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Conférence d'honneur
Keynote Lecture

10:30 – 12:00

The neural mechanisms of speech: From computational modeling to neural prosthesis. Franck Guenther (Boston University, Speech Lab, Neural Prosthesis Lab)

Speech production is a highly complex sensorimotor task involving tightly coordinated processing in the frontal, temporal, and parietal lobes of the cerebral cortex. To better understand these processes, our laboratory has designed, experimentally tested, and iteratively refined a neural network model whose components correspond to the brain regions involved in speech. Babbling and imitation phases are used to train neural mappings between phonological, articulatory, auditory, and somatosensory representations. After the imitation phase, the model can produce learned phonemes and syllables by generating movements of an articulatory synthesizer. Because the model's components correspond to neural populations and are given precise anatomical locations, activity in the model's neurons can be compared directly to neuroimaging data. Computer simulations of the model account for a wide range of experimental findings, including data on acquisition of speaking skills, articulatory kinematics, and brain activity during normal and perturbed speech. Furthermore, "damaged" versions of the model are being used to investigate several communication disorders, including stuttering, apraxia of speech, and spasmodic dysphonia. The model has also been used to guide development of a brain-computer interface aimed at restoring speech output to an individual suffering from locked-in syndrome, characterized by complete paralysis with intact sensation and cognition.

12:00 – 13:00 Lunch

Séance d'affichage
Poster session

13:00 – 15:30

Acquisition et développement
Acquisition and Development

a1. Attitudes linguistiques en français langue seconde. Monelle Guertin (Université du Québec à Montréal)

Les images qu'on se fait d'une langue seconde ont une valeur persuasive ou dissuasive dans l'apprentissage de cette langue (Castellotti et Moore, 2002). En 2008, Maurais indiquait que des allophones de Montréal préfèreraient parler le français d'Europe à 63%, contre 37% pour la variété locale. Les attitudes envers la langue au Québec recèlent fierté, mais aussi, dépréciation, notamment sur la prononciation : le modèle parisien est souvent envié (Bouchard, 2002, 2011). De plus, selon Calinon (2009), un amalgame est réalisé en classe de français langue seconde entre langue formelle et français européen, et langue familière et français québécois. Enfin, pour Gardner (1985), l'attitude est une réaction évaluative produite à partir des croyances et opinions de l'évaluateur. Quelles sont aujourd'hui ces attitudes linguistiques d'immigrants fréquentant des établissements de francisation à

Montréal, devant des variétés du français québécois et européen? Au moyen de la technique du locuteur masqué (Lambert et coll. 1960), cette étude se penche sur les jugements et préférences d'apprenants de FLS à l'égard de variations sociophonétiques qui interviennent entre des variétés dialectales québécoise et française, produites elles-mêmes dans des styles plus et moins formels.

a2. A study of abstract categorization of lexical tones in non-tone-learning infants. Elsa Santos (Université du Québec à Montréal), Rushen Shi (Université du Québec à Montréal), Chen Qu (Université du Québec à Montréal)

À la naissance les enfants ont la capacité de discriminer les contrastes phonologiques présents dans toutes les langues. Puis, selon l'environnement langagier, il y a une réorganisation perceptive et la discrimination des contrastes devient fonction de l'expérience linguistique. Ce phénomène a été observé pour les consonnes et les voyelles, et la question de recherche peut aussi être appliquée aux tons lexicaux qui se présentent dans certaines langues. En français, le ton n'est pas pertinent pour distinguer les mots. Les bébés francophones de 4 et 6 mois discriminent les tons lexicaux en Thaï, mais cette discrimination commence à se décliner quelque temps après cet âge (Mattock, Molnar, Polka, & Burnham, 2008). Dans cette étude, nous avons examiné la catégorisation des enfants francophones des deux tons les plus dissemblables en mandarin, ton élevé (High) par rapport à bas (Low). Nous avons placé les contrastes de ces tons dans la première syllabe de divers non-mots bi-syllabiques afin de tester la catégorisation abstraite des tons qui se situent dans les unités prosodiques plus larges. Les enfants de 11 mois furent observés avec la "headturn preference procedure ". Ils ont été familiarisés avec un ton (H ou L), puis testés sur leur discrimination de l'autre ton et de nouveaux exemplaires du ton familiarisé. Résultats : les bébés n'ont pas distingué les deux tons. Ces résultats indiquent que même les tons les plus dissemblables ne sont plus discriminables pour les enfants non-ton à 11 mois lorsque les tons se trouvent dans le contexte prosodique plus large.

a3. Abstract representation of feature agreement across grammatical categories in infants. Andréane Melançon (Université du Québec à Montréal), Rushen Shi (Université du Québec à Montréal)

This study examines infants' abstract syntactic representation by using gender feature assignment and agreement across grammatical categories. In a preferential looking procedure, French-learning 24-month-olds were familiarized with pseudo-nouns that contained no phonological cue to gender, one noun co-occurring with feminine determiners and another with masculine determiners (e.g., leMASC/unMASC mouveille "the/a mouveille", laFEM/uneFEM gombale "the/a gombale"). In the test sentences, topicalized subject-NPs contained a gender-unmarked determiner les ("the"). In Correct-Agreement test sentences (e.g., Les mouveillesMASC, ilsMASC pèsent les graminées. "The mouveilles, they weigh the gramineae."), the subject-pronoun agreed with the pseudo-noun in gender (i.e., the noun gender assigned by the determiners during familiarization). In Agreement-Violation sentences (e.g., *Les mouveillesMASC, ellesFEM pèsent les graminées. "… they …"), the subject-pronoun did not agree with the pseudo-noun in gender (i.e., the noun gender assigned by the determiners during familiarization). Specific Det+Noun gender assignments in the familiarization phase were counterbalanced across infants, and all infants heard the same test trials. We predicted that if infants encoded the noun gender according to the preceding determiners during familiarization and activated gender agreement between the nouns and the subject-pronouns while listening to test sentences, they should discriminate the Correct-Agreement and Agreement-Violation trials. Results showed that infants discriminated the two types of trials, suggesting that abstract grammatical representation is present and robust in infants. This experiment is the first to show that 24-month-olds track feature agreement abstractly across multiple grammatical categories. Our study demonstrates sophistication and productivity in infants' syntactic representation.

a4. Asymmetries in vowel perception: Effects of formant convergence and category "goodness". Matthew Masapollo (McGill University), Linda Polka (McGill University), Lucie Ménard (Laboratoire de Phonétique UQAM)

The mechanisms underlying directional asymmetries in vowel perception have been the subject of considerable debate. One account – the Natural Referent Vowel (NRV) framework – suggests that asymmetries reflect a language-universal perceptual bias, such that listeners are predisposed to attend to vowels with extreme articulatory postures, which display greater formant convergence (Polka & Bohn, 2011). A second (but not mutually exclusive) account – the Native Language Magnet (NLM) theory – suggests that asymmetries reflect an experience-dependent language-specific bias favoring "good" exemplars of native language vowel categories (Kuhl, 1993). We tested the above hypotheses by investigating whether listeners, from different language backgrounds, display asymmetries influenced by formant proximity and/or language experience. Specifically, we examined monolingual English and French listeners' performance in a within-category AX vowel discrimination task, using variants of /u/ that systematically differed in both their degree of formant proximity (between F1 and F2) and category "goodness" judgments. Results revealed asymmetries that pattern as predicted by NRV when pairs of /u/ tokens exhibited a relatively larger difference in their F1-F2 convergence

patterns, and as predicted by NLM when the pairs of /u/ tokens exhibited a relatively smaller difference in their F1-F2 convergence patterns. These findings demonstrate that language-universal perceptual biases and learning from specific language experience interact to shape vowel perception.

a5. Speech production and intelligibility in children with cochlear implants. Christine Turgeon (Laboratoire de Phonétique UQAM), Lucie Ménard (Laboratoire de Phonétique UQAM), Pamela Trudeau-Fisette (Laboratoire de Phonétique UQAM), Marie Bellavance-Courtemanche (Laboratoire de Phonétique UQAM), Élizabeth Fitzpatrick (University of Ottawa)

In pediatric cochlear implant (CI) users, early implantation generally induces highly intelligible speech. However, it may remain problematic for some children to become intelligible. Studies of speech production in CI users have primarily been based on perceptual judgment and acoustic measures. Articulatory measures, such as those collected using ultrasound and an optical tracking system, provide the opportunity to more precisely evaluate what makes pediatric CI users more intelligible. 10 CI users (M= 7 years, congenitally deaf, and implanted before 2 years old) who were compared with 13 normal-hearing children (NH), matched in age and gender. CI users repeated the English vowels /i/, /a/ and /u/ with and without auditory feedback. Synchronous ultrasound and visual tracking were used to capture the tongue and lip positions. Acoustic signals were recorded simultaneously. The acoustic quality of vowel production is provided by 1) contrast between vowels, reduced contrast generally correlates with diminished intelligibility, and 2) dispersion within a vowel, reduced dispersion within a vowel correlates with better intelligibility. Compared to the NH children, the contrast between vowels and the dispersion within vowels do not differ significantly in CI users according to feedback condition (with and without auditory feedback). These findings suggest that early cochlear implantation can lead to a typical amount of variability and accuracy in the acoustic production of vowels. However, CI participants used different articulatory strategies when they produced vowels, even though their acoustic target is achieved. These findings suggest that early auditory deprivation can alter to some extent the articulatory-to-acoustic relationships.

a6. Auditory feedback perturbation of vowel production: A comparative study of congenitally blind speakers and sighted speakers. Pamela Trudeau-Fisette (Laboratoire de Phonétique UQAM), Lucile Rapin (Laboratoire de Phonétique UQAM), Christine Turgeon (Laboratoire de Phonétique UQAM), Marie Bellavance-Courtemanche (Laboratoire de Phonétique UQAM), Thomas Granger (Laboratoire de Phonétique UQAM), Lucie Menard (Laboratoire de Phonétique UQAM)

Studies with congenitally blind speakers show that visual deprivation yields increased auditory discrimination abilities as well as reduced amplitude of labial movements involved in vowel production, compared with sighted speakers. To further investigate the importance of auditory and visual feedback in speech, a study of auditory perturbation of rounded vowels was conducted in congenitally blind and sighted French speakers. Acoustic and articulatory (electromagnetic articulography) recordings from ten congenitally blind speakers and ten sighted speakers were obtained during the production of the French rounded vowel /ø/. All participants were first asked to produce the vowel repeatedly in a normal condition, i.e., with regular auditory feedback. In the perturbed condition, participants received, in real-time through headsets, an altered version of their speech, in which F2 was gradually increased up to 500 Hz. To compensate for this perturbation, speakers had to enhance lip protrusion and/or tongue retraction. These adaptive manoeuvers should have been concurrent with auditory perception abilities. Preliminary results show that congenitally blind speakers gave greater weight to auditory perception than their sighted peers, while compensating differently for the perturbations. These findings support the hypothesis that vision plays a significant role in the implementation of phonological targets.

a7. Bouncing and clapping to a beat: a comparison between drummers, dancers and non-musicians. Pauline Tranchant (BRAMS, CRBLM, University of Montreal), Isabelle Peretz (BRAMS, CRBLM, University of Montreal)

Most people are able to move in time with music, but trained musicians and trained dancers have higher auditory-motor synchronisation (AMS) abilities than non-musicians and non-dancers, respectively. However, this expertise has been demonstrated using different movements across the groups (tapping in musicians and bouncing in dancers), leaving open the question of whether training for a specific type of movement or for temporal precision is driving the advantage of expertise. In this study, we compared drummers, dancers and non-musicians in bouncing and clapping to music (N=10 for each group). We predicted higher performance in drummers than in dancers for both conditions if temporal precision hypothesis holds, but only in the clapping condition if the movement type hypothesis holds. We found higher synchronization performance in drummers and dancers than in nonmusicians. We also found higher clapping performance in drummers than in dancers, but no difference between the two groups in the bouncing condition. This suggests that both movement type and temporal precision may play an important role during AMS and that superior temporal precision in drummers may compensate for their lack of specific expertise for bouncing.

b1. Musical beat perception and production in congenitally blind adults. Laureline Arnaud (Integrated Program in Neuroscience, McGill University), Lucie Ménard (Laboratoire de Phonétique UQAM), Vincent Gracco (School of Communication Sciences and Disorders, McGill Univeristy)

The brain has a remarkable ability to adapt when problems occur early in development. In congenitally blind adults (CB), brain reorganization occurs and brain areas devoted to vision are taken over for other senses. Apparently as a result, CB adults often exhibit better performance for auditory processing tasks including pitch processing tasks. Few studies have investigated rhythm perception or production in CB adults. The purpose of this study was to test musical beat perception and production abilities in CB adults. Here, an adaption of the Beat Alignment Test was used. Fourteen CB adults and fourteen controls (matched for age, gender, education and formal musical training) participated in the study. Perception: participants had to decide if a beep track presented simultaneously along with musical excerpts was on or off the musical beat. There was no significant difference between the perception score of the blind group and the control group ($t(26)=1.39$, $p=.175$). Production: participants tapped along with 14 musical excerpts. The blind group showed a significantly better ability to match the music tempo than controls ($t(26)=2.16$, $p=.0399$). The variability of tapping was not significantly different between the groups ($t(26)=-1.21$, $p=.238$). Interestingly, significant correlations were found between perception and production scores for the controls only ($r_{cc\text{-}control}=0.69$, $p=.006$; $r_{cv\text{-}control}= -0.72$, $p= .003$; $r_{cc\text{-}blind}=0.19$, $p=.51$; $r_{cv\text{-}blind}=-0.04$, $p=.88$). In conclusion, blind participants showed a significantly better ability to tap the beat in synchronization with the musical beat. These results echo back to previous results obtained in speech production in congenitally blind adults.

b2. Behavioral and neural effects of hearing the past, present, and future during music performance. Brian Mathias (McGill University), Guido Guberman (McGill University), William Gehring (University of Michigan, Ann Arbor), Caroline Palmer (McGill University)

In order to produce auditory sequences such as language and music quickly and accurately, individuals plan upcoming sequence events while monitoring the auditory feedback of their productions. According to future-oriented models of planning, altered feedback that corresponds to future events may create more interference than feedback corresponding to past events. The current study investigated electrophysiological correlates of performers' planning processes by presenting future- and past-oriented auditory feedback during musicians' performances. Pianists memorized isochronous melodies and then performed the melodies from memory at a cued tempo in a synchronization-continuation task while electroencephalography was recorded. Auditory feedback contained occasional altered tones that matched either a Future pitch (next intended event) or a Past Future feedback were larger than pitch (preceding event). The timing of pianists' key presses slowed following Future feedback; in contrast, no slowing was observed in the Past condition. Larger N100 amplitudes were observed one tone after the altered feedback for the Future compared to the Past condition, and greater slowing was associated with larger N100 amplitudes for the Future condition only. Both Future and Past altered feedback tones elicited a feedback-related negativity (FRN). These findings suggest roles of both neural detection (FRN) and sensory evaluation (N100) of altered feedback that accompany compensatory timing adjustments during music performance. Anticipatory planning of future events may modulate influences of auditory feedback on the production of auditory sequences, consistent with models that weight the future and suppress the past in accounting for planning processes during sequence production.

b3. Vibrotactile stimulation for tempo synchronization in music performance. Marcello Giordano (IDMIL, CIRMMT, Schulich School of Music, McGill University), Marcelo Wanderley (IDMIL, CIRMMT, Schulich School of Music, McGill University)

In recent years, increasing interest has been dedicated to investigating the role of haptic feedback and stimulation in the context of musical interaction, and to the development of new, tactile-enabled interfaces capable of addressing this rich sensory channel. Commercial tactile-augmented devices have started to appear on the market claiming, for instance, to be able to provide musicians with reliable tempo cues. Surprisingly though, no quantitative evaluation of the capability of the sense of touch to process such information, in the context of music performance, has been conducted so far. We performed a pilot study evaluating the effectiveness of a tactile metronome for music performance and training. We designed a simple prototype of a vibrotactile metronome, and characterized the system's mechanical properties in terms of frequency response and latency. Subsequently, we asked four guitar players to synchronize to a metronome click-track delivered either aurally or via a vibrotactile stimulus, while performing a musical task. We recorded their performance at different tempi (60 and 120 BPM) and compared the results across modalities. Our results indicate that a tactile metronome

can reliably cue participants to follow the target tempo. Such a device could hence be used in musical practice and performances as a reliable alternative to traditional auditory click-tracks, generally considered annoying and distracting by performers.

b4. Using an Arduino microcontroller to provide low-latency auditory feedback in sensorimotor tapping experiments. Benjamin Schultz (Université de Montréal), Floris van Vugt (McGill University)

Sensorimotor synchronization often measured by having participants tap their finger along with a metronome and presenting tap-triggered auditory feedback. These experiments predominantly use electronic percussion pads with software (e.g., FTAP or Max/MSP) that records responses and delivers auditory feedback. However, these setups involve unknown latencies between tap onset and auditory feedback and can sometimes miss responses or record multiple superfluous responses for a single tap. These issues may distort measurements tapping performance or affect the performance of the individual. We present an alternative setup using an Arduino microcontroller that addresses these issues and delivers low-latency auditory feedback. We validated our setup by having participants (N=6) tap on a force sensitive resistor pad connected to the Arduino and on an electronic percussion pad with various levels of force and tempi. The Arduino delivered auditory feedback through a pulse-width modulation (PWM) pin connected to a headphone jack or a Wave Shield component. The Arduino's PWM (M=0.6ms, SD=0.3) and Wave Shield (M=2.6ms, SD=0.3) demonstrated significantly lower auditory feedback latencies than the percussion pad (M=9.1ms, SD=2.0), FTAP (M=14.6ms, SD=2.8), and Max/MSP (M=15.8ms, SD=3.4). The PWM and Wave Shield latencies were significantly less variable than FTAP and Max/MSP. The Arduino missed significantly fewer taps, and recorded fewer superfluous responses, than the percussion pad. The Arduino captured all responses but, at lower tapping forces, the percussion pad missed more taps. Regardless of tapping force, the Arduino outperformed the percussion pad. Overall, the Arduino is a high-precision, low-latency, and affordable tool for auditory experiments.

b5. The effect of information complexity on the perception of audio-visual temporal synchronicity. Ramona Kaiser (University of Montreal, BRAMS), Carolina Brum Medeiros (McGill University, CIRMMT), Marcelo M. Wanderley (McGill University, CIRMMT), Marc Schoenwiesner (University of Montreal, BRAMS)

Point-light displays are reduced portrays of a person's body, presenting exclusively the position of the head and the major joints. In numerous studies it has been demonstrated that observers are fairly sensitive to movement information in such displays (cf. Blake & Shiffrar, 2007) and to temporal synchronicity of performed actions and their related sounds (Petrini et al, 2009; Saygin, Driver & deSa, 2008). Our study focuses on the effect of information complexity on observers' ability to detect audio-visual temporal synchronicity. We presented point-light displays of three differently complex movements (foot-tapping, clapping and dancing) accompanied by a metronome and music (two levels of auditory complexity). Temporal synchronicity was altered by delaying modalities relative to each other (auditory- and visual-leading stimuli) with delays ranging from 80ms to 280ms, in steps of 40ms. During three subsequent sessions participants were asked to rate the perceived synchronicity of each stimulus using a 6-points rating scale. Across sessions each stimulus was presented 28 times. Results show significantly higher thresholds for more complex relative to simpler movements (effect of movement complexity), interactions between leading modality and information complexity, as well as a general advantage for auditory leading, relative to visual-leading stimuli. These findings extend previous research on the perception of temporal synchronicity, demonstrating for the first time that sensitivity to audio-visual synchronicity is affected by the complexity of the portrayed movement. These interesting results contribute to the understanding of the perception of kinematic information and, more generally, of multisensory integration.

b6. Procedural learning in language impairment: Evidence of a deficit in autism spectrum disorder with LI but not in specific language impairment. Hanady Bani Hani (McGill University), Aparna Nadig (McGill University)

Deficits in procedural memory have been hypothesized to explain language impairment in Autism Spectrum Disorders (ASD+LI) as well as in Specific Language Impairment (SLI) (Ullman, 2004). Few studies have investigated procedural memory in children with ASD+LI, and none have compared their performance to that of children with SLI on the same measure. We tested school-age children with ASD+LI and children with SLI, matched on age and NVIQ on a Serial Reaction Time task. This task assesses implicit learning of a visual pattern presented on a computer screen. It involves 5 blocks: on three blocks a dog follows a repeating 4-step-sequence and on two blocks movement is random. The child is instructed to press a button on a response box that corresponds to the location of the dog. Sequence learning is indicated by significantly faster reaction times in block5 (sequence) relative to block4 (random). This was measured by a sequence learning score (mean of block4–mean of block5)/(mean of block4+mean of block5). The sequence learning score in the ASD group was significantly lower than in the SLI group, U=52.5, p=.04. Within-group comparisons showed signifycantly faster responding in block5 than block4 in the

SLI group; T=0, p<.001, but not the ASD group, T=30, p=.17, indicating that only the SLI group learned the sequence. Our results demonstrate that sequence learning was impaired in the ASD+LI group but intact in the SLI group. This suggests that procedural memory processing deficits are not shared across forms of language impairment and that they are particularly implicated in ASD.

b7. The point of no return? An evaluation of ERP linguistic materials. Lauren Fromont (Université de Montréal), Audrey Borgus (Université de Montréal), Karsten Steinhauer (McGill University), Phaedra Royle (Université de Montréal)

When developing Event-related potentials (ERP) experiments for syntactic processing, careful manipulation of stimuli is crucial. Poorly managed materials lead to confused or wrong interpretation of ERP data (Luck, 2005). In the language domain, a key component of the influential "syntax-first" model (Friederici, 2002), the Early Left Anterior Negativity (ELAN), has been observed for word category violations. However, Steinhauer and Drury (2012) argued that ELAN studies contain important flaws in their design causing artefacts. An important issue is that the conditions do not match: the context immediately preceding the target word differs between conditions, possibly resulting in artefacts in the ELAN time window . In order to re-address this issue without design flaws, we created a balanced design, taking advantage of the homophony between French articles le/la/les 'the' and accusative clitics le/la/les 'him/her/them', as in (1-2):
(1) Les dames poussent le camion
The ladies push.PRES the truck
(2) Les dames pensent le saluer
The ladies think.PRES him greet '
The word category violation is introduced by cross-splicing the two sentences before the target word (the main verbs subcategorize for verb or noun complements only):
(3) Les dames poussent le *saluer
(4) Les dames pensent le *camion
All our conditions were pre-tested for grammaticality, as well as for semantic priming (details will be presented) in offline tasks with native speakers. Our behavioural data show that grammaticality judgements are modulated by correctness. Results for semantic priming effects revealed a potential confound that will be controlled for by complexifying our experimental design.

b8. Temporal neural dynamics of detecting speaker credibility in vocal communication. Xiaoming Jiang (McGill University), Marc Pell (McGill University)

Dynamic formation of a speaker's credibility is crucial to interpersonal communication. Using EEGs, we explored when and how a speaker's voice-implied in-group or out-group status (i.e., accent information) affects listener's judgment of the speaker's believability in online vocal communication. Participants listened to each utterance and judged how much they believed the speaker. ERPs revealed a larger N100 for the in-group than for the out-group voices and a larger N1-P2 complex for low-believable utterances. The modulation of speaker's believability on N100 only occurred in out-group voices (e.g. foreign accent) but not in in-group voices, while the P200 modulation sustained for all voices. Our data show that a lack of believability can be rapidly and reliably detected 200 ms after vocal information is encountered; moreover, the effect of a listener's stereotype towards an out-group member can be mediated by N100 response, which subserves an initial acoustic analysis preceding vocal judgments.

Approches neuroscientifiques
Neuroscientific Approaches

c1. Electrophysiological correlates of adaptation effects on distinct sound categories: evidence from speech and music. Simon Rigoulot (McGill University), Jorge Armony (McGill University)

Adaptation effects refer to the diminution of cerebral responses when a given stimulus is repeated. Surprisingly, very little is known on the categorical effects that could occur when stimuli from different categories are used. Consequently, we investigated here how sounds from different categories (speech and music) adapt each other. We modified for EEG sequences of stimuli used in an fMRI adaptation paradigm employing pseudo-sentences, piano and violin excerpts. The task of the participants was to detect occasional white noise, while their EEG was recorded. We observed on the N1 component an adaptation of the responses to musical sounds (piano and violin) when they were preceded by musical, but not speech, sounds. In contrast, responses to speech sounds were not influenced by the preceding stimulus, regardless of their category. For P2 component, the pattern was reversed, as we observed an adaptation of responses to speech but not musical sounds. Altogether, these results suggest that speech and music are processed separately in the first steps of

auditory processing, confirming that category selectivity takes place in the auditory cortex.

c2. Emotional music and voices: A magneto-encephalography study. Kyle Logie (McGill University), Simon Rigoulot (McGill University), Pierre Jolicoeur (Université du Québec à Montréal), Jorge Armony (Dept Psychiatry, Douglas Mental Health Institute)

We used magnetoencephalography (MEG) to investigate the similarities and differences in how humans process emotional music and voices. Participants (N=21) listened to human vocalizations, as well as short (1.5 sec) musical excerpts played with saxophone, piano, or violin. Prior to the study the auditory stimuli were rated as sad, happy, fearful or neutral. Source localization (dSPM) revealed significant differences in spatial and temporal activation patterns between vocalizations and music, particularly within the temporal lobes, consistent with previous fMRI results. Specifically, vocalizations elicited stronger activation in both hemispheres during the magnetic equivalent of the P50, compared to music. Vocalizations also resulted in slightly more temporal/frontal lobe activation in later components (200 ms onwards). In turn, musical excerpts evoked significantly stronger responses during the magnetic equivalent of the N100, especially in the right temporal lobe. These differences between music and human vocalizations were mainly driven by piano. In contrast, violin elicited similar patterns in magnetic signal to those of vocalizations, which is likely due to the similarity of violin to the human voice in their frequency. In terms of emotion, the largest differences were observed between happy and sad stimuli. By using emotionally complex auditory stimuli across various domains, results from this MEG study can provide valuable insights into how music and human voices are processed in the brain. Our study is also useful as a means to assess the strengths and limitations of the MEG approach in auditory emotion research.

c3. Prédire l'efficacité de l'implant cochléaire: Mesures de la connectivité cérébrale. Marie Simon (Centre de recherche en Neuropsychologie et cognition (CERNEC), Université de Montréal), Latifa Lazzouni (Centre de recherche en Neuropsychologie et cognition (CERNEC), Université de Montréal), Aaron Newman (NeuroCognitive Imaging Lab (NCIL), Dalhousie University), Alexandria Muise-Hennessey (NeuroCognitive Imaging Lab (NCIL), Dalhousie University), François Champoux (Centre de recherche en Neuropsychologie et cognition (CERNEC), Université de Montréal), Franco Lepore (Centre de recherche en Neuropsychologie et cognition (CERNEC), Université de Montréal)

L'implant cochléaire (IC) se trouve être, à ce jour, le moyen le plus efficace dans la restauration de l'audition des surdités sévères à profondes tant chez l'enfant que chez l'adulte. Bien que cette technologie existe depuis maintenant plus de 30 ans, une grande variabilité interindividuelle persiste dans les performances langagières obtenues à la suite de l'IC. Les facteurs neurocognitifs et la réorganisation cérébrale pourraient expliquer cette variabilité, notamment à travers l'utilisation des techniques d'imageries combinées telles que : le resting state (RS) et l'imagerie par diffusion. Une fraction d'anisotropie (FA) significativement supérieure a été retrouvée chez des enfants candidats à l'IC de bon niveau de langage oral en comparaison aux enfants de faible niveau, notamment dans les régions du corps calleux, des aires auditives et de l'aire de Broca. D'autre part, une réduction de la FA dans le gyrus temporal supérieur et dans les voies du traitement auditif a également été retrouvée chez l'enfant sourd. Cette relation de FA n'a pas pu être établie chez l'adulte sourd post-lingual, ni dans les mesures d'interactions fonctionnelles (RS) entre régions cérébrales distantes. L'objectif de cette étude est ainsi d'identifier les changements de connectivité cérébrale à la suite d'une privation auditive chez les adultes sourds post-linguaux candidats à l'IC. Ces changements corticaux seront corrélés à des variables caractéristiques de la déficience auditive telles que l'âge d'apparition, la durée de la surdité ou encore le port d'une prothèse auditive. Ces résultats permettront d'offrir des marqueurs prédictifs des performances langagières post-implantation cochléaire.

c4. The effects of aging and noise exposure on adaptation to repetitive stimuli in A1. Miguel Cisneros-Franco (McGill University), Maryse Thomas (McGill University), Etienne de Villers-Sidani (Montreal Neurological Institute)

A mature cortical inhibitory system allows the adult A1 to detect low probability sounds and rapidly suppress repetitive stimuli. This adaptation response can be used as an index of short-term plasticity. Notably, inhibitory mechanisms are (a) immature during early development, and (b) dysregulated with aging, potentially contributing to increased plasticity at the extremes of life. Interestingly, inhibition in A1 can also be modified by noise exposure, as continuous noise exposure can delay the maturation of inhibition or even impair its function in the adult, also leading to increased experience-dependent plasticity. We studied adaptation to repetitive stimuli in five groups of Long Evans rats: pups (P14- P16), adults (4-6 months), adults exposed to continuous white noise, adults exposed to amplitude-modulated white noise, and aged rats (22-24 months). We subsequently recorded neuronal responses to short trains of repetitive tones and observed a progressive increase in A1 sensitivity to these tones in pups and in aged rats as compared to adults. Non-modulated noise exposure resulted in functional changes resembling those observed in aged rats. However, modulated noise exposure did not elicit

such changes. The effects of aging and noise exposure result in similar functional deficits in adaptation. However, it is possible to reduce these deficits through changes in the sensory environment as we observed in rats exposed to modulated noise. These findings can help researchers develop sensory stimuli to specifically target inhibitory mechanisms in the aging brain.

c5. Structural covariance networks of language and communication in autism spectrum disorders. Megha Sharda (University of Montreal), Nicholas Ev Foster (University of Montreal), Ana Tryfon (McGill University), Krissy Ar Doyle Thomas (Bloorview Research Institute), Evdokia Anagnostou (Bloorview Research Institute), Alan C Evans (Montreal Neurological Institute), Krista L. Hyde (University of Montreal)

Autism spectrum disorders (ASD) are characterized by significant difficulties in language and communication. However, the relationship of these abilities to brain structure remains unknown. Recent developments in anatomical correlation-based approaches to map structural covariance networks (SCN) offer an alternative for studying such connections in-vivo. In this study, we employed such an approach to study the integrity of SCNs associated with language and communication in 46 male children with ASD compared with 50 age-matched, typically developing male controls. High-resolution T1-weighted images were analyzed using the CIVET pipeline, developed at the MNI, to calculate cortical thickness. Seed-based analysis of anatomical covariance was performed to measure the Pearson correlation coefficient, across subjects, between cortical thickness at a seed vertex and all other vertices to generate a group map of covariance. Statistical analyses were performed with SurfStat using a vertex-wise general linear interaction model. Our findings showed that there was widespread disruption of left hemisphere SCNs in ASD compared to controls, indicated by reduced covariance of a left temporal seed with a region in the right frontal loci in ASD. Consistent with previous studies, we find decreased interhemispheric connectivity between fronto-temporal regions, demonstrative of atypical lateralization in language networks. Furthermore, this interhemispheric interaction was modulated by structural language ability of the ASD group (measured by CELF4) rather than communicative function (measured by CCC2), suggesting that language functions do in fact govern overall network architecture in ASD.

c6. Pitch direction perception predicts the ability to detect local pitch structure in autism and typical development. Esther Germain (BRAMS- International Laboratory for Brain, Music and Sound Research), Nicholas E.V. Foster (BRAMS- International Laboratory for Brain, Music and Sound Research), Rakhee Chowdhury (BRAMS- International Laboratory for Brain, Music and Sound Research), Megha Sharda (BRAMS- International Laboratory for Brain, Music and Sound Research), Ana Tryfon (BRAMS- International Laboratory for Brain, Music and Sound Research), Krista L. Hyde (BRAMS- International Laboratory for Brain, Music and Sound Research)

Individuals with Autism Spectrum Disorders (ASD) often present atypical auditory perception. Studies have reported both enhanced low-level pitch discrimination and superior abilities to detect local pitch structure on higher-level global-local tasks in ASD. However, it is unclear how low and higher levels of auditory perception are related in ASD or typical development (TD), or whether these skills change with development. In the present study, 17 children with ASD and 19 TD children matched in age were tested on a low-level pitch direction task and a high-level global-local task. Groups performed similarly on both pitch tasks, moreover pitch direction ability improved with age. Low-level pitch direction ability strongly predicted performance in higher-level global-local pitch perception in general, but most prominently for local pitch judgments in ASD. The study of auditory perception in ASD serves as a complementary lens to symptom-based studies and to refine ASD endophenotypes.

c7. Pitch perception in autism is associated with superior non-verbal abilities. Rakhee Chowdhury (BRAMS), Megha Sharda (BRAMS), Esther Germain (BRAMS), Nicholas E.V. Foster (BRAMS), Ana Tryfon (BRAMS), Krista L. Hyde (BRAMS)

Autism spectrum disorders (ASD) are often characterized by atypical auditory profiles and language impairments. However, auditory perception and its relation to language ability as well as other non-verbal cognitive abilities in ASD remain poorly understood. In the current study, we examined the relationship between auditory perceptual ability (on both low and higher-level auditory pitch tasks) with both verbal and non-verbal cognitive abilities in 17 individuals with ASD and 19 typically developing (TD) participants, matched on age and IQ. Both groups performed similarly on both low-level and high-level auditory pitch tasks. Verbal abilities did not predict performance on low or higher-level pitch tasks in either group. However, non-verbal abilities predicted better auditory perception in both groups, and particularly on higher-level global pitch tasks in TD. These findings underline the importance of examining the relationship between auditory perception and both verbal and non-verbal abilities in ASD.

c8. Introducing RISC: A new inventory for testing social perception in neuropsychological populations. Kathrin Rothermich (McGill University), Marc D. Pell (McGill University)

Nonliteral language, such as jocularity, sarcasm, or white lies, occurs frequently in daily communication. During natural social interactions, linguistic and paralinguistic information about nonliteral speech unfolds simultaneously in several communication channels. However, there are four common limitations in studies investigating social communication and speaker intentions: (1) using only unimodal stimulation, i.e. visual; (2) designing static experiments depicting stimuli that are far away from everyday communication; (3) neglecting important factors such as discourse context and relationship type; and (4) insufficient stimulus control and number of trials to perform neuroimaging experiments. Relational Inference in Social Communication (RISC) is a newly developed database, which entails short video vignettes depicting social interactions, including sincere, sarcastic, jocular, and white lie exchanges. For the first time we also manipulated the type of social relationship between communication partners (e.g. friends vs. couple) and carefully controlled the availability of contextual cues (e.g. preceding conversations) while keeping lexical-semantic content constant. First validation data reveals an overall accuracy for identifying speaker intentions above 80%, indicating that our material is suitable for testing healthy and neuropsychological populations. Results further show that both relationship type and context are influencing the categorization of literal and nonliteral interactions. This demonstrates that is important to consider social as well as discourse context when studying speaker intentions. By including crucial aspects that have often been neglected in previous research, RISC represents a contemporary set of naturalistic video stimuli that creates a useful resource for future neuroscientific research.

Questions cliniques et applications
Clinical Issues and Applications

d1. Production of contrastive focus in children with autistic spectrum disorder (ASD). Lucile Rapin (Laboratoire de Phonétique UQAM), Lucie Ménard (Laboratoire de Phonétique UQAM), Paméla Trudeau-Fisette (Laboratoire de Phonétique UQAM), Marie Bellavance-Courtemanche (Laboratoire de Phonétique UQAM)

Contrastive focus serves to emphasize the importance of a semantic unit in the language string. Children with autistic spectrum disorder (ASD) appear to show difficulties in producing this prosodic marker. This study aimed to identify acoustic correlates related to contrastive focus in children with ASD. Nine francophone children with ASD and nine francophone typically developing (TYP) children produced simple four-word sentences (for example «C'est une chaise.»: «it is a chair.») in a neutral condition and then in a contrastive focus condition. Ninety-six speech productions were recorded using a system that synchronised acoustic signals with lingual and labial movements. Maximum pitch, mean pitch and pitch range, as well as maximum and mean sound intensity and duration were investigated. Values for pitch range, maximum and mean sound intensity and duration were greater in the focus condition than in the neutral condition. Moreover, the differences were significantly greater in TYP children than in ASD children, who did not have increased speech values when switching to the focus mode. This suggests that pitch range, as well as intensity and duration of sound correlate most with contrastive focus marking in both groups. Yet, it appears that ASD children show less contrastive focus marking than TYP children.

d2. Executive functioning in bilingual children with ASD: Are there advantages of being bilingual?. Ana Maria Gonzalez Barrero (McGill University - SCSD), Aparna Nadig (McGill University - SCSD)

We examine the impact of bilingualism on Executive Functioning (EF) in Autism Spectrum Disorders (ASD). We hypothesized that bilingual children with ASD would be impaired in set-shifting relative to bilingual typically-developing (TYP) children, but would be less impaired than monolinguals with ASD. As a control we hypothesized that short-term memory would not differ between groups. We examined EF via parental report on the Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia et al., 1996). To evaluate set-shifting we used a computerized version of the Dimensional Change Card Sort task (DCCS; Zelazo, 2006). Short-term memory was assessed by a number repetition task. Bilingual TYP, bilingual ASD, and monolingual ASD groups were matched pairwise on nonverbal IQ and age. Preliminary data is available from 7 biTYP, 7 biASD, and 7 monoASD 5- to 9-year-olds. Results for the BRIEF showed that Bilingual TYP and Monolingual ASD groups were significantly different ($p = .007$), whereas the Monolingual and Bilingual ASD groups ($p = .56$) and Bilingual TYP and Bilingual ASD groups ($p = .12$) were not. On the DCCS task the percentage of children passing the post-switch phase was: biTYP= 100%; biASD= 86%; monoASD = 57%. This difference did not reach significance ($p= .08$), nor did a measure of switch cost on response time. Finally, short-term memory was not significantly different across groups. Data collection is ongoing and will allow us to investigate in a

larger sample if executive function difficulties experienced by monolinguals with ASD are significantly reduced in bilinguals with ASD.

d3. Sensorimotor control of vocal pitch and formant trajectories in Parkinson's disease. Fatemeh Mollaei (McGill University), Douglas M. Shiller (Université de Montréal), Shari R. Baum (McGill University), Vincent L. Gracco (McGill University)

Auditory feedback provides information on multiple speech output parameters including pitch (fundamental frequency, or F0) and formant properties. Each of these parameters underlies different linguistic dimensions in English, with F0 encoding primarily prosodic properties and formant frequencies encoding the vocal tract area functions that underlie phonological units. Inducing auditory errors in one or the other of these acoustic parameters has been used to examine the manner in which auditory feedback is integrated with ongoing speech motor processes. The capability of individuals to adapt to induced sensory errors may be used to evaluate the control problems associated with speech motor disorders. Parkinson's disease (PD) is one such disorder in which patients exhibit difficulty in learning new sensory-motor correspondences. An issue that has not been addressed is whether this impairment applies to all aspects of speech or whether fundamental frequency and formant parameters of speech might be differentially affected. Here we employed a sensorimotor compensation paradigm to investigate the mechanisms underlying the control of vocal pitch and formant parameters using a within subject design. PD and age-matched control participants produced speech while their auditory feedback corresponding to F0 and first formant frequency (F1) was altered unexpectedly and on random trials. PD participants exhibited a larger compensatory response to F0, however they showed a reduced compensation to F1 perturbations compared to age-matched controls. The results suggest that the sensory-based control of pitch and formant frequency might be differentially impaired in PD.

d4. Les effets acoustiques et articulatoires de la forme congénitale de la dystrophie myotonique de type 1 (DM1) sur les voyelles et les consonnes du français. Marie Bellavance-Courtemanche (Laboratoire de Phonétique UQAM), Lucie Ménard (Laboratoire de Phonétique UQAM), Lucile Rapin (Laboratoire de Phonétique UQAM), Christine Turgeon (Laboratoire de Phonétique UQAM), Paméla Trudeau-Fisette (Laboratoire de Phonétique UQAM), Thomas Granger (Laboratoire de Phonétique UQAM)

La production de la parole requiert la participation de plusieurs muscles, qu'ils soient impliqués dans les déplacements de la langue ou encore qu'ils permettent de projeter ou d'étirer les lèvres. Or une maladie comme la DM1 entraine une faiblesse musculaire ainsi qu'une difficulté à relâcher les muscles après une contraction. Quels effets cette condition entraine-t-elle sur la production des phonèmes? Notre objectif est d'étudier les effets acoustiques et articulatoires de ce déficit sur la production de la parole en français. Trois jeunes atteintes de DM1 ainsi que trois contrôles appariées en âge ont participé à une tâche de production de la parole lors de laquelle elles devaient prononcer, en condition neutre, rapide et hyperarticulée, des syllabes ouvertes intégrées à une phrase porteuse. Les productions étaient enregistrées à l'aide d'un système synchrone composé d'un microphone, d'un Optotrak et d'un échographe afin d'enregistrer les mouvements des articulateurs visibles et non visibles. Les valeurs formantiques des voyelles, ainsi que les mesures de courbure et d'asymétrie de la langue, de même que de projection et d'étirement des lèvres, ont été étudiées. L'analyse préliminaire révèle que les trapèzes acoustiques des sujets DM1 sont moins contrastés que ceux des contrôles, et que les sujets DM1 n'utilisent pas les articulateurs d'une manière aussi optimale que les contrôles. Finalement, les DM1 montrent moins de différenciation acoustique et articulatoire entre chacune des conditions que leurs pairs contrôles.