

CRBLM Scientific Day – Poster abstracts

May 6, 2022

Note: odd-numbered posters will present during session 1 (1:00-2:00pm), while even-numbered posters will present during session 2 (2:00-3:00pm)

1. Investigating the written production of multiword language with keystroke dynamics

A. Saliba, M. Yang, M. Senaldi, D. Titone

Keywords: multiword expression, idioms, typing

Abstract: Multiword expressions like idioms (e.g. kick the bucket, bite the bullet) are formulaic word sequences that exhibit some degree of formal and semantic rigidity (Libben & Titone, 2008; Sag et al.2002). Research has shown that pauses in speech can serve as an indicator of multiword boundaries (Dalhmann & Adolphs, 2007). Support for similar findings in typed production has also been found (Goodkind & Rosenberg, 2015). In this poster, we present a proposal for a type-to-copy study investigating the written production of multiword language by analyzing keystroke dynamics. If idiomatic and multiword phrases are directly retrieved from memory as conventional strings, we might expect shorter pauses and faster typing latencies with respect to equivalent non-idiomatic and literal phrases. At the same time, we will evaluate potential differences in typing behavior between first-language and second-language speakers, as well as the effects of textual enhancement (e.g. color-coding) on typing behavior. In this preliminary work, we will present feasibility data from a pilot task. From a methodological standpoint, we aim to demonstrate the usefulness of typing data for investigating language processing beyond the single-word level. As opposed to speech data, typing data do not require a time-consuming speech transcription procedure, and offer letter-by-letter fine-grained information to identify word boundaries and measure pauses. From an empirical point of view, this project will provide information on the on-line production of multiword language in first and second language users.

For further information: alexandra.saliba@mail.mcgill.ca ; <https://www.mcgill.ca/language-lab/>

2. The limits of self-evaluation: Can bilingual adults accurately self-evaluate their own accents?

C. Jeffers, E. Hernández-Rivera, D. Titone

Keywords: bilingualism, accentedness, linguistic experience, self-ratings, sociolinguistics

Abstract: Bilingualism research relies upon people's self-evaluations to quantify their language proficiency and experience. Such measures probe specific skills and experiences that are complex and multifaceted. Thus, people's self-evaluations may not always give an unbiased picture of a person's linguistic experiences or capacities. Moreover, some self-evaluations may be subject to more bias than others (e.g., when evaluating their language ability globally vs. evaluating a specific ability that is sociolinguistically charged, such as accentedness). Thus, we examined whether bilinguals accurately evaluated their first and second language (L1, L2) accentedness in relation to their own global self-assessments of L1 vs. L2 language proficiency. We were particularly interested in the degree to which their accentedness ratings and their global proficiency ratings were coupled (or uncoupled), as a function of whether they identified as Anglophone, Francophone, or Simultaneous Bilingual (i.e., their "inner comparison group"). We thus analyzed questionnaire data for 64 French-English bilingual adults. We

extracted self-rated English and French accentedness ratings, and created latent variables corresponding to English vs. French global ability. Preliminary results suggest that Anglophones' accentedness self-evaluations were less coupled with their general proficiency self-evaluations than Francophones', in a manner suggesting less accentedness than would otherwise be predicted by their general proficiency. Interestingly, accentedness judgments for Simultaneous bilinguals were tightly coupled with proficiency judgements when self-evaluating French, but less coupled when self-evaluating English. These results suggest that sociolinguistic differences in how accentedness is valued between English and French could impact the reliability of people's self-assessments for these languages.

For further information: esteban.hernandezrivera@mail.mcgill.ca ; <https://www.mcgill.ca/language-lab/our-team/esteban-hernandez-rivera>

3. Facing the challenges of assessing bilingual language experience: are some self-report data more accurate than others?

A. Kalogeris, E. Hernández-Rivera, D. Titone

Keywords: bilingualism, self-report, language proficiency, self-assessment, linguistic experience

Abstract: The multifaceted complexity of bilingual language experience has proven to be difficult to characterize, as it is often based on self-reported judgements of language behaviour. Self-report estimates of people's own first (L1) and second (L2) language behaviours are often assumed to accurately reflect their bilingual language experiences, however this assumption may be more or less valid depending on the particular self-report measure in question. Some self-report measures require self-evaluative judgements, such as rating how "good" or "bad" you are on a given skill. Of note, self-evaluations can be compromised by self-perceptions about how one feels they compare to others they encounter in their daily life. Accordingly, two bilinguals of equal L2 ability might differ in how they self-report based on who their "inner" comparison group is. Of note, other self-report measures rely less on self-evaluation, such as reporting the daily proportion of time spent using different languages. This study compares self-report data from a sample of 64 French-English bilingual adults residing in Montreal to a "ground truth" language processing task. Through linear regression analyses, we find positive associations between self-reported language proficiency and objective language proficiency. We also find positive associations between self-reported language use and objective language proficiency. Furthermore, we find that our sample more accurately reports proficiency in the language that corresponds to their family's language. Appropriately assessing and considering the variability of language experience and the role of comparison groups is crucial for bilingualism research because it can capture potentially important factors that might explain certain group differences in experimental designs. Subsequently, this advances the field in understanding bilingualism and its implications for language processing and development or general cognition.

For further information: esteban.hernandezrivera@mail.mcgill.ca ; <https://www.mcgill.ca/language-lab/our-team/esteban-hernandez-rivera>

4. Semantic bias influences interlingual homograph reading among French–English Bilinguals: An eyetracking study

K. Tarin-Murillo, C. Gerard, E. Hernandez-Rivera, V. Whitford & D. Titone

Keywords: bilingualism, reading, social language experience, eye movement recording

Abstract: Words shared across languages that differ in meaning (e.g., CHAT; a conversation in English, a cat in French) tend to be read slower than matched control words because both meanings are automatically retrieved, causing semantic interference that takes time to resolve. Libben and Titone (2009) showed that this effect was reduced when interlingual homographs were embedded in English sentence contexts semantically biasing the English meaning, suggesting that cross-language activation can be down-regulated by context. Here, we are interested in whether the reverse can also happen: would biasing the French meaning of an interlingual homograph up-regulate cross-language activation and thus interference?. We examined this for two groups of French dominant, French-English bilingual adults. One group read sentences containing interlingual homographs or control words where the context was neutral or semantically biased toward the English meaning. Another group performed the same task except the contexts biased the homographs' French meaning. The English-biased group showed greater homograph interference overall compared to the French-biased group (even for the neutral condition), suggesting French-biasing contexts caused readers to activate French globally over the experiment, putting them in bilingual mode. This was modulated by individual differences in the degree to which people normally distributed language usage when reading (language entropy). People who routinely read in both languages experienced less interference in the French-biased experiment because their experience allowed them to juggle multiple languages effectively. These results suggest that bilingual language processing is highly sensitive to the context of readers' local task demands and daily reading habits.

For further information: karla.tarin@mail.mcgill.ca

5. The Effects of Closed-Loop Auditory Stimulation of Sleep Spindles on Memory Performance

A. Mergui, B. Jourde, C. Coffey

Keywords: sleep; memory consolidation; sleep spindles; slow oscillations

Abstract: The brain's oscillatory activity allows for information to be regulated under different conditions and underlies the process of learning and memory. Electric brain-wave activity shows dynamic changes throughout the lifespan, and has been repeatedly shown to impact cognitive functioning among older adults. A waxing and waning form of salient EEG brain activity, known as sleep spindles, has been repeatedly found to be related to enhanced memory functioning. Previous research has demonstrated that delivering auditory stimulation with temporal accuracy to slow oscillations improves memory consolidation after a sleep period. Based on these findings, the present study aims to apply this closed-loop auditory method to sleep spindles using a device called the Portiloop. During an afternoon session, participants (N = 20) will be tested on a declarative and procedural memory task, both before and after a 120 minute nap period. We expect those who received closed-loop auditory stimulation during sleep to show improved memory performance on both tasks when comparing pre- and post-nap measure, as opposed to those who were not administered any auditory stimulation. These findings would have implications for older adults, as they would allow for a deeper understanding of the relationship between sleep and memory, specifically by observing the variables that mitigate the effects of cognitive decline.

For further information: Maya.mergui@hotmail.com

6. Do sleep spindles actually block sound?

H.R. Jourde, E.B.J. Coffey

Keywords: sleep spindles, auditory processing, EEG, MEG

Abstract: Sleep spindles are transient 11-16 Hz brain oscillations generated by thalamocortical interactions. While their role in memory consolidation is well-established, whether and how they play a role in sleep continuity and protection of memory consolidation against interference is still debated. Because the thalamus both generates spindles and plays a role in sensory processing and relay to the cortex, it has been suggested that spindles might act as a gating mechanism. Recently, it has also been proposed that neural refractory periods following spindles are the critical protective elements. To date, there is little evidence for whether and how spindles or their refractory periods might influence the gating of auditory information. In the present work, we conducted three experiments to examine different aspects of auditory processing in the presence of and following spindles. In the first experiment, we used combined MEG-EEG and distributed-source modeling techniques to record the frequency-following responses as an index of the strength of pitch encoding in the auditory cortex. In the second experiment, we recorded MEG-EEG overnight to explore cortical evoked responses. Finally, we investigated the effect of closed-loop auditory stimulation of cortical slow oscillation up-states in the presence of sleep spindles. Altogether, our results demonstrate that neither sleep spindles nor their refractory period decrease the amplitude of early or late cortical indices of sound representation nor the effects of introducing auditory stimulation on the sleeping brain. These results contradict the view that one role of sleep spindles is to block auditory interference via thalamic gating.

For further information: hugo.jourde@concordia.ca

7. Did I Hear Chewing? How Identification of Misophonic Triggers Influences Affective Responses

M-A. Savard, A.G. Sares, M.L.D. Deroche, E.B.J. Coffey

Keywords: misophonia, sound sensitivity, aversion, emotions

Abstract: Individuals with misophonia, a disorder involving extreme sound sensitivity, report significant distress in response to select but usually common sounds. Even though roughly 1 in 5 people experiences moderate-to-severe misophonic responses to such “trigger” sounds, there is little understanding of the fundamental processes involved. In this study, we aimed to clarify whether misophonics' responses to these trigger sounds are partly caused by acoustic characteristics of sounds themselves, or by an aversive emotional association with sounds of a specific identity. Using multi-talker babble as masking noise, we assessed how identification of common trigger sounds related to subjective emotional responses in 300 adults who participated in an online study. Participants listened to and identified neutral, unpleasant and trigger sounds embedded in different levels of masking noise, and then to evaluate their subjective judgment of the sounds (pleasantness) and emotional reactions to them (anxiety, anger, and disgust). Using participants' scores on a scale quantifying misophonia sensitivity, we selected the top and bottom 20% scorers from the distribution to form a Most-Misophonic subgroup and Least-Misophonic subgroup. Both groups were better at identifying triggers than unpleasant sounds, which themselves were identified better than neutral sounds. Both groups recognized the aversiveness of the unpleasant and trigger sounds, yet for the Most-Misophonic group, there was a more drastic drop in subjective ratings once the sounds became identifiable, especially for trigger sounds. These results acknowledge the heightened salience of trigger sounds but suggest a role of learning and higher-order evaluation of sounds by listeners most prone to misophonia.

For further information: marieanick.savard@concordia.ca

8. The effect of a music-making program on student-teacher closeness in adolescents on the autism spectrum and with intellectual disability.

M. Kaedbey, C. Sim, H. Dahary, E.M. Quintin

Keywords: Music Program, Student-Teacher Relationship, Autism Spectrum, Intellectual Disability

Abstract:

Student-teacher relationships (STRs) are a predictor of concurrent and long-term adjustment and are important for behavioural, social, and emotional development. Preliminary evidence suggests that music programs can foster measurable improvements in STRs. Thirty-seven adolescent participants with ASD (n= 25) or ID (n= 12) aged 13 to 21 years participated in this study implemented in a high school setting. Students and teachers learned to play the djembe primarily as well as other percussion instruments and learned a set of 30 group dependent rhythms. Both the students' classroom and music teachers completed the Student-Teacher Relationship Scale-Short Form (STRS-SF), before and after the music program, to measure potential changes in teacher perceptions of student-teacher closeness and conflict. Paired-sample t-tests revealed improvements in music teacher reports of student-teacher closeness for the AS and ID groups ($p < .05$) and decreases in student-teacher conflict for the ID group ($p < .05$) as a result of the music-making program. Paired-sample t-tests also showed significant improvements in the classroom teacher reports of student-teacher closeness for the AS group only ($p < .05$). Our finding of improved student-classroom teacher relationships following joint participation in a music program may stem from opportunities for reciprocal and positive interactions between students on the AS and their teachers that are inherent to group music-making. Incorporating group music programs in education curricula for students on the AS can foster better student-teacher relationships, which could give rise to better social inclusion, cognitive and academic results.

For further information: mira.kaedbey@mail.mcgill.ca

9. The Effects of a Group-Based Music Program on Observable On-Task Behaviours of Autistic Adolescents

A. Servant, M. Kaedbey, M. de la Sablonnière, H. Dahary, S. Wong, M. Lanovaz, & E.M. Quintin

Keywords: Engagement, On-Task Behaviours, Musical Interventions, Autism Spectrum Disorder, Strength-Based Approaches

Abstract: Autistic adolescents show strong musical interests and abilities. As such, they respond well to music therapy and intervention. Consequently, music interventions are considered strength-based interventions for autistic adolescents and are known to improve social skills and engagement. Music interventions are usually performed in one-on-one settings and are expensive. This study aims to investigate the efficacy of a school-based group music program on student engagement during the program, assessed by measuring on-task behaviour. Student engagement is necessary to foster appropriate learning, the development of student-teacher relationships and adhering to social rules. Our aim is to test if a school-based group music-making program impacts observable on-task behaviours. We hypothesized that observable on-task behaviours would significantly increase for autistic participants enrolled in the

program. We also aimed to explore if changes reported during the musical activities within the music program would generalize to non-musical activities within the music program. We assessed autistic students' on-task behaviours during a music program previously conducted over a period of 11 weeks in a high school. The participants (N=10) were autistic students aged 13 to 17 years old (M=15.16). All sessions of the music program were recorded on video, allowing for behavioural data coding. Significant results could emphasize the role of group-based music program to improve engagement of autistic students and support efforts for increasing accessibility to music-based interventions for this population in educational settings.

For further information: alexa.servant@mail.mcgill.ca

10. Musical memory is associated with mental ages of children on the autism spectrum but not of typically developing children.

S.T.S., Wong*, S. Stanutz*, S. Sivathanan, E. Stubbert, J.A. Burack, E.M. Quintin *Equal Contribution

Keywords: Music learning, music memory, autism, music experience, visuospatial reasoning skills

Abstract: One explanation for relatively enhanced music perception among persons on the autism spectrum (AS) would be that auditory working memory and visuospatial skills, both areas of strengths, are associated with advanced musical memory and discrimination abilities. The participants included children on the AS (N = 19) and with typical developmental histories (TD, N = 18), aged 7-13 years. In the first session, they learned melodies in specific keys that were each paired with a picture of an animal. One week later, they were presented the melodies in the original key and two new transposed keys, and then asked to identify 1) the key in which they originally learned each melody (pitch memory); and 2) the animal with which each melody was paired (melodic memory). Verbal, nonverbal, and auditory working memory mental ages (MAs) and music experience were accounted for in both groups. Positive correlations were found between music experience and pitch and melodic memory for both groups (AS group $p < .05$; TD group $p < .01$), but only the children on the AS showed positive correlations between pitch or melodic memory and non-verbal ($p < .05$), verbal ($p < .05$) and auditory working memory ($p < .01$) MAs. These findings suggest an alternate cognitive profile for children on the AS including commonalities between cognitive processes used for visuospatial, linguistic, auditory working memory and musical tasks.

For further information: samantha.t.wong@mail.mcgill.ca

11. OSMose: Accommodating Neurodivergent Needs in Educational Concert Settings

C. Sim, E-M. Quintin

Keywords: Autism, Music, Neurodiversity, Social Inclusion

Abstract: The Orchestre Symphonique de Montreal (OSM) has a tradition of welcoming schools and families to educational classical music concerts. OSM has recently designed educational concerts with both a traditional concert format and a new inclusive format to offer neurodiverse children an accessible concert experience. OSM and our Behaviour, Autism, and NeuroDevelopment (BAND) Research Group, including an autistic researcher, are collaborating to assess whether there is an experiential difference for audience members between the traditional and the inclusive concerts, particularly for the neurodivergent

audience members. Together, we have created a post-concert questionnaire for schools and families to assess the audience's appreciation of the musical repertoire and of the concert's inclusivity and accessibility accommodations. The questionnaires will be answered by teachers (for school groups) and parents or guardians (for family units) of neurotypical and neurodivergent children. The anonymous data will be analyzed to draw patterns and determine which accommodations were deemed useful by audience members and which ones could be permanently added to educational or general public concerts to make the Symphony House a more welcoming place for neurodivergent patrons of all ages.

This partnership between academic research and a prestigious cultural institution such as OSM will add to a growing movement of inclusion where accessibility is not seen as exceptional but expected. It has the potential to expand the movement to Montreal's cultural and classical music scenes. Our findings hold the potential to demonstrate that it is possible to break down barriers and make accessibility a universal experience that benefits everyone.

For further information: cassiea.sim@mail.mcgill.ca

12. Des tâches de perception des aspects émotionnels et structurels de la musique révèlent des habiletés d'empathisation et de systémisation musicales comparables chez les personnes autistes et neurotypiques

M. de la Sablonnière, H. Dahary, E. M. Quintin

Keywords: Trouble du spectre de l'autisme, cognition musicale, empathisation-systémisation, reconnaissance des émotions

Abstract: La théorie Empathisation-Systémisation (E-S) distingue deux processus cognitifs : l'empathisation, qui permet entre autres d'identifier les émotions d'autrui, et la systémisation, qui permet d'analyser la structure de systèmes. Selon la théorie E-S, le trouble du spectre de l'autisme est caractérisé par des habiletés d'empathisation inférieures et des habiletés de systémisation égales ou supérieures à la moyenne. Comme la perception musicale est une force chez les autistes, la présente étude vise à déterminer si les déficits d'empathisation et les forces en systémisation des autistes prédites par la théorie E-S sont aussi présentes en musique. Pour ce faire, une tâche de reconnaissance d'émotions dans la musique et une tâche de discrimination mélodique ont été créées pour évaluer l'empathisation et la systémisation musicales, respectivement. Les performances de 15 garçons autistes (12-16 ans) et de 38 jeunes adultes neurotypiques (18-32 ans) ont été comparées. Pour la tâche d'empathisation, un test U de Mann-Whitney n'a révélé aucune différence entre la performance des groupes ($p > .05$). Une analyse de la variance (ANOVA) a montré que les deux groupes ont des habiletés de systémisation similaires ($p > .05$) mais que la complexité des stimuli avait un impact différent sur la performance des participants autistes et neurotypiques ($p = .004$). Cette étude suggère que les autistes ont des habiletés d'empathisation et de systémisation musicales intactes et que les personnes autistes et neurotypiques utilisent des mécanismes différents pour comprendre la structure musicale. Ces résultats encouragent le recours à la thérapie musicale pour favoriser le développement socio-émotionnel des autistes.

For further information: marie.delasablonniere@mail.mcgill.ca

13. Extracting the entrained component from electroencephalography to assess synchronization stability during gait

C. Ziane, S. Dalla Bella, F. Dal Maso

Keywords: Electroencephalography; Rhythmic auditory cueing; Entrainment; Gait; Aging

Abstract: A third of older adults is affected by gait dysfunctions (e.g., decreased speed, increased variability), which impact their autonomy, health, and are costly to the public health-care system. Rhythmic auditory cueing (RAC) can improve older adults' gait, though benefits seem to be modulated by entrainment of cortical oscillations to RAC. Synchronization of cortical and auditory rhythms has never been quantified during gait. In a recent study, the entrained cortical component could be successfully extracted from electroencephalography (EEG) recordings during finger tapping. This project's goal was to adapt and validate this method for a gait task with RAC. Ten young adults equipped with 64 EEG electrodes walked on an instrumented treadmill while synchronizing their footsteps to a metronome matching their preferred cadences. EEG signals were reduced to one maximally entrained component via generalized eigendecomposition. The standard deviation of this component's instantaneous frequencies was used as an index of entrainment stability. Mean asynchronies, resultant vectors lengths, and relative phase angles were computed from the treadmill's kinetic data. For half of the participants, topographical representations of the extracted components showed activity over central sensorimotor regions, consistent with lower limb somatotopic representation. Fast Fourier transforms revealed power peaks at stimulation frequencies and harmonics, confirming cortical synchronization to the beat. Additionally, there were moderate correlations between entrainment stability indexes and behavioral performance outcomes. These results validate the use of our method to analyze cortical entrainment during gait and are promising toward explaining individual responses to RAC with the goal of optimizing rhythm-based gait interventions.

For further information: clara.ziane@umontreal.ca

14. Minimal gender differences in music perception in a large global sample

M. Bertolo, D. Müllensiefen, S. C. Woolley, S. A. Mehr, J. T. Sakata

Keywords: music evolution sexual selection big data

Abstract: Since Darwin, researchers have proposed that human music production and perception may have been shaped by sexual selection via mechanisms for signalling mate quality. Consistent with this idea, sex differences at various levels of auditory perception have been documented in some populations of humans. However, patterns of sex differences are inconsistent across studies and have relied on relatively small sample sizes. We tested for sex differences in music perception in over 400,000 men and 215,000 women (self-identified gender) living in 200+ countries. Participants completed three tasks that assess abilities in melodic discrimination, mistuning perception, and beat alignment. From these three individual test scores, an additional general musical ability variable was derived through factor analysis. We find minimal gender differences, controlling for demographic variables (e.g., age, education, music training, extent of music listening, income). Cohen's d effect sizes for differences on the three tests range between .01 and .11, with gender differences for general musical ability being $d = .01$. These findings contrast with previous reports of sexual dimorphisms in human auditory perception and in the perception of traits purported to be under sexual selection in non-human animals, lending little support to the idea that music perception has been significantly shaped by sexual selection.

For further information: mila.bertolo@mail.mcgill.ca

15. A quantitative analysis of the language environment and lexical development of trilingual toddlers

E. Quirk, N. Hadeed, K. Byers-Heinlein

Keywords: trilingualism, early childhood, language environment, family language strategy

Abstract: While quantitative studies of groups of trilingual children are exceedingly rare, the few that exist point to poorer outcomes than bilingual and monolingual peers, particularly in a heritage language (HL), a language not widely spoken in the community. Yet little is known about trilingual competence in early childhood nor the factors that influence its development. The current study addresses these gaps, testing the hypothesis that parents' choices about how they use their languages with their children in the home, called family language strategies (FLS), influence language outcomes via their effect on children's language exposure. Parents of 24 toddlers (M age=26 mos, SD=5) acquiring French, English and a HL in Montreal were interviewed about their family's language background and completed three vocabulary questionnaires, one for each of their child's languages. Nine families adopted a strategy by which at least one parent spoke only the HL to the child (heritage only) and 15 adopted an approach whereby parents either mixed or used a community language only with the child (community/mixed). "Heritage only" children received significantly less English and French exposure and significantly more HL exposure. Only HL vocabularies showed a marginally significant difference by FLS ($p=.07$), HL vocabularies being larger in "heritage only" children. In a linear regression analysis, age and language exposure, but not FLS, made independent contributions to variation in children's vocabulary sizes. These findings support the central role of exposure in developing trilingual competence, in particular, heritage language competence.

For further information: erinnoraquirk@gmail.com

16. Investigating the role of locus coeruleus degeneration in attentional control in prodromal and established Parkinson's disease

S. Sun, V. Madge, R.B. Postuma, D.L. Collins, M.E. Sharp

Keywords: attention, noradrenaline, locus coeruleus, parkinson's disease

Abstract: Noradrenergic neurons in the locus coeruleus are thought to degenerate early in Parkinson's disease, possibly as early as the prodromal stage. Noradrenaline is also known to play an important role in supporting selective attention and response inhibition. Whether specific deficits related to degeneration in the locus coeruleus can be detected as early as prodromal Parkinson's disease remains unknown. To address this, we are measuring attentional control using a visual oddball task. Participants include prodromal Parkinson's patients, defined as the presence of REM sleep behaviour disorder ($n = 20$), Parkinson's patients ($n = 88$), and older controls ($n = 39$). Logistic mixed modelling reveals that controls and prodromal patients are more likely to respond correctly compared to Parkinson's patients. Linear mixed modelling reveals no differences in response time. These results insinuate that attentional control is preserved in prodromal patients despite suspected beginnings of locus coeruleus degeneration. Future analyses will relate individual differences in attentional control to neuromelanin- and diffusion-weighted MRI-derived measurements of locus coeruleus degeneration. Identifying early brain-behaviour

relationships will help us understand the mechanisms underlying the cognitive profile of Parkinson's patients and allow us to distinguish the specific contribution of degeneration in the locus coeruleus from the more generalized degeneration that occurs as the disease progresses.

For further information: sophie.sun@mail.mcgill.ca

18. Frontal sleep spindles and impaired overnight memory consolidation in Parkinson's disease

S. Lahlou, M. Kaminska, J. Carrier, M. Sharp

Keywords: memory, Parkinson's disease, sleep

Abstract: Healthy sleep is required for successful memory consolidation, i.e., the transformation of newly acquired learning into long-term memory. Sleep spindles, EEG oscillations occurring during non-REM sleep, are thought to promote brain plasticity processes that underlie consolidation. In Parkinson's patients, sleep spindle abnormalities have been associated with cognitive deficits and with the subsequent development of dementia, but the mechanism is unknown. The goal of this study is to investigate the relationship between sleep spindle abnormalities and memory consolidation in Parkinson's patients.

We are recording overnight polysomnography and measuring memory before and after sleep in PD patients free of dementia (n=29, mean age 64 years, 27% female). The memory task consists of an initial encoding phase where participants rehearse a list of 50 word pairs. Recall for one half of the word pairs is tested before sleep (one word is shown and participants verbally recall its associate), and recall for the remaining half is tested in the morning. Consolidation is measured as the difference between the pre- and post-sleep performance. Participants accurately recalled 56% of words at night and 36% in the morning. There was an association between worse overnight memory consolidation and lower spindle density on frontal derivations ($r=0.45$, $p=0.02$). This effect was only found for spindles occurring during N3 (i.e., slow-wave sleep), and not N2 sleep ($r=-0.03$, $p=0.1$). No associations were found between spindle amplitude, spindle frequency and memory consolidation. Additional exploratory analyses will investigate spindle trains and sleep spindle type (slow vs. fast). Our current results suggest that sleep abnormalities in Parkinson's disease are associated with specific deficits in sleep-dependent cognitive processes.

For further information: soraya.lahlou@mail.mcgill.ca

19. Cue primacy effects in Mandarin tone imitation

W. Zhang, M. Clayards, F. Torreira

Keywords: phonetic imitation, lexical tones, cue weighting

Abstract: Phonetic imitation is found to be mediated by phonological contrast. When the feature in the sound is unclear to designate a phonological category, the sound is hard to imitate. Evidence of the phonological mediation was mostly found from imitations of segmental features such as voice onset time (VOT) and formants. Suprasegmental features, on the contrary, have been generally found to be easier to imitate compared to segmental features. Nevertheless, the phonological contrast effect to suprasegmental feature in imitation is less investigated. In this study, an imitation experiment was carried out on Mandarin flat-falling tonal continua which were created by varying two suprasegmental features, F0 falling range (the primary cue) and syllable duration (the secondary cue). Results showed that the

imitation of the F0 falling range was mediated by the tonal contrast whereas the imitation of the duration was not. The discrepancy indicates that the general hypothesis that suprasegmental features are easy to imitate is weaker than the phonological contrast effect.

For further information: wei.zhang16@mail.mcgill.ca

20. Two-dimensional parsing and the iambic-trochaic law in actual words

E. Moghiseh, M. Wagner

Keywords: Perception, Prominence, Grouping

Abstract: How do we parse the acoustic stream into words? We present evidence that we can better understand this process if we take into account that listeners in fact parse the signal along two in principle orthogonal dimensions, grouping (in our experiments the segmenting of the stream into words) and prominence (in our experiment the detection of word stress). We show evidence that prominence and grouping perception mutually inform each other, and make use of overlapping cues. We also illustrate how this perspective can explain the so-called ‘Iambic-Trochaic Law’ (ITL), the fact that in English there is a tendency to perceive sequences of alternating soft and loud sounds as bisyllabic words with initial stress (trochees), and sequences of alternating short and long sounds as bisyllabic words with final stress (iamb). In this perception study, unlike prior ITL studies that used sequences of tones, or nonce words, we used actual English words and asked participants to do two tasks, a grouping task and a prominence task. The results show that intensity and duration were strong cues to grouping and prominence, but only poor cues for foot choice. As expected, when intensity and duration correlated, the prominence choice was consistent and the grouping choice closer to chance, and vice-versa when they anti-correlated. Moreover, by manipulating the order of the tasks, we show an influence of one decision on the other providing further evidence that listeners parse the signal along two separate dimensions—grouping and prominence.

For further information: esmail.moghiseh@mail.mcgill.ca

21. OH NO! We’re going to Disneyland: How Musicians and Bilinguals use emotional cues differently

Cassandra Neumann, Anastasia Sares, Erica Chelini & Mickael Deroche

Keywords: prosody, semantics, bilingualism, musicianship, emotions

Abstract: To infer emotions in speech, listeners can use the way people speak (prosody) or what people literally say (semantics). Monolingual children have been shown to rely more on semantics in ambiguous situations, whereas bilinguals rely more on prosodic cues. Whether this remains true for adults is still unclear. Furthermore, musicians are overall more accurate at detecting the emotional prosody than non-musicians. We hypothesized that bilinguals and musicians will resist semantic interference (Study 1) and monolinguals and non-musicians will resist prosodic interference (Study 2). In two online experiments, we collected data on 1000 young adults (18-30 y.o.) across two studies recruited through Prolific. Participants listened to 144 emotionally-loaded sentences that either matched in their semantic and prosodic cues to emotion or differed. Participants were asked to either identify the emotion enacted by the speaker ignoring semantics (Study 1) or identify the emotion in the semantics ignoring prosody (Study 2).

In both experiments, performance suffered when prosody and semantics conflicted (10-20% lower performance). However, the nature of this interference depended on music group and not only on language group. In Study 1, musicians resisted the interference of semantic cues. In Study 2, musicians resisted the interference of prosodic cues but only when also bilingual. Thus, musicians may not be using one cue over another when making emotional judgements, rather they have an overall better ability to inhibit irrelevant information. Additionally, being bilingual may only be advantageous in specific situations (i.e., when asked to make an emotional judgment while ignoring prosodic cues).

For further information: cassandra.neumann@concordia.ca

22. A Frenchman and an Englishman Walk Into Noisy Bar: Bilingual Listening Abilities in the Cocktail Party

E. Lew, S. Hallot, K. Byers-Heinlein, M. Deroche

Keywords: auditory masking, speech perception, bilingualism, noisy environments

In cocktail party situations, listeners use word decoding skills to understand the target voice and inhibition skills to ignore masking voices. In multilingual societies like Montreal, listeners may need to decode either their L1 or L2 in the presence of competing voices speaking L1, L2, or a foreign language. How does bilinguals' language proficiency and the relationship between the target and masker affect performance? Linguistic theories predict that listeners will have the most trouble when they are proficient in the masking language, while informational masking theories suggest that greater similarity between target and masking language will cause the greatest interference in performance.

We recruited 128 English-French bilinguals with different second language (L2) proficiencies to complete an online competing speech task. A male target speaking French or English was masked by two females speaking French, English, or Tamil, or by speech-shaped noise. We expected lower (better) speech reception threshold (SRT) in L1 than L2 targets depending on listeners' proficiency in each language but hypothesized that balanced bilinguals might be advantaged in different- vs same-language situations. We confirmed the effect of target language and suggested that L2 proficiency acted categorically rather than continuously with respect to SRT. However, no balanced bilingual advantage was observed with respect to masking. Unexpectedly, L1 maskers caused the most interference, regardless of target language. This agrees with previous linguistics research (Rhebergen et al., 2005; Calandruccio et al., 2013) but is unexpected from the perspective of informational masking (Durlach et al., 2003; Kidd et al., 2005).

For further information: emilia.lew@mail.concordia.ca

23. The *Fach* System under attack: taking physical appearance out of the equation

J. Marchand Knight, A. Sares, M. Deroche

Keywords: transgender, implicit bias, voice, multimodal perception, timbre

Abstract: A person's *Fach* (voice-type) should be determined by acoustic cues characterizing their voice. Instead, voice appraisal is often influenced by the individual's appearance. This is distressful for transgender people, excluded from formal singing because of perceived body-voice mismatches. To counter these visual biases, we must understand why they occur. We hypothesized that trans listeners

would better resist such biases than cis listeners, due to heightened awareness of appearance-voice dissociations. In an online study, 85 cisgender and 81 transgender participants evaluated 18 different actors, singing or speaking short sentences and representing six voice-types from high/bright (traditionally feminine) to low/dark (traditionally masculine) voices: soprano, mezzo, alto, tenor, baritone, and bass. Participants provided voice-type ratings for 1) Audio-only stimuli (unbiased estimate of actors' voice types), 2) Video-only stimuli (to get an estimate of the strength of the bias), and 3) combined Audio-Visual stimuli (to see how much visual cues would pull AV-ratings away from A-ratings in the direction of V-ratings). Results demonstrated that visual biases are not subtle and hold across the entire scale, shifting voice appraisal by about 1 third of a step (one step being bass-to-baritone distance, for example). This shift was 30% smaller for trans than for cis listeners and was particularly reduced (in trans listeners) for actors on the extremities of the scale (basses or sopranos). This occurred whether actors sang or spoke. This study demonstrates that transgender listeners are better judges of voice type because they resist the appearance-bias, opening avenues to counter implicit (or sometimes explicit) biases.

For further information: juanita.marchand@mail.concordia.ca

24. Hearing Loss is Associated with Alterations in Sensory and Higher-order Resting-State Networks in Individuals with Mild Cognitive Impairment.

N. Grant, N. Phillips, G. Luk, & X. Chai.

Keywords: Aging, Hearing Loss, fMRI, MCI, ICA

Abstract: Background: Hearing-loss (HL) is prevalent in adults with mild cognitive impairment (MCI). MCI and HL are associated with altered resting-state network connectivity, particularly in the default-mode network (DMN). These alterations have been associated with cognitive impairment in both groups and progression to Alzheimer's disease in MCI. These results suggest that altered network connectivity is a potential mechanism for the cognitive decline and increased dementia risk in these populations. Objective: We investigated how HL influenced DMN connectivity in individuals with MCI in a subset of the COMPASS-ND study. Methods: Based on a pure-tone screening protocol participants were classified as having either normal hearing (NH, n=60, %female= 40%, age=74.5, education=15.19) or HL (n=35, %female=48%, age=70.07, education=16.5). Independent component analysis was used to identify resting-state networks. The primary analysis tested whether DMN connectivity differed as a function HL. Secondary analyses tested the effect of HL on the connectivity of other resting-state networks. In all analyses, age, education, reading acuity, and contrast sensitivity were included as covariates. Results: Compared to participants with NH, those with HL had decreased connectivity between the DMN and visual and cerebellar regions (p-FWE=0.012), within the visual network (p-FWE=0.002), between the visual network and prefrontal regions, and between the dorsal-attention network and regions of the DMN (p-FWE=0.01). All significant findings were in the left hemisphere. Conclusion: The increased risk for cognitive decline and dementia in individuals with HL may be due to a loss of functional connectivity between and within sensory and higher-order resting-state networks and several cortical regions.

For further information: nicole.grant@mail.concordia.ca

25. Subjective Cognitive Decline through the lens of network analysis

N. Grunden, N. Phillips

Keywords: aging, cognition, network analysis, graph theory

Abstract: Subjective cognitive decline (SCD) is considered to reflect increased risk for decline into dementia. However, research is still needed to identify what subtle cognitive aspects of SCD might differentiate it from healthy aging. Recently, researchers have used network analysis to statistically model interrelationships between cognitive domains in healthy and clinically impaired older adults. These networks can capture a more holistic view of performance within and across cognitive domains, providing insight into cognitive status above and beyond what is captured in simple univariate analysis. Studies of individuals with AD and amnesic mild cognitive impairment (aMCI) have revealed distinct networks in clinical groups compared to cognitively normal (CN) older adults. Despite the potential of network analysis to reveal cognitive reorganization, it has yet to be used to determine whether networks in SCD show evidence of reorganization compared to controls.

This poster will outline an ongoing project to determine whether the relationships between cognitive domains in SCD differ from those in healthy older adults, with a specific aim to assess whether subtle changes in global organization of cognitive abilities, as well as relative salience of specific nodes (e.g., language nodes), can be identified in SCD. Whereas previously modelled cognitive domains were based on fewer cognitive tests, this project will derive networks from multiple tests in each domain within the CIMA-Q and COMPASS-ND neuropsychological batteries. Planned methods include constructing Gaussian graphic models to estimate relationships between neuropsychological variables in CN, SCD, and MCI groups and subsequently comparing group network structures.

For further information: ngrunden3@gmail.com

26. Effects of a personalized sound intervention on anxiety, pain, and dissatisfaction during autogenous gingival graft in adults: Preliminary results of a randomised controlled trial

J. Pilon, É. Ponton, R. Voyer, R. Durand, R. Kabir, P. Rainville, E. Emami, P. Rompré, N. Gosselin

Keywords: "gingival graft", music, anxiety, pain, dissatisfaction

Abstract: Anxiety feeds the avoidance of dental treatments, leading to the neglect of general oral health. This avoidance is often amplified by the fear of potential pain and dissatisfaction after a dental appointment. A music listening intervention could be beneficial to reduce anxiety, pain and dissatisfaction. This intervention has the advantage of being non-invasive, cheap, and easy to implement in clinical settings. The objective of this study is to explore the effects of a personalised musical intervention on anxiety, pain and dissatisfaction associated with an autogenous gingival graft in comparison to the use of an audiobook (control). In this regard, two groups of patients received the gingival graft along with the personalised music intervention (n=8) or an audiobook (n=5). Participants were distributed randomly between conditions in a single blind design (surgeons were unaware of the condition). Self-reported measures of anxiety, pain, and dissatisfaction were taken at different times (baseline, preoperative, postoperative, and follow-up). Preliminary results show lower dissatisfaction levels for the participants in the audiobook group ($U = 3.5, p = .017$). No significant differences between conditions were revealed for anxiety and pain levels. The lack of power of our initial analysis might explain these results due to our small sample size.

For further information: jadziah.pilon@umontreal.ca

27. Emotional Judgements of Musical Excerpts in Older Musicians and Non-Musicians: An Online Study

A. Cloutier, N. Monette-Gagné, N. Gosselin

Keywords: Musical emotions, emotional judgements, musical expertise, older adults

Abstract: Some studies show differences in how musicians and non-musicians evaluate degree of arousal (stimulating vs relaxing) and valence (pleasant vs unpleasant) to music. However, these studies are limited to small sample sizes and young adults. The purpose of this online study was to compare older musicians and non-musicians in their emotional judgment of different classical musical excerpts. Musicians and non-musicians, ages 60 years and older, provided arousal and valence evaluations to 51 musical excerpts using a 10-point Likert scales (e.g., 1 = Very relaxing and 10 = Very stimulating). Selected musical excerpts were composed in major mode, half characterized as slow in tempo ($M = 50.31$ beats per minute, BPM), half as fast in tempo ($M = 138.31$ BPM). Mixed design ANOVA with musical expertise as a two-level between-subject factor (musicians vs non musicians) and the type of musical excerpt as a two-level within-subject factor (slow vs fast) will be performed with activation and valence data examining the effects of musical expertise and tempo. Preliminary results indicate that there is no difference between musicians and non-musicians in their judgments about arousal and valence evaluations.

For further information: amelie.cloutier.1@umontreal.ca

28. Examiner l'impact de la stimulation magnétique transcrânienne sur le traitement de la parole chez l'adulte : résultats préliminaires

V. Brisson, P. Tremblay

Keywords: Perception de la parole, vieillissement, stimulation magnétique transcrânienne

Abstract: Le vieillissement normal s'accompagne de difficultés à suivre les conversations en présence de bruit, ce qui nuit aux interactions sociales. La stimulation magnétique transcrânienne (TMS) excitatrice appliquée à des régions qui contribuent au traitement de la parole (TP) pourrait réduire ces difficultés. Toutefois, le potentiel de la TMS pour induire des changements bénéfiques au TP dans le cerveau vieillissant n'a pas été établi, et les facteurs qui influencent la réponse post-TMS demeurent peu connus. Ce projet vise à déterminer s'il est possible d'améliorer la perception de la parole à l'aide de la TMS excitatrice appliquée à trois régions du cerveau impliquées dans le TP. Le second objectif est d'explorer les facteurs qui influencent l'amélioration post-TMS. Méthode. 30 adultes âgés de 20 à 80 ans seront recrutés (collecte en cours). Des images de l'anatomie et de l'activité cérébrale sont acquises par IRM pour la sélection des cibles pour la TMS (gyrus temporal supérieur, sulcus temporal supérieur, cortex prémoteur, contrôle). Chaque stimulation est suivie d'une tâche de discrimination de syllabes dans le bruit. Des modèles linéaires mixtes ont été réalisés sur un échantillon préliminaire ($N=14$) afin d'évaluer l'effet de la région stimulée, de l'âge et de la performance initiale sur les taux d'amélioration post-TMS (précision, temps de réaction). Résultats. La TMS améliore la performance, en particulier chez les personnes plus âgées, ainsi que chez les personnes présentant plus de difficultés initialement. Ce projet permettra de paver la voie à l'utilisation de la TMS comme stratégie pour maintenir la communication chez les aînés.

For further information: <https://speechneurolab.ca/fr/>

29. Aging of Resting-state Networks in Amateur Singers and Non-singers

X. Zhang, P. Tremblay

Keywords: Aging, singing, resting-state, functional magnetic resonance imaging

Abstract: Aging is associated with decreased resting-state functional connectivity in multiple networks. Despite this important decline, the adult human brain retains a remarkable capacity to modify its organization in an enduring manner throughout the lifespan, as a correlate of skill acquisition. Studies suggest that the practice of musical activities can have a transformative effect on the resting-state functional connectivity. Singing is a universal human activity that engages the perceptual and motor systems, as well as affective and motivational systems. The goal of this study was to examine resting-state networks in groups of amateur singers and non-singers including young, middle-aged, and older adults. We expect that singing would be associated with higher resting-state connectivity, especially in older singers.

41 amateur singers (M = 55±19 years; 22-87 years) and 43 non-singers (M = 54±29 years; 20-86 years) were recruited. The groups were matched on age, education, cognition, and general health condition. Participants completed were scanned on a 3T MRI scanner. The resting-state fMRI data was first preprocessed (motion correction, field distortion correction, bandpass filter, and physiological noise removal), then it was analyzed using a seed-based approach focusing on two networks: the speech network and default-mode network. The group analysis focused on the effect of age, group and the interaction between age and group. The analyses were controlled for sex and health condition. Preliminary results suggest lesser resting-state connectivity in the speech and default networks in singers compared to non-singers. Further data analyses are underway. Preliminary results will be present in the poster.

For further information: xiyue.zhang.2@ulaval.ca

30. Relation entre l'attention visuelle et auditive et la pratique d'une activité musicale au cours du vieillissement normal

A. Sicard, M. Joyal, V. Penhune, P. Tremblay

Keywords: Attention, Chanteur, Instrumentiste, Vieillissement

Abstract: Les capacités cognitives et exécutives, incluant les capacités attentionnelles, déclinent avec l'âge. Certaines activités, comme le chant et la musique, pourraient atténuer les effets du vieillissement sur le fonctionnement cognitif, mais les données sont insuffisantes et hétérogènes. L'objectif de ce projet est d'examiner la relation entre la pratique d'activités musicales à un niveau amateur et les capacités attentionnelles chez des personnes jeunes et âgées. Trois groupes de participants âgés de 20 à 88 ans (n = 110), en bonne santé, appariés pour l'âge, la scolarité, le niveau de santé et le fonctionnement cognitif général, ont été recrutés : (a) 37 chanteurs amateurs, (b) 35 instrumentistes amateurs, et (c) 38 personnes pratiquant une activité psychomotrice non musicale. Les participants ont effectué une batterie de tests incluant un test d'attention soutenue bimodale (Integrated Visual and Auditory Continuous Performance Test ou IVA-CPT) ainsi qu'une séance IRM. L'hypothèse générale du projet est que la pratique d'un instrument de musique, et, dans une moindre mesure, la pratique du chant seront associées à de meilleures capacités attentionnelles, surtout dans la modalité auditive. De plus, la relation négative entre l'âge et la

performance à l'IVA sera réduite chez les musiciens et les chanteurs comparativement au groupe contrôle. Les analyses statistiques sont en cours et seront présentées lors de la journée scientifique. Ce projet de recherche permettra d'identifier de possibles effets de transfert de la pratique d'activités musicales au niveau amateur sur les fonctions cognitives chez les adultes.

For further information: alexandre.sicard.1@ulaval.ca

31. Experience-dependent plasticity in the auditory preferences of female zebra finches measured by fMRI

E. Wall, N. Vidas-Guscic, A. Van Der Linden, S.C. Woolley

Keywords: auditory perception, fMRI, vocal communication, experience-dependent plasticity

Abstract: Vocal communication requires proper interpretation of vocal signals which can depend not only on the content of the signal, but also on an individual's experiences. While social interactions throughout life appear to play a significant role in shaping perception, experience-dependent changes in perception remain poorly understood. To address this question, our project investigates how developmental and social experiences shape the perception of vocal signals, and the mechanisms that drive these changes in the brain. Female songbirds, such as the zebra finch, are an excellent model for studying auditory perception as they use learned vocal signals (songs) produced by males to identify individuals and choose mates. Like humans, zebra finches have an auditory system that is tuned during development and shows more limited plasticity in adulthood that may depend on salient social experiences. Through our research, we have found that adult mating experiences profoundly affect female auditory preferences. In contrast, auditory-only exposure to a male was not sufficient to drive song preference. These data suggest that receiving auditory stimuli demands more than passive listening - it requires dynamic encoding of the signal. To investigate the impact of these experiences on neural processing, we coupled our behavioral paradigm with whole-brain functional imaging. Using BOLD fMRI, we explored changes in neural responses to song before, during, and after social or auditory-only experience. By uncovering the experiences and neural mechanisms that shape the perception of auditory signals, these experiments will answer essential questions about neuroplasticity and learning in a behaviorally-relevant model species.

For further information: erin.wall@mail.mcgill.ca

32. Functionally homologous representation of vocalizations in the auditory cortex of humans and macaques

C. Bodin, R Trapeau, P. Belin

Keywords: primate, vocalisation, auditory cortex

Abstract: How the evolution of speech has transformed the human auditory cortex compared to other primates remains largely unknown. While primary auditory cortex is organized largely similarly in humans and macaques, the picture is much less clear at higher levels of the anterior auditory pathway, particularly regarding the processing of conspecific vocalizations (CVs). A "voice region" similar to the human voice-selective areas has been identified in the macaque right anterior temporal lobe with functional MRI; however, its anatomical localization, seemingly inconsistent with that of the human temporal voice areas (TVAs), has suggested a "repositioning of the voice area" in recent human

evolution. Here I present data from my PhD thesis showing a functional homology in the cerebral processing of vocalizations by macaques and humans, using comparative fMRI and a condition-rich auditory stimulation paradigm. The anterior temporal lobe of both species possesses cortical voice areas that are bilateral and not only prefer conspecific vocalizations but also implement a representational geometry categorizing them apart from all other sounds in a species-specific but homologous manner.

These results reveal a more similar functional organization of higher-level auditory cortex in macaques and humans than currently known.

For further information: clementine.bodin@mcgill.ca

33. Neural and Behavioural Predictors of Successful Second Language Perception

C. T. Honda, M. Clayards, S. R. Baum

Keywords: Frequency following response, electroencephalography, phonetic perception, individual differences

Abstract: Mastering a second language (L2) in adulthood is challenging, but it is unclear why some learners achieve better speech perception and production abilities than others. Behavioural tasks have revealed robust individual differences not only in L2 perception, but also in native language (L1) phonetic sensitivity (i.e., use of relevant acoustic cues to distinguish speech sounds) and perceptual gradiency (i.e., perception of gradual/sharp changes along a continuum of speech sounds). One hypothesis is that these differences in L1 perception relate to differences in how well speech sounds are encoded and could relate to early stages of L2 learning. The frequency following response (FFR) also shows inter-individual differences among healthy adults, potentially reflecting the fidelity of sound encoding. We therefore examined individual differences in L1 perception, non-native perception, and the FFR, and explored the relationships among them. To measure L1 phonetic skills, English monolinguals responded to stimuli varying along a continuum (e.g., bet—bat) in two-alternative-forced-choice and visual-analog-scaling tasks. To measure non-native perception, participants discriminated unfamiliar German sounds in an oddity task. The FFR was elicited using the syllable /da/. We predicted that participants with greater L1 phonetic sensitivity and perceptual gradiency would show more consistent FFRs, and that this would also relate to better non-native perception. Preliminary behavioural results suggest that differences in L1 perception across tasks do relate to how consistently speech sounds are perceived, and may also relate to differences in non-native perception. This work advances our understanding of individual differences in how speech sounds are encoded and perceived.

For further information: claire.honda@mail.mcgill.ca

34. Proof-of-concept of a beat-based serious game for telerehabilitation in children with ADHD: Effects on executive functioning

K. Jamey, H. Laflamme, S. Rigoulot, N. E. V. Foster, S. Lippé, S. A. Kotz, S. Dalla Bella

Keywords: Executive Functioning, Rhythm, Attention-Deficit Hyperactivity Disorder, Music, Telerehabilitation

Abstract: Tapping to a musical beat requires self-monitoring while maintaining regular movements and filtering relevant from distracting musical information. This poses important demands on executive functioning such as inhibitory control as well as inhibition-dependent functions like set-shifting and working memory. We investigated if training beat-synchronization has an effect on executive functioning in children with Attention-Deficit Hyperactivity Disorder (ADHD), a disorder characterized by deficits in executive functioning. This study served to validate an at-home longitudinal protocol in which 30 children aged 7 to 13 years were randomly assigned to a beat-synchronization game (Rhythm Workers - RW, tablet application) or an active control condition (Frozen Bubble game - FB) that lacked tapping to the beat but involved comparable motor movement. Children were asked to play the game for 300 minutes over the course of 2 weeks. Pre- and post-training rhythmic abilities (Battery for the Assessment of Auditory Sensorimotor and Timing Abilities, BAASTA) and executive functioning (flanker, go-nogo, n-back, set-shifting) were measured. Data from 25 children showed both games were rated equally for difficulty and pleasantness ($p > .38$). The synchronization game had a greater effect than the control on executive functioning ($p = 0.42$). Improvements in attentional inhibition seem most pronounced for younger children between ages 7-9 years in RW than FB ($p = .007$), which may be due to a sensitive period for skill transfer. This study shows preliminary evidence that a beat-based training game affects attentional inhibition in young children with ADHD. A full-scale clinical trial is planned, and these findings suggest targeting 7-9-year-old children.

For further information: kevin.jamey@umontreal.ca

35. The ramp paradigm: A new protocol for uncovering individual differences in walking to an auditory beat

A. Zagala, N. Foster, F. van Vugt, S. Dalla Bella

Keywords: Auditory-motor synchronization, Rhythm perception and performance, Gait, Individual differences

Abstract: Walking to the beat of an auditory stimulus seems effortless for most humans. However, recent studies suggest significant individual differences in the spontaneous tendency to synchronize to the beat. Some individuals (“responders”) tend to adapt their walking pace to the stimulus beat while others (“non-responders”) show little or no adjustment to the beat. This distinction remains to be empirically validated, and little is known about the mechanisms explaining these differences. Unfortunately, to date, there is no protocol sensitive to individual differences in adapting to rhythmic stimuli while walking. To fill this gap, we introduce the ramp paradigm, which allows to test whether a person adapts or not to a rhythmic change in a gait task. In this protocol, a participant is asked first to walk at a spontaneous cadence without metronome. After several steps, a metronome starts in synchrony with the footfalls. Then, the stimulus tempo progressively departs from the participant’s cadence by either accelerating or decelerating. Reliable measurement of the timing of the participant’s cadence is ensured by using force-sensitive resistors (FSRs) and a portable Teensy device. Pilot data will be presented. To distinguish the capacities of the participant regarding synchronization and their spontaneous response, instructions will also be manipulated asking the participant to synchronize, walk naturally or ignore the stimulus. The method aims to quantify the individual adaptation to tempo changes in the beat, thus allowing to objectively distinguish responders from non-responders. This will pave the way to the study of mechanisms driving individual differences in gait synchronization.

For further information: agnes.zagala@gmail.com

36. Investigating the mechanisms of reward and synchronization: selection of musical stimuli by an online study

M-A. Richard, M-J. Azzi, N.E.V. Foster, N. Gosselin, S. Dalla Bella

Keywords: music, reward, auditory-motor synchronization, movement, running

Abstract: Running while listening to music is common and enjoyable for many recreational runners. Testing the role of music in a running task offers a good model to examining the mechanisms underpinning auditory-motor synchronization to a beat and music reward. To date, it is still unclear if these mechanisms, both related to dopaminergic circuitries, are overlapping or partly independent. The aim of the study was to select musical stimuli that vary in terms of arousal (relaxing – stimulating) and wanting to move (low - high), both variables linked to music reward.

In an online study, 193 participants living in Canada (18 - 35 years old, 169 females) listened to a randomly selected block of 24 songs from a total selection of 264 songs. For each song, participants rated the arousal, valence, familiarity and their wanting to move using visual analog scales. All songs had a strong beat saliency and a stable tempo, ranging between 134 and 170 bpm, and were selected to be potentially suitable for running at a light to moderate cadence. Scores were averaged, and songs that were frequently rated as unfamiliar or unpleasant were subsequently removed.

On the basis of these ratings, groups of stimuli were selected to differ significantly in terms of arousal and wanting to move. This music material allows the manipulation of wanting to move and arousal independently, and will be used in further studies evaluating the overlapping of the mechanisms underlying music reward and auditory-motor synchronization in a running task.

For further information: marie-andree.richard@umontreal.ca

37. The potential of rhythm-based training in pre-adolescent children who stutter

M. Lemire, S. Dalla Bella, K. Jamey and S. Falk

Keywords: Developmental Stuttering, Speech motor control/learning and rhythmic training, preadolescent

Abstract: Rhythm-based music training has been proposed as a potential means to help people improve speech abilities. Benefits have been found for children with impaired speech and language development and adults with a neurogenic speech disorder. Rhythm-based training could also be relevant for stuttering: a neurodevelopmental speech motor disorder, potentially due to alterations in the neural circuits underlying auditory-motor integration. Hence, rhythm-based training targeted to improve auditory-motor integration and coordination skills could be an interesting tool to support motor processes (non-verbal/verbal) in young people who stutter.

We investigate this hypothesis in a proof-of-concept study with 20 pre-adolescent children who stutter on average 11 years old. They are invited to attend a 4-week musical rhythmic training based on beat synchronization (i.e., the “Rhythm Worker” game) or a non-rhythmic training (a “Frozen Bubble” game).

Twice before and once after training, participants will complete verbal tasks, aimed at assessing verbal fluency and aspects of stuttering. We will also assess on their non-verbal sensori-motor synchronization skills (BAASTA) and oromotor performance and some cognitive tests. We will control for IQ, music and

language experience. We expect that training rhythmic capacities in pre-adolescents who stutter may improve auditory-motor control and examine whether effects may transfer to speech-motor functions.

Data collection is about to start and we will discuss the expected results in the broader context of the literature on the interface between musical and speech capacities as well as the hypothesis that stuttering emerges from altered rhythm and timing networks in speech as well as non-speech production.

For further information: marilyne.lemire-tremblay@umontreal.ca ; simone.falk@umontreal.ca

38. Proof-of-concept of a beat-based serious game for telerehabilitation in children with ADHD: Effects on auditory motor synchronization

H. Laflamme, K. Jamey, S. Rigoulot, N. E. V. Foster, S. Lippé, S. A. Kotz & S. Dalla Bella

Keywords: rhythm, children, ADHD, auditory, sensorimotor

Abstract: Tapping to a musical beat requires self-monitoring while maintaining regular movements and filtering relevant from distracting musical information. This poses important motor and executive functioning demands. We investigated if a serious game involving finger-tapping to music generalizes to auditory motor synchronization skills and mediates skill transfer to executive functioning in children with Attention-Deficit Hyperactivity Disorder (ADHD), a disorder characterized by deficits in executive functioning and rhythmic abilities. This study validated an at-home longitudinal protocol in which 30 children aged 7 to 13 were randomly assigned to a beat-synchronization game (RhythmWorkers, tablet application) or an active control condition (Frozen Bubble game) that lacked tapping to the beat but involved comparable motor movement. Children were asked to play the game for 300 minutes over the course of 2 weeks. Pre- and post-training rhythmic abilities (Battery for the Assessment of Auditory Sensorimotor and Timing Abilities, BAASTA) and executive functioning (flanker, go-nogo, n-back, set-shifting) were measured. Preliminary findings for 26 children showed both games were rated equally for difficulty and pleasantness ($p > .38$). After playing RhythmWorkers, the rhythmic abilities of children with ADHD improved for paced tapping (to music and a metronome; $p < .05$), compared to the children with ADHD playing the control game. These preliminary findings validate that playing Rhythm Workers generalizes to auditory motor synchronization skills in children with ADHD and likely plays a mediating role in far-transfer effects to executive functioning.

For further information: hugo.laflamme.1@umontreal.ca

39. Tempo Rubato: Using Participatory Music to Convey the Lived Experience of Parkinson's Disease

N. Kuhlmann, A. Thomas, S. Blain-Moraes, Piece of Mind Collective

Keywords: arts-based knowledge translation, participatory music, Parkinson's disease, lived experience, research-creation

Abstract: Despite significant research advances in understanding and treating Parkinson's disease (PD), communication barriers continue to limit fruitful exchange between bench, bedside and beyond. Traditional means of knowledge dissemination are inaccessible to non-academic audiences, hampering meaningful dialogue with and research uptake by community stakeholders. To explore other strategies for

engaging diverse stakeholders, Piece of Mind brought together neuroscientists, people with PD and artists to co-create a multi-media knowledge translation performance based on scientific research and lived experience. Here, we focus on our innovative approach to participatory music by way of virtual collaborations, drawing on two examples: 1) “Musical Diaries” ; and 2) “Sur le fil”. For “Musical Diaries”, a participant with PD met weekly with 3 musicians over Zoom, conducting them based on how the disease and medication affect various aspects of her life. Each musical session was completed by a discussion of how her experiences relate to current neuroscientific research. In “Sur le fil”, we began with a poem written by another participant with PD, describing her experience as one of walking a tightrope, and—through an iterative process—experimented with how this could be illustrated in music. The resulting piece includes the layered voices of multiple participants recorded via Zoom, as well as samples from “Musical Diaries”, and was used for the final act in the Piece of Mind: Parkinson’s performance. Semi-structured interviews indicated that creative collaboration facilitated empathy and understanding between the project participants, and that music was a powerful tool for conveying experiences that are difficult to articulate in words.

For further information: pieceofmind.montreal@gmail.com ;
<https://www.youtube.com/channel/UCN8PIYIYVGYTP8vqdvSPXwA>

40. An ERP Study of Auditory Adjective and Determiner Agreement in Quebec Adolescents

G. Blais, É. Courteau, K. Steinhauer, P. Royle

Keywords: ERP, Agreement, Adolescents, French, Oral language

Abstract: We investigated event-related potential (ERP) effects of agreement violations on noun-adjective and noun-determiner gender mismatches on French speaking adolescents in an audio-visual presentation paradigm. The main goal of the study is to test whether adolescents’ ERPs elicited by agreement violations differ from adult patterns, as adolescence is a transition period where grammatical knowledge may be mature in some domains and consolidating in others. For example, processing complexity of agreement differs in French irregular adjectives and regular determiners; the former should be more difficult to process than the latter. In reading studies, adults elicit biphasic left-lateralised negativity+P600s for adjective gender-agreement errors and an anterior negativity plus P600 for determiner errors. While younger children exhibit a central N400-like negativity for adjective errors and a late frontal positivity for determiners. 21 French-speaking adolescents (aged 10.1-16.0 years) and 29 adults (aged 19-39 years) looked at images that were described with auditory sentences and made grammatical judgements on the sentences. Visualisation shows a similar LAN-P600 response for the determiner condition in both adults and adolescents. The two groups differed in the adjective condition where adolescents elicited an N400 followed by a late P600 overlapped by a frontal negativity, while adults showed a left-lateralised negativity followed by a P600. These results point towards different grammatical processing between adults and adolescents for irregular adjectives—, indicating that consolidation is ongoing in this case—, but not for regular determiner agreement, which appears to be mature.

For further information: guillaume.blais@umontreal.ca

41. The joint effects of hedonic response and predictability on motor learning in music

A. Albury, M. Didaskalou, R. Bianco, A. Johnson, V. Penhune

Keywords: music, motor learning, prediction, emotional arousal

Abstract: Music can vary independently on the dimensions of predictability and liking. However, these characteristics also interact such that musical predictability influences emotional arousal. This results in an inverted U-shaped relationship indicating that moderately predictable melodies are more liked than both highly predictable and low predictable melodies. This relation indicates that, in addition to the individual effects of predictability and liking, motor learning may be influenced by the interaction between these two dimensions. To test this, we created a paradigm wherein non-musicians learned to play melodies that varied in their level of predictability and enjoyment on a piano keyboard. We then collected both physiological and subjective measures of hedonic response using pupillometry and subjective ratings of enjoyment respectively. By relating participants' performance for of the melodies to the measures of liking, we were able to relate variations in musical pleasure to differential motor learning. We hypothesize that participants' performance will be better for high liked melodies compared to the low liked ones. We also expect predictable melodies will be performed better than unpredictable ones. However, we expect an interaction between predictability and liking to overshadow this effect such that highly liked melodies will be performed better regardless of their level of predictability. The results of this study further contribute to the growing literature on the relationship between liking and learning as well as provide clearer insights on the cognitive and hedonic mechanisms underlying motor learning.

For further information: alexander.albury@mail.concordia.ca

42. Disentangling The Sensation of Groove

I. Romkey, M. Psomas, N. Foster, S. Dalla Bella, V. Penhune.

Keywords: Groove, Music Anhedonia, Music Perception

Abstract: Groove refers to the pleasurable desire to move to music. Previous work where listeners rate groove stimuli on pleasure and desire to move, these factors are typically found to be highly related, however, recent work has shown that they may be separable. First, the effect of harmonic complexity appears to be primarily mediated through pleasure rather than desire to move. Second, the results of fMRI work showed that pleasure was more associated with reward networks and desire to move was more associated with motor networks. To further explore the separability of wanting to move and pleasure, the current study investigates people with musical anhedonia, who have a blunted ability to derive pleasure from music but can still derive pleasure from other domains (e.g., sex and food). We predict that if the two factors of groove are separable, individuals with musical anhedonia will rate high groove samples as lower in derived pleasure but have comparable ratings of desire to move compared to controls. Individuals with specific musical anhedonia are identified using the Barcelona Musical Reward Questionnaire. Groove responses are measured through ratings of a set of rhythm samples that have previously been shown to differ in participants' level of rated pleasure and desire to move. We are currently in the process of cleaning and analyzing data, therefore we are confident of having results to present by the research day. The current study has implications for better understanding the sensation of groove.

For further information: isaac.romkey@mail.concordia.ca