory in adults.

14. Top-down influences in the auditory cortex of young and older adults modulation by an adaptive spectral discrimination training. Jonathan Cote (McGill University), Lucy Karp (McGill University), Etienne de Villers-Sidani (McGill University)

“Top-down” influences continuously modulate the sensitivity of sensory cortical fields to increase the salience of behaviourally relevant stimuli. In auditory

pathways such context-dependent filtering improves ones ability to perceive sounds and speech presented in noisy or distracting conditions. With natural aging, this “filter” however commonly fails resulting in difficulty understanding speech in noise without peripheral hearing loss, suggesting that a central mechanism might be responsible. In a first step towards understanding how such filters might fail with aging we trained for 2 weeks young (20-40 years old, n=8) and healthy older adults (65-85 years old, n=8) on an adaptive auditory discrimination task involving arbitrary spectrally complex sounds and examined at several time points during the training the changes in activity and connectivity between auditory fields and putative brain areas involved in top-down sensory modulation using magnetoencephalography. We found that (1) training was associated in both groups with a significant reduction in A1 activation to non-target training sounds and that (2) this change was correlated with their improvement on the task. We also saw (3) that the pattern in connectivity between the auditory cortex and dorsolateral prefrontal cortex changed over the two weeks of training. We conclude that learning and dynamic sensory filtering changes with age and that dysregulation of connectivity in theta and gamma between the auditory and frontal cortical fields is associated with poorer auditory discrimination. Moreover the larger area of cortical activation in older participant throughout training suggests a lesser overall efficiency of cortical circuits in that groups.

15. Lexically-guided and distributional learning for speech in younger and older adults. Sarah Colby (McGill University), Meghan Clayards (McGill University), Shari Baum (McGill University)

Perceptual flexibility is necessary for speech perception, as listeners must adapt to speaker variability. Older adults have been shown to adapt to ambiguous speech stimuli when disambiguating lexical information is available (Scharenborg & Janse, 2013). As older adults seem to show an increased lexical bias compared to younger adults (Mattys & Scharenborg, 2014), the question remains whether older adults will remain flexible when lexical information is not advantageous, like younger adults have previously shown in a distributional learning task (Schreiber, Onishi, & Clayards, 2013). Younger (n=31) and older (n=27) adults completed two perceptual learning tasks to address this question, as well as several cognitive tasks to investigate individual differences in

perceptual learning. Both learning tasks exposed participants to clear and ambiguous tokens, but crucially, the lexically-guided task also provided disambiguating lexical information. Separate mixed effects logistic regressions were run for the lexically-guided and distributional tasks. Learning consistency (response given the direction of exposure) increased from pretest to posttest (Distributional: $\beta=0.72, z=6.11, p<0.001$; Lexically-guided: $\beta=0.63, z=3.6, p<0.001$), thus participants showed learning in both tasks. Older adults showed marginally less learning in only the distributional task ($\beta=0.41, z=1.76, p=0.07$), suggesting increased importance of lexical information for perceptual flexibility in older adults. Additionally, participants with larger vocabularies showed more learning consistent behaviour in both learning tasks (Distributional: $\beta=0.94, z=2.95, p=0.003$; Lexically-guided: $\beta=0.82, z=2.12, p=0.03$), and the effect of vocabulary size was greater for older adults (Distributional: $\beta=-2.16, z=-1.86, p=0.06$). This project provides evidence that older adults remain perceptually flexible in learning tasks, but that lexical information provides an additional benefit to maintaining flexibility.

16. Investigating the Effects of Transparency and Ambiguity on Idiom Learning. Mehrgol Tiv (McGill University), Tessa Warren (University of Pittsburgh), Evelyn Milburn (University of Pittsburgh)

The purpose of this study was to learn how transparency and ambiguity affect idiom learning. To start, 157 French idioms were translated to English and normed for familiarity, transparency, and ambiguity. Experiment 1 was a training study in which 32 of these idioms were taught to 25 native English speakers over two days of training. A cued recall test during a third session showed a reliable effect of transparency, but performance was close to ceiling. In Experiment 2, the amount of training was reduced to one session and a semantic relatedness test was included after the cued recall test. The results of Experiment 2 suggest that high transparency idioms are recalled with greater accuracy in a cued-recall test but low transparency idioms are recalled with greater accuracy in a semantic relatedness test. No significant effect of or interaction with ambiguity was found. Three individual difference measures for working memory, creativity, and figurative language proficiency did not have a reliably significant effect on idiom learning.

17. Language familiarity mediates identification of bilingual talkers across languages. Adriel John Orena

(McGill University), Linda Polka (McGill University), Rachel Theodore (University of Connecticut)

Previous research consistently show that listeners are more accurate at identifying talkers in their native language than in an unfamiliar language. Much less is known about the nature of this language familiarity effect in bilingual speech. In the current study, we explored the relationship between language and talker processing by assessing listeners' ability to identify bilingual talkers across languages. Two groups were recruited: English monolinguals and English-French bilinguals. Participants were trained to identify bilinguals speaking in only one language (English). They were then tested on their ability to identify the same talkers speaking in the trained language (same language context: English) and in their other language (different language context: French). Both monolinguals and bilinguals had above chance performance in identifying talkers in both language contexts at test – confirming that there is sufficient talker information in bilingual speech to generalize across languages. Moreover, the results showed a language context effect that was facilitated by language familiarity: monolinguals - who understood only the trained language at test - showed a substantial decrease in performance between the same and different language context, whereas the bilinguals – who understood both languages at test – showed only a slight decrease in performance between the two language contexts. These results indicate that language familiarity affects talker encoding and retrieval, even for bilingual speech.

18. Eye movement methods to investigate text processing within real-world linguistic landscapes. Naomi Vingron (McGill University), Julia Hamill (McGill University), Jason Gullifer (McGill University)

In daily life, we encode visual input from a 'linguistic landscape' (LL) comprised of text and objects (signs, billboards, etc.; Gorter, 2013; Landry & Bourhis, 1997; Shohamy, 2006). In cities like Montréal, LLs incorporate multiple languages in a manner determined by law and inhabitants' propensities. While much is known about LLs sociolinguistically, how people encode LLs is unknown. Do bilinguals fixate text that is most prominent, that is known the best, or objects that support textual interpretation? Building upon the bilingual reading (reviewed in Whitford, Pivneva, & Titone, 2015) and scene viewing literature (reviewed in Henderson & Ferreira, 2004), we monitored French-English bilinguals' eye movements as they viewed LL images from

Montréal, and Canada generally. Participants viewed each image for 8 seconds, and subsequently made “informativeness” or “aesthetics” evaluative ratings (within-subject, counterbalanced). Preliminary results suggest that fixation proportions over time reflected both language background and rating type. When viewing L2 signs, bilinguals regressed more to L2 vs. L1 text. As well, when viewing mixed language signs, bilinguals fixated prominent text first (French), and increased fixations for English text at later viewing intervals. Interestingly, L1-French bilinguals looked at English text more than French text compared to L1-English bilinguals at later viewing intervals. Bilinguals also fixated text-related objects more during aesthetic vs. informativeness ratings. These pilot results are promising with respect to developing methods that use eye movements to address novel questions about how people visually encode real-world LLs.

19. The effect of bilingualism on phonological working memory in young adults: A functional magnetic resonance imaging study. Shanna Kousaie (McGill University), Élise Barbeau (McGill University), Xiaoqian Chai (McGill University), Jen-Kai Chen (McGill University), Denise Klein (McGill University)

Previous research comparing monolingual and bilingual groups has found behavioural differences in executive function that are also reflected both functionally and structurally in the brain. However, to date it is not clear what impact language experience has on executive function. For example, it is not clear how age of second language (L2) acquisition and attained L2 proficiency might impact phonological working memory (PWM). It has been shown that international adoptees, whose native language (Chinese) is discontinued very early (before age 3) and who subsequently learn French, demonstrate similar brain activation as Chinese-French bilinguals when performing a PWM task. This suggests that early exposure to a language can have a long-term influence on phonological processing. Some questions that remain are whether the influence of early language exposure exerts effects into adulthood, whether there are similar effects of language experience on phonological processing when the two languages of a bilingual are similar (i.e., English and French), whether PWM is similar in a native language (L1) and an L2, and whether language-experience (i.e., age of L2 acquisition, attained L2 proficiency) impacts PWM. To address these questions, 19 bilingual speakers of English and French, who varied

with respect to their age of L2 acquisition and attained L2 proficiency, underwent functional magnetic resonance imaging (fMRI) while performing a phonological n-back task in both of their languages. Behavioural and fMRI results were affected by language (L1 vs. L2), and language experience. These findings have implications for our understanding of how early experience may impact brain development.

20. Locality and variability in cross-word alternations: a production planning account. Oriana Kilbourn-Ceron (McGill University), Michael Wagner (McGill University), Meghan Clayards (McGill University)

ABSENT

21. The Acoustic Counterpart to Articulatory Resistance and Aggressiveness in Locus Equation Metrics and Vowel Dispersion: the Effects of Phrasal Accent. Hye-Young Bang (McGill University)

Research on locus equation metrics (LEs) tend to take it for granted that vowel space is invariable across consonantal contexts. However, articulation-based studies report a mutual influence between neighboring segments such that segments with greater constraints in dorsal articulation are more resistant to and concurrently more aggressive in coarticulation than those with less constraints (Farnetani, 1990). Further, all else being equal, phrasal accent should reduce anticipatory coarticulation in CV syllables, resulting in a shallower LE slope. We examine (1) whether articulatory resistance and aggressiveness can be acoustically captured through LEs and vowel dispersion, (2) how the acoustic correlates of phrasal accent affect LE slopes, and (3) how phrasal accent modulates LE slopes after accounting for its acoustic correlates. These questions were investigated in CV sequences in English--where C is one of /p t s j/ that varies in the articulatory constraints imposed on the tongue dorsum. Phrasal accent was elicited by contrastively stressing the target consonants. Our results show that there is a tight relationship between LE slopes and vowel dispersion where articulatory resistance and aggressiveness appear as the mirror image of each other in the acoustic signal. It was further found that phrasal accent enhances durational cues that are directly correlated with the ranges of F2 values that affect LE calculations. After accounting for the acoustic correlates of phrasal accent, consistent lowering effects on LE slopes were observed across all consonants.

22. Individual differences in the relation between perception and production and the mechanisms of phonetic imitation. Donghyun Kim (McGill University), Meghan Clayards (McGill University)

Studies exploring a perception-production link within individuals have been mixed probably due to the complex nature of the relationship and different experimental methods in previous studies. The current study uses phonetic imitation to understand more about how individuals perceive and produce speech and to examine the link between the two processes. We used manipulated stimuli with the goal of more directly probing the link and to test (1) whether individual listeners' perceptual cue weights are related to their patterns of phonetic imitation and (2) the underlying mechanisms of phonetic imitation. Twenty-three native speakers of English completed a two-alternative forced choice identification task followed by a baseline production and a forced imitation task. Perception stimuli were created from productions of 'head' and 'had' recorded by a native speaker of English. Seven steps varying in formant frequency (created with TANDEM-STRAIGHT) were crossed with 7 duration steps (PSOLA in Praat). Imitation stimuli were a subset of stimuli from the perception task plus extended and shortened vowel durations. Our results suggest that phonetic imitation is mediated in part by a low-level cognitive process involving a direct link between perception and production as evidenced by imitation of all vowel durations. However, this study also suggests that imitation is mediated by a high-level linguistic component, i.e., phonological contrasts, which is a selective rather than an automatic process as indicated by imitation of phonologically relevant formant frequencies.

23. Exploration des liens entre le langage et l'activité motrice chez les adolescents : validation d'un appareil portatif utilisé dans un protocole d'analyse de l'activité motrice suite à des stimuli linguistiques. David Labrecque (Université du Québec à Montréal), Rémi Descheneaux-Leroux (Université du Québec à Montréal), Victor Frak (Université du Québec à Montréal)

Problématique: L'étude du lien entre l'activité motrice et le langage suscite de plus en plus d'intérêt. Suite aux études de Frak et al. (2010) et Aravena et al. (2012, 2014), un appareil portatif pour analyser les modulations de force (MF) fut conçu par le laboratoire Cerveau, Motricité et Langage (CML). Cet appareil nous a permis d'effectuer des recherches développementales dans les

écoles primaires et secondaires du Québec. Méthodologie: Les MF de 15 adolescents, suite à l'écoute de stimulations linguistiques (verbes d'action manuels (ex: prendre) et noms de non-action (ex: tempête)) furent analysées. Les adolescents ayant la maturité de l'aire intrapariétale nécessaire à la simulation motrice, ces participants ont été comparés aux adultes de l'étude de Frak et al. (2010). Les MF sont analysées à l'aide de capteurs de force étant capables d'enregistrer une variation en millinewton à chaque milliseconde. Les capteurs sont uniaxiaux (force de préhension) suite aux conclusions de Frak et al. 2010. Le traitement des données est inspiré des résultats des travaux d'Aravena et al. (2014) et Nazir et al. (2015). Résultats: Tout comme les résultats de Frak et al. (2010), les adolescents ont démontré un niveau de force significativement plus élevé suite à l'écoute du verbe ($p < 0,05$ de 400 à 700ms). Le système portatif est donc un outil valide pour ce type de recherche et son apport est considérable pour favoriser l'expérimentation dans divers milieux.

24. Percept : une plate-forme ouverte et collaborative pour héberger des expériences en ligne. Catherine Prévost (Université du Québec à Montréal), Daniel Rivas (Université du Québec à Montréal), Stevan Harnad (Université du Québec à Montréal)

Percept est une plate-forme web permettant d'héberger des expériences comportementales de toutes sortes sur le web. Les tâches sur percept sont construites à l'aide de jsPsych, une librairie de programmation web. Les chercheurs associés à chaque expérience peuvent manipuler plusieurs propriétés de l'expérience en ligne sans toucher à une ligne de code. Des expériences plus complexes peuvent aussi être construites à l'aide de javascript et jsPsych et transmises aux chercheurs pour être placées sur la plate-forme. Percept est un projet open-source présentement disponible en ligne, des chercheurs et programmeurs peuvent aussi y participer. Les données collectées sont disponibles en tout temps aux chercheurs associés à l'expérience à télécharger sous forme de fichiers au format csv. Grâce au côté ouvert et collaboratif, percept vise à standardiser la construction d'expériences et le partage de données entre chercheurs. L'utilisation de percept est gratuite pour tous et le projet est développé par une communauté de chercheurs multi-disciplinaires en informatique et en sciences cognitives.

25. Category Learning Generates Categorical Perception: Behavioral, Neural and Computational Aspects. Fernanda Pérez-Gay Juárez (McGill University),

Daniel Rivas (Université du Québec à Montréal), Xi-Wei Kang (University of Southampton), Hisham Sabri (Université du Québec à Montréal), Christian Thériault (McGill University) Stevan Harnad (Université du Québec à Montréal)

It is known that categorical perception (CP) — between-category compression and within-category separation — occurs innately in both perceived similarity and discriminability for colors, phonemes and facial expressions. It is now emerging that categorical perception can also be induced by category learning. We trained human subjects through trial and error with corrective feedback to sort samples of multidimensional visual stimuli into two categories based on features that covaried with category membership. Event-related potentials (ERP) were measured during the training. We tested two kinds of stimuli: black and white textures made up of distributed microfeatures and fish images with local features. For both types of stimuli pairwise similarity judgments before and after learning revealed between-category separation and within-category compression. These effects were absent in subjects who failed to learn. We also found ERP changes in an early, occipital N1 component (150-220 ms) that correlated with the degree of perceived separation. Learning also had an effect on frontal and parietal late positive components that correlated with learning performance rather than CP effects. To model the observed CP effects, we trained “deep learning” nets to categorize our textures through auto-association followed by supervised reinforcement learning with corrective feedback. Comparing the average within- and between-category distances in hidden-unit activation space before and after category-learning also revealed between-category separation and within-category compression. We hypothesize that CP occurs through dimensional reduction: a learned filter selects for the covarying features and ignores the non-covariant ones, thereby changing the encoded distance between the inputs.

26. Early stages of sentence processing: syntactic categories in French. Lauren Fromont (Université de Montréal), Phaedra Royle (Université de Montréal), Irina Perlitch (McGill University), Karsten Steinhauer (McGill University)

According to Friederici's (2002) influential “syntax-first” model of sentence processing, each incoming word is initially analyzed in terms of its syntactic category (e.g. verb) to build a phrase-structure (Phase 1), essential to

initiate subsequent semantic interpretation in Phase 2. Indeed, German syntactic category violations seemed to elicit early left-anterior negativities (ELANs) in Phase 1 and ‘block’ semantic N400 effects in Phase 2. However, Steinhauer and Drury (2012) argued that most previous ELAN studies used flawed designs, promoting ELANs and affecting N400s. We aim to test Friederici's predictions in an improved paradigm to clarify the real-time integration of syntactic and semantic information. In French, definite articles (le = the (1)) and accusative clitics (le = him (2)) are homophonous:

- (1) Elles poussent le CAMION. (They push the truck)
- (2) Elles pensent le SALUER. (They think of greeting him).

The verbs in (1) and (2) subcategorize specifically for either noun or verb complements. Syntactic category violations (e.g. 3) are created by cross-splicing the two sentences before the TARGET.

- (3) Elles poussent le *SALUER. (They push the *greet)

All sentences are preceded by a context that establishes various degrees of semantic priming to study semantic N400 effects in the presence of word category violations. Syntactic category violations such as (3) elicited no ELAN but negativities after 300 ms reflecting syntax-semantics integration, followed by a ‘reanalysis P600’. This suggests there is no early automatic stage of syntactic processing, and lexical semantic processing is not blocked but takes place in parallel to syntactic processes.

27. Mechanisms underlying the social enhancement of vocal learning in songbirds. Yining Chen (McGill University), Laura E. Matheson (McGill University), Jon T. Sakata (McGill University)

Social processes profoundly influence speech and language acquisition. Despite the importance of social influences, little is known about how social interactions modulate vocal learning. Like humans, songbirds learn their vocalizations during development, and they provide an excellent opportunity to reveal mechanisms of social influences on vocal learning. Using yoked experimental designs, we analyzed the degree to which attention, multisensory stimulation, the structure of tutor vocalization, and reciprocal interactions mediated social influences on vocal learning. We demonstrated that social interactions with adult tutors for as little as one day significantly enhanced learning. Social influences on attention appeared central to the social enhancement of learning because socially tutored birds were more

attentive to the tutor's songs than passively tutored birds and because variation in attentiveness and in the social modulation of attention significantly predicted variation in learning. Attention was modulated by the nature of the song since pupils paid more attention to songs that tutors directed at them. Tutors altered their songs when directing them at pupils in a manner that resembled how humans alter their vocalizations when speaking to infants, that was distinct from how tutors changed their songs when singing to females, and that could influence attention and learning. Furthermore, social interactions that rapidly enhanced learning increased noradrenergic and dopaminergic midbrain neuronal activity. These data highlight striking parallels between humans and songbirds in the social modulation of vocal learning and suggest that social influences on attention and midbrain circuitry could represent shared mechanisms underlying the social modulation of vocal learning.

28. Experimental evidence for innate biases in vocal communication. Logan James (McGill University), Jon Sakata (McGill University)

Across languages, particular word and sound sequences are substantially more prevalent than others, and many have postulated that this results from innate sensory, motor, or cognitive biases (e.g., theories of universal grammar). However, there are no rigorous experimental tests of innate biases in vocal sequence learning across development. Zebra finches offer a powerful animal model to experimentally assess innate predispositions underlying vocal sequence learning because they, like humans, learn their vocalizations during development. The songs of individual zebra finches consist of syllables arranged in a single stereotyped sequence (motif), and these sequences vary extensively across individuals. In order to experimentally test the hypothesis that intrinsic biases guide vocal sequence learning, we tutored juvenile zebra finches ($n=51$), with randomized sequences of five species-typical syllables. All birds were tutored with all 120 possible five-syllable sequences in equal proportion. Because the stimuli do not provide any bias in sequencing, consistencies across tutored birds in the sequences produced would reflect intrinsic predispositions. Consistent with intrinsic biases in vocal learning, we found significant similarities in the

sequencing of syllables across birds. For example, we observed significant biases in the location of individual syllables within a song motif (e.g., beginning, middle, or end). Additionally, we found directional biases between pairs of syllables wherein transitions from one syllable to the other were significantly more common than the reverse direction. These results provide strong experimental support for the hypothesis that sensory and/or motor systems are endowed with intrinsic biases that guide vocal sequence learning.

29. Modeling idiomatic flexibility judgments with entropy, distributional semantics and frequency. Marco S. G. Senaldi (Scuola Normale Superiore di Pisa), Gianluca E. Leboni (University of Pisa), Alessandro Lenci (University of Pisa)

The issues of non-compositionality and restricted formal flexibility in idiomatic expressions can be analyzed both via computational corpus-based methods and human-elicited data. In our study we intended to verify whether these two complementary perspectives tally and to what extent. First of all, we extracted 54 Italian idioms from the La Repubblica corpus and we exploited distributional semantics to measure their compositionality and Shannon entropy to calculate the morphosyntactic flexibility of their verbs and arguments. Participants to a CrowdFlower questionnaire rated on a 1-7 acceptability scale sentences that contained the same 54 idioms in different syntactic variants (base form, adverb insertion, adjectival modification, left dislocation and wh-movement). Hierarchical regression techniques were employed to predict the crowdsourced ratings from our corpus-based indices, including frequency. Principal Component Analysis was carried out on our predictors to avoid multicollinearity. A significant increase in the predicted variance was registered both by inserting the argument-related entropic PCs in our models after the frequency and verb-related entropic PCs (adjusted R-squared change = 0.368, $p < 0.001$) and vice versa (adjusted R-squared change = 0.148, $p < 0.001$). The best fitting model consisted thus in a linear combination of frequency and verb-related entropic PCs and argument-related entropic PCs (adjusted R-squared = 0.547, $F(3, 50) = 22.32$, $p < 0.001$).