

# CRBLM Scientific Day

May 13, 2019

## Poster Session 2 – 12:30-2:30pm

### **1b. The Music-In-Noise Task (MINT): A Tool for Dissecting Complex Auditory Perception**

Emily B. J. Coffey (Concordia University), Isabelle Arseneau-Bruneau (McGill University), Xiaochen Zhang (Tsinghua University), and Robert J. Zatorre (McGill University)

Keywords: auditory stream segregation; hearing-in-noise; interindividual variability; multilingualism; musical training; neuroplasticity; skill assessment tool

The Music-in-noise task (MINT) represents a new tool developed by our lab to expand currently available measures of complex auditory perception. Clinical hearing in noise tests traditionally used only speech stimuli, and did not systematically consider additional cues (e.g. visual, spatial) present in real hearing situations. Our match/mismatch task used brief target melodies embedded in a musical background, with subtasks in which we varied the contributions of spatial, visual, and predictive cues when hearing in noisy conditions. Data from a sample of young adults showed that the MINT has good reliability and internal consistency, and demonstrated performance benefits from musical training, particularly in the presence of additional cues. We also observed benefits on MINT performance from multilingualism which were separable from those of musicianship. Overall, average MINT scores were correlated with scores on a sentence-in-noise perception task, but only accounted for a relatively small percentage of the variance, indicating that the MINT is sensitive to additional factors and can provide a complement for speech-based tests that examine stream segregation. A customizable version of the MINT is made available for use and extension by the scientific community.

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### **2b. Effect of background music on inhibition: The influence of anxiety**

Catherine Houde-Archambault (Université de Montréal), Amélie Cloutier (Université de Montréal), Natalia Fernandez (University of Geneva), Nathalie Gosselin (Université de Montréal)

Keywords: background music, anxiety, inhibition, emotions

The omnipresence of music in daily activities arises questioning about its impact on our ability to inhibit distractions when working on a task. Studies exploring the effect of background music on cognition, specifically on inhibition, have shown inconsistent results. Since music and anxiety both modulate activity in brain structures related to emotions, it is possible that the emotional parameters of music and the individual levels of anxiety influence the observed effect of background music on inhibition. The aim of this study is to explore the effect of the activation levels of background music (relaxing/stimulating) and individual anxiety variations (low/high) on inhibition capacity. To this aim, 46 healthy participants (18-35) were recruited and divided in two groups according to their state anxiety scores on Spielberger's State and Trait Anxiety Inventory (Form Y). Both groups performed the Eriksen's Flanker task under three auditory conditions: 1 – stimulating music, 2 – relaxing music and 3 – in silence. The difference in mean response time (RT) for the incongruent (>><<>>, <<>><<) and congruent (<<<<, >>>>) trials revealed the Flanker effect. Performance was compared on this parameter. The Low Anxiety (LA) group's performance was significantly longer mean response time (RT) in the relaxing condition compared to both stimulating music and silence. There was no difference across auditory conditions for the High Anxiety (HA) group performances. These preliminary results suggest that activation levels of background music have a different effect on inhibition performances depending on state anxiety levels.

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### **3b. Effect of background music on attentional control in a normal aging perspective**

Amélie Cloutier (Université de Montréal), Catherine Houde-Archambault (Université de Montréal), Natalia Fernandez (University of Geneva)

Keywords: normal aging, executive functions, background music

Previous studies demonstrated that background music can enhance executive functions (e.g., working memory and verbal fluency) both in older and younger adults. Nonetheless, the effect of background music on attentional control has not yet been explored. According to the arousal-mood theory, the positive effect of background music on cognitive performance would be due to its ability to increase the arousal level of the listener and to improve his mood. Therefore, a pleasant and stimulating music could enhance cognitive performance. However, knowing that normal aging is accompanied by a decline in attentional control, it is legitimate to think that background music can be more distracting for older adults than for younger adults. This project aims to explore the age-related differential effect of background music on attentional control performances. To do so, 21 young (18-35) and 21 older (60-75) participants performed an Eriksen's Flanker task during the exposure of relaxing and stimulating acoustical music, in addition to a silent condition, to the same amount of time. Musical excerpts were chosen based on a previous study to ensure they were judged as stimulating or relaxing. For all participants and in all sound conditions, reaction time was slower in the incongruent condition of the task compared to the congruent one. This difference is significantly smaller under stimulating music compared to relaxing music, due to a faster reaction time in the incongruent condition. In conclusion, background music has the same effect on attentional control performance for both older and younger adults.

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#### **4b. Perceptual processing of pre-boundary lengthening during phrase segmentation in English: Preliminary ERP evidence.**

Annie C. Gilbert, Jasmine Lee, Max Wolpert, Shari R. Baum (McGill University)

Keywords: Prosody, Speech Segmentation, Event-Related Potentials (ERP), Closure Positive Shift (CPS)

The study of phrase processing has greatly benefited from the identification of a specific Event-Related Potential (ERP) component associated with the perception of phrase boundaries, namely the Closure Positive Shift (CPS). Most of the work on the CPS has looked at higher-level phrase processing where the phrasing informs the syntactic-semantic parsing of the sentence. Interestingly, a few studies have also found CPSs (or CPS-like positivities, hereafter included in CPS) associated with the acoustic processing of the prosodic markers of phrase boundaries, even if such boundaries did not have a significant impact on the interpretation of the stimuli (in nonsense stimuli, for example). Among these studies, Gilbert et al. (2015) demonstrated that phrase-final lengthening (without F0 modulation) is sufficient to trigger a CPS-like positivity in both simple French sentences and nonsense series of syllables. They interpreted their results as reflecting a domain-general perceptual process related to phrase segmentation and independent of the content of the utterance. It should be noted that French has a very simple prosodic system with no lexically-coded prosody; thus, it is unclear if a similar perceptual CPS would emerge in languages from different prosodic typologies. To answer this question, we designed an ERP experiment to determine if phrase-final lengthening would trigger a perceptual CPS in simple English utterances, and recruited both monolingual English speakers and English-French bilinguals. Preliminary results demonstrate that phrase-final lengthening triggers a perceptual CPS in English in both groups, which supports the domain-general interpretation of phrase-final lengthening acting as a lower-level phrase segmentation cue.

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#### **5b. Inhibition control outcomes of a music intervention for autism**

Kevin Jamey (University of Montreal), Nicholas E. V. Foster (University of Montreal), Megha Sharda (University of Montreal), Carola Tuerk (University of Montreal), Rakhee Chowdhury (University of Montreal), Melissa Tan (Westmount Music Therapy), Aparna Nadig (McGill University), and Krista L. Hyde (University of Montreal).

Music is a complex, multimodal activity which depends on and may in turn enhance inhibition control (IC) during cognitive development. IC is an executive function important for regulating appropriate and inappropriate responses and for adapting behaviour to shifting situational demands. Individuals with autism spectrum disorder (ASD) have shown impairments on standard IC tasks. The object of this study was to evaluate changes in IC measures in children with ASD after 8-12 weeks of a music or non-music intervention. Data were collected as part of a larger 8-12 week randomized controlled trial of music for school-age children

with autism. Both the music and non-music therapies targeted social and communication outcomes. Music sessions were individual, semi-improvisational and participants could choose from several instruments. Groups had average IQ and were matched on age, sex, IQ and socioeconomic status in both analyses ( $p \geq .274$ ). Mixed-effects analyses tested changes in IC performance. IC performance was not significantly greater in children with ASD who participated in 8-12 weeks of music intervention compared to those in the non-musical intervention, and overall no changes in IC performance were found in either intervention. In the larger RCT, positive effects were previously found on communication scores for the music group versus the non-music group. More intense interventions with a greater focus on music and movement coupling may be beneficial in music-based interventions where IC is a targeted outcome. As such, these results may help guide the effectiveness of future music-based interventions in ASD.

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## **6b. Exploring the relationship between prosodic cue production and brain structure in the bilingual brain**

Jasmine G. Lee (McGill University), Annie C. Gilbert (McGill University), Shanna Kousaie (McGill University), Denise Klein (McGill University), Shari R. Baum (McGill University)

Keywords: bilingualism, brain structure, prosody, fMRI

All languages use prosodic cues [e.g. fundamental frequency (F0) and duration] to segment the speech stream, however different languages use these cues following different segmentation strategies. While English has both lexical and phrasal level prosodic cues, French only has phrasal level prosodic cues. This can lead to accent and transfer between languages in bilinguals. The current study investigated the relationship between native-like production of prosodic cues by bilinguals in their two languages and brain structure in terms of gray matter volume (GMV). Fifteen bilinguals (L1 English, L2 French) completed a language production task, involving eighty sentence pairs (forty sentence pairs per language). The target words in each sentence pair were oronyms, sharing the same phonology, but with different spellings and meanings (e.g. 'kiwi' and 'key we'). Speakers therefore had to utilize the prosodic cues to differentiate between oronyms. F0 and duration production values for the target words were measured and each participant was placed on a continuum from native-like to non-native-like in both English and French. Production measures were then related to differences in brain structure using a whole-brain voxel-based morphometry analysis. We found that F0 production was associated with GMV in the bilateral basal ganglia (the putamen in English and the caudate in French) whereas duration production was associated with GMV in the left cerebellum (in both languages). Although the basal ganglia and the cerebellum have not traditionally been associated with language processing, the results from the current study illustrate the potential role of these regions in prosodic production.

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## **7b. Verbal fluency, language and executive musical working memory in children with autism spectrum disorders.**

Dianne Macdonald (McGill University), Gwenaëlle Philibert-Lignières (McGill University), Eve-Marie Quintin (McGill University)

Key words: verbal fluency, musical working memory, executive functioning

There is debate as to whether children with autism spectrum disorder (ASD) have adequate or impaired verbal fluency, i.e., the ability to generate a list of items within a specific semantic category, despite deficits in executive functioning and language skills. Language may play a role in verbal fluency and executive functioning. Given musical strengths of children with ASD, we study the relationship between verbal fluency, language and executive functioning as used when playing music, i.e. executive musical working memory (EMWM). Children with ASD ( $n=30$ ) ages 8 to 12 were divided into low language (VCI  $<75$ ,  $n=16$ ) or high language (VCI  $>75$ ,  $n=14$ ) groups. Within each group, we examined the relationship between verbal fluency and EMWM (judging whether 2 consecutive sequences of musical pitches were the same or different). Verbal fluency in the ASD group with lower VCI, but not high VCI, was significantly related to performance on the executive musical working memory task  $F(2,13)=6.032$ ,  $p=.014$ , when accounting for age. Results suggest that language influences the relationship between verbal fluency and EMWM in children with ASD. This sheds light on the debate over whether children with ASD have adequate or impaired verbal fluency by suggesting

that language and executive functioning should be considered when assessing verbal fluency. Furthermore, children with ASD and lower levels of VCI may benefit more from musical training, known to improve verbal skills and auditory working memory in children with typical development.

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### **8b. Quantifying The Active Ingredients of Music Therapy: An Analysis of Movement Dynamics Between Therapist and Children with Autism**

Aparna Nadig (McGill University), Angela MacDonald (McGill University), Megha Sharda (Université de Montréal), Nida Latif (McGill University), Cynthia DiFrancesco (McGill University), and Krista L. Hyde (Université de Montréal)

Keywords: music therapy, movement coordination, autism

Background: In a randomized controlled trial, we recently showed that 8-12 weeks of music intervention can improve auditory-motor brain connectivity and parent-reported social communication in school-age children with ASD (Sharda et al., 2018). Here we applied a novel, optical flow analysis method to videos of therapy sessions from Sharda et al. (2018) to examine movement amplitude between child and therapist. Objectives: 1) Quantify movement amplitude between therapist and child using an optical flow-based analysis method 2) Examine how movement amplitude may evolve over time. Methods: For each participant, we selected 1-minute video clips of the same activity (e.g., handheld percussion) occurring at an early (T1) or late (T2) therapy session. Movement amplitude between child and therapist were analyzed using FlowAnalyzer Software. Results: Average amplitude of movement was calculated for both child and therapist at each time point. Child movement amplitude was significantly higher in MT than nonMT. Movement amplitude varied due to the nature of each activity.

Conclusions: Previous studies have reported that early motor difficulties are often predictive of later social communication impairments in ASD. Thus interventions targeting motor skills, measured here using movement amplitude, may impact later social outcomes and may provide a mechanism for music-based interventions (Jauzen & Thaut, 2018). These factors in concert may have given rise to the positive outcomes observed for MT (Sharda et al., 2018).

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### **9b. Brain Connectivity Changes and Second-Language Learning Success**

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Keywords: language learning, plasticity, biomarkers

Learning a first language occurs easily and naturally at a young age. However, learning a second language (L2) at a later age is more difficult, and there is a large variability in L2 acquisition, with individuals learning with more or less difficulty depending on the age and environment of acquisition. Variability in L2 acquisition is also influenced by between-individual differences in language learning abilities, though little is known about the factors that lead to those differences. The main goal of the presented project is to identify neural biomarkers or predictors associated with language learning success in individuals. Specifically, we are interested in the functional brain connectivity between the language areas of the brain. This project hypothesizes that functional connectivity changes in the brain are the consequence of brain plasticity, and that these changes relate to variability in language learning. We tested eighteen French learners before and after they took a language training course. We acquired resting-state functional Magnetic Resonance Imaging along with several language samples to capture changes in language proficiency. We measured BOLD signal changes at rest between relevant language regions-of-interest (ROI) and looked to see how this related to behavioural outcomes. This project has several outcomes that are relevant to our understanding of L2 acquisition. Linking intrinsic functional patterns and the ability to acquire an L2 informs us about neural biomarkers predicting L2 learning success or difficulty, and comparisons of pre- and post-training reveals how the brain changes with language training.

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### **10b. Behavioral and Neurological Correlates of Spoken and Sung Utterances in Adults Who Stutter**

Robert van de Vorst (McGill University), Mickael L. D. Deroche (Concordia University), Sazzad M. Nasir (Northwestern University), Vincent L. Gracco (Haskins Laboratories)

Keywords: stuttering, singing, anticipation

The purpose of this study is to investigate if adults who stutter (AWS) show a reduction in the anticipation of stuttering when instructed to sing compared to when preparing to speak and if acoustic and neural correlates can reveal differences between stuttering and fluent speakers during these conditions. Participants were 16 AWS and 20 age- and gender-matched fluent adult speakers (FA). During the experiment, EEG (electroencephalography) was recorded while participants were instructed to either speak or (freely) sing aloud sentences on the screen and subsequently asked to rate their experience of stuttering anticipation prior to production. Productions were acoustically analyzed for reaction time, duration between syllables, syllabic rate and spectral distributions of power. Currently, we are computing neural time-frequency and phase-coherence measures across theta, alpha and beta frequency bands with respect to the preparatory phase of the productions. Findings thus far show that AWS rate significantly lower stuttering anticipation for sentences in the singing condition than for spoken sentences. Additionally, compared to FA, AWS exhibit delayed and more variable reaction time regardless of the condition, slower articulation rate when speaking, and a lack of flexibility between speech and singing in energy allocation across frequency. Measures of time-frequency thus far show overall increased power in beta band and enhanced inter-trial variability compared to fluent speakers regardless of the experimental condition. The results indicate that, even when fluency is induced, AWS show atypical neuromotor behaviors with respect to oral production.

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### **11b. Bilingual adjusted vocabulary size: A developmentally-informed bilingual vocabulary measure**

Ana Maria Gonzalez-Barrero (Concordia University), Esther Schott (Concordia University), & Krista Byers-Heinlein (Concordia University)

Keywords: Bilingualism, Vocabulary Development, Toddlers

Vocabulary size is one of the most important early metrics of language development, often used as a screener to identify children who may be at risk of language impairment or delay. While there are well-established norms and guidelines for monolingual infants and children, assessing vocabulary in bilinguals is complicated because bilinguals learn words in two languages, which include translation equivalents (cross-language synonyms). We investigated how translation equivalents should be counted to yield a comparable metric across toddlers of monolingual and bilingual language backgrounds. We collected expressive vocabulary data from English and French monolinguals ( $n = 220$ ), and English-French bilinguals ( $n = 184$ ) aged 18-33 months, via parent report using the American English and Quebec French adaptations of the MacArthur-Bates Communicative Development Inventories (CDIs; Fenson, Marchman, Thal, Dale, & Bates, 2007; Trudeau, Frank, & Poulin-Dubois, 1999). Our results showed that traditional approaches over-estimate (total vocabulary size; full credit for translation equivalents) or under-estimate (total conceptual vocabulary size; no credit for translation equivalents) bilinguals' vocabulary knowledge. Instead, we propose a new metric: the bilingual adjusted vocabulary size. Uniquely, this approach counts translation equivalents differently at different ages, giving the youngest toddlers (18-23 months) full credit, middle toddlers (24-32 months) partial credit, and oldest toddlers (33 months) no credit for translation equivalents. This developmentally-informed bilingual vocabulary measure reveals differences in word learning abilities across ages, and provides improved recommendations for clinicians to appropriately assess vocabulary in bilingual toddlers.

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### **12b. Patterns of emotion recognition in speech and song among children with ASD: Investigating the effects of emotion and intensity**

Tania Palma Fernandes (McGill University), Jacob A. Burack (McGill University), Eve-Marie Quintin (McGill University)

Keywords: autism, emotion perception, music, speech

The social communication profile characteristic of persons with ASD may be related to difficulties in inferring the emotional state of others from several components of social interaction including speech. Yet, researchers

have not reliably found deficits in emotion recognition from speech, depending on the specific emotions and the intensity to which they are conveyed. In one example of a strength, people with ASD appear to be particularly able to recognize emotions from instrumental music. The extent to which this strength is generalizable can be seen if it is extended to song (vocal music). The aim of this research is to compare emotion recognition from speech and song in children with ASD. Thirty children with ASD completed a computerized task in which they identified emotions (happy, sad, angry, fear) of varying intensity from spoken or sung sentences with neutral semantic content. The results demonstrate that children with ASD more easily recognize intensely conveyed emotions (except in the case of sadness) from speech compared to song. This suggests that their observed strength in recognizing emotions from instrumental music may not extend to song. The finding that fear was less accurately identified as compared to other emotions supports the amygdala theory of ASD, that they may show atypical connectivity of the amygdala, an area implicated in fear perception and response. These findings also have implications for interventions that extend beyond recognition of facial expressions and considers emotion intensity by first teaching emotions that are intensely conveyed followed by those that are more subtle.

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### **13b. The effect of stimulating and relaxing music on stress, measured by the acoustic startle reflex**

Marie-Andrée Richard (Université de Montréal), Gabriel Pelletier (McGill University), Sylvie Hébert (Université de Montréal), Philippe Fournier (Université d'Aix-Marseille), Mathieu Roy (McGill University), Nathalie Gosselin (Université de Montréal)

Keywords: Music, acoustic startle reflex, stress

Music is an efficient way to modulate emotions and to reduce stress. However, results on the effect of music on stress are inconsistent across studies, probably because the dimensions of musical emotions, the valence (unpleasant vs pleasant) and the arousal (relaxing vs stimulating), are not systematically reported. The acoustic startle reflex (ASR), an eye blink triggered by a loud short noise, is a good way to induce stress and to examine the impact of emotional stimuli. A previous study revealed that ASR magnitude was shorter and its latency longer during pleasant music compared to unpleasant music. However, the effects of the musical arousal on ASR are still unknown. The aim of this study is to explore the effect of relaxing and stimulating music on ASR. To this aim, 48 healthy participants listened to pleasant stimulating and relaxing musics (e.g. Alla turca by Mozart and Ave Maria by Gounod), selected from a prestudy. Intense and short white noises were presented over musical excerpts to generate ASR. The magnitude and the latency of the ASR, i.e. the muscular contraction of the left eye, were measured with an electromyogram. Participants also judged, with visual analogue scales, the arousal (very relaxing to very stimulating) and the valence (very unpleasant to very pleasant) of the excerpts. Preliminary results revealed that latency was shorter during relaxing music compared with stimulating music, suggesting that musical arousal affects the ASR.

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### **14b. The music and language habits of individuals who stutter: an online survey**

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Keywords: stuttering, bilingualism, music

The purpose of this study is to examine the relationship between music/language habits and self-rated stuttering severity in individuals who stutter. This is currently being assessed with an online survey, which includes questions about stuttering severity and anxiety, musical training, language use/proficiency, therapeutic and diagnostic history, and an online music perception test. The survey is being distributed through stuttering support groups, mailing lists, and Facebook groups. Thus far, around 40 individuals who stutter have completed the survey. Participants demonstrate a wide range of characteristics, from absent to extensive musical experience and from purely monolingual to highly multilingual language backgrounds. Preliminary results indicate that stuttering severity is negatively correlated with the ability to detect melodic incongruity, whereas no association was yet found between stuttering severity and hours of musical experience. These findings suggest that musical practice does not appear to have a substantial influence on stuttering severity; instead, long-term stuttering severity might be predicted by music perception ability. The

influence of other potential factors on stuttering severity, such as therapeutic history and language profile, are currently under analysis.

### **15b. Initial Findings on Age-Related Sensory Loss in Older Adults with (or at Risk for) Dementia**

Sana Rehan (Concordia University), Nathalie Giroud (Concordia University), Faisal Al-Yawer (Concordia University), Kathy Pichora-Fuller (University of Toronto), Walter Wittich (Université de Montréal), Paul Mick (University of British Columbia), Natalie Phillips (Concordia University)

Keywords: aging, dementia, sensory loss

Previous literature on associations between hearing and visual impairment (i.e., sensory loss) and cognitive decline suggests that substantive sensory loss increases the risk for developing Alzheimer's dementia. Given that the mechanisms underlying the sensory-cognitive relationship in individuals with or at risk for dementia remains unknown, the purpose of this study was to characterize the frequency and degree of sensory loss in a Canadian sample using measures of visual acuity (i.e., MNRead Acuity) and contrast sensitivity (i.e., MARS Contrast Sensitivity) to assess visual functioning, and measures of hearing loss (i.e. audibility of 2kHz pure-tones at 25dB HL and 40 dB HL) and speech-in-noise perception thresholds (i.e., the Canadian Digit Triplet Test) to assess hearing functioning. Using data from the COMPASS-ND dataset, we conducted preliminary analysis exploring sensory loss in groups diagnosed with subjective cognitive impairment (SCI; N = 36), mild cognitive impairment (MCI; N = 78), and Alzheimer's dementia (AD; N = 23). 67% of SCI, 47% of MCI, and 16% of AD participants were characterized as having normal visual acuity and contrast sensitivity and 47% of SCI, 29% of MCI, and 16% of AD participants were categorized as having no or mild hearing loss. Associations within modalities were stronger for the AD and MCI groups in vision while they were stronger for MCI and SCI groups in hearing. Besides providing baseline data for longitudinal changes, this research sets the groundwork for further examining the relationship between sensory and cognitive functions in these clinical populations.

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### **16b. The Impact of Restricted and Repetitive Behaviours on Social Emotional Learning and Executive Functioning in Adolescents with Autism Spectrum Disorder**

Charlotte Rimmer (McGill University), Hadas Dahary (McGill University), Eve-Marie Quintin (McGill University)

Keywords: autism, repetitive behaviours, social functioning, executive functioning

Restricted/repetitive behaviours (RRBs) can be the most disabling feature of autism spectrum disorder (ASD) (Bishop et al., 2007). RRBs compete with social interactions and impact communication (LaGasse & Hardy, 2013). Moreover, studies find that RRBs are associated with deficits in cognitive flexibility and planning (Lopez et al, 2005). The current study aimed to examine the relationships between RRBs and the social emotional learning and executive functioning profiles of youth with ASD. Forty-five youth with ASD between 12 and 18 years old completed questionnaires measuring social communication (SRS-2; Constantino, 2012), social emotional learning (SSIS-SEL; Gresham & Elliot, 2017), executive functioning (BRIEF-2, Gioia et al., 2015) and cognitive abilities (WISC-V; Wechsler, 2014). MANOVAs revealed a significant difference ( $p < .05$ ) on four subscales of the SRS-2 and on four subscales of the SSIS-SEL, demonstrating that youths with higher severity of RRBs have greater difficulties in these areas. Further, results revealed a significant difference ( $p < .05$ ) on six subscales of the BRIEF-2, indicating that participants with higher severity in RRBs have more difficulty with components of executive functioning. Results contribute to the literature in identifying specific social and executive processes related to RRBs and support previous ASD research showing a relationship between executive functions and RRBs, specifically, to inhibitory control (Mosconi et al, 2009; South et al, 2007) and working memory (Lopez et al, 2005). Findings also highlight the negative impact that RRBs have on the social and executive profiles of adolescents with ASD and support interventions targeting these behaviours.

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### **17b. Efficacy of Musical Interventions on Cognition in Individuals with Autism Spectrum Disorder: A meta-analysis.**

Nathalie Roth (Université de Montréal), Nicholas E.V. Foster (Université de Montréal), Kevin Jamey (Université de Montréal), Simona M. Brambati (Université de Montréal), Krista L. Hyde (Université de Montréal)

Keywords: autism, music intervention, meta analysis

Autism spectrum disorder (ASD) is characterized by restricted social functioning, interests and stereotypical behaviors (American Psychiatric Association, 2013). A growing body of research indicates that music interventions (MI) could have a positive effect on these symptoms. A previous systematic review (Geretsegger et al., 2014) supported the efficacy of MI for social behaviors in ASD children. Our study is an extension of the latter, following PRISMA guidelines and contrasting MI with non-music interventions to measure their efficacy in enhancing social behavior and executive functions. This will allow us to better understand the relation between music therapy and autism and inform future interventions. After rigorous literature search of studies from 1995 to 2018, 11 studies corresponded with our inclusion criteria. Our results did not find a significant difference for social measures between MI and non-musical interventions, ( $g = .07$ , CI =  $-.41 - .54$ ,  $p = .79$ ). However, neither MI ( $g = .17$ , CI =  $-.39 - .73$ ,  $p = .56$ ), nor alternative interventions ( $g = .16$ , CI =  $-.02 - .34$ ,  $p = .08$ ) showed significant changes in terms of social measures. There was no significant difference between MI and standard care for executive function measures ( $g = -.03$ , CI =  $-.73 - .66$ ,  $p = 9.3$ ). Our study focused on social behavior and executive function, but it is possible that MI present other benefits. Future MI would benefit from larger sample sizes and longer duration and respect an RCT design. This would allow for better generalizability of future meta-analyses.

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### **18b. Are emotional speakers more memorable? The influence of fearful prosody on voice identity memory**

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Keywords: identity recognition, voice, fear

Listeners can recognize familiar identities under different circumstances, even when emotional prosodies vary. Previous studies have reported better memory for stimuli with fearful expressions, but it is unclear whether this advantage applies to the recognition of identity. Here, we addressed this question using a mixed-design paradigm. During encoding, 24 participants listened to 6 speech clips with fearful prosody produced by six different speakers twice (Fear group). Twenty-four other participants listened to similar stimuli, but expressed in a neutral tone (Neutral group). Immediately after encoding, subjects completed a speaker recognition test. Four clips produced by each of the old speakers (same-emotion/same-sentence, same-emotion/different-sentence, different-emotion/same-sentence, and different-emotion/different-sentence) were presented, together with the same amount of clips produced by 6 novel speakers. Participants' memory accuracy and rate correctness score (RCS, an index combining accuracy and reaction time) were submitted to ANOVAs. Results showed a better recognition for speech uttered in the same emotion or content ( $ps < 0.001$ ) as during encoding. Post-hoc t-tests further suggested emotion as a stronger influencer of memory than semantic content. The analysis on RCS yielded an emotion vs. group interaction ( $p < 0.001$ ): participants exposed to neutral voices at first showed high confidence when making a correct generalization of speaker identity to fearful prosody, which may indicate an implicit identity memory benefit. Together, these results confirm the influence of emotion, and content to a lesser extent, on explicit memory recognition, and further reveal a reduced ability to recognize speakers' identity from different exemplars when initially exposed to fearful, compared to neutral, prosody.

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### **19b. Portrait des habiletés langagières et des processus neurocognitifs linguistiques des adolescents avec un trouble du langage : présentation de l'étude et première série de résultats.**

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Keywords: Potentiels évoqués, trouble développemental du langage, morphosyntaxe, sémantique lexicale



Ce projet de recherche s'intéresse aux similitudes et différences entre les jeunes avec et sans trouble développemental de langage (TDL). Les théories sur l'étiologie du TDL proposent que des déficits du traitement de la (morpho)-syntaxe sont la cause principale du TDL, avec toutefois un traitement sémantique-lexical relativement préservé et semblable à celui des enfants neurotypiques. Afin de tester ces hypothèses, nous utilisons l'électroencéphalographie et les potentiels évoqués (PÉs) qui en sont extraits. Les PÉs présentent des marqueurs spécifiques associés aux différents mécanismes linguistico-cognitifs impliqués lors du traitement de la sémantique lexicale ou de la (morpho)-syntaxe, et permettent d'identifier lesquels de ces domaines sont utilisés en compréhension du langage. Nous présentons une première série de résultats de ce projet, ceux du groupe contrôle d'adultes (n = 22) sur une sous-tâche visant l'accord en nombre (Courteau et al, sous révision). Les PÉs sont enregistrés pendant que les participants entendent des phrases grammaticales qui correspondent ou non aux images qu'ils voient. Les résultats innovants s'appuient sur des structures spécifiques au français. Ils ont permis d'identifier les processus neurocognitifs qui sous-tendent le traitement de l'accord sujet-verbe et de relever des ondes liées au traitement neurocognitif (LAN, N400, P600) selon le type d'incongruence auditivo-visuelle présentée : articles – le/la/les – verbes à liaison – ils[z]aiment – ou à consonne finale – boit/boivent [bwa/v]. Ces résultats serviront de référence pour l'interprétation des résultats trois groupes expérimentaux, soit des adolescents avec TDL (en recrutement, n = 15), des témoins appariés sur l'âge, et des témoins appariés sur le niveau du langage.

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### **20b. Music-in-Noise: Attentional Modulation in Subcortical and Cortical Auditory Structures**

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Keywords: auditory stream segregation, EEG, music-in-noise, auditory neural representation, reconstruction methods

The ability of humans to follow a single audio stream with competing noise is thought to be affected by how well the brain encodes basic auditory information such as the amplitude envelope of the acoustic signal (~2-9Hz in speech), and the pitch content of the signal (~>40Hz). It has previously been shown that the amplitude envelope information is enhanced via attention to a target stream, relative to an ignored stream, using machine-learning based reconstruction techniques. However, increasing evidence suggests that pitch representation can also be modulated via top-down control. We investigated how the combined top-down influences of attention, prediction, and audiovisual integration affect pitch information by having participants listen to music-in-noise, which includes a target audio stream of a musical sequence and an ignored stream of a scrambled version of the same acoustic information, while electroencephalography (EEG) was recorded. Reconstructions of target and ignored audio streams from EEG signals were computed using multi-lag models to assess overall correlations to the original streams, and single lag models were fit to explore peaks in correlations with respect to time. Results of EEG-FFR reconstruction using only the frequency range related to stimulus pitch (80-300Hz) show significantly better attended than ignored stream correlations, with peaks at 7-9 ms, suggesting a top-down effect on subcortical sources, and 44-48 ms, which may represent a mixture of subcortical and cortical contributions. Our aim is to use the complexity and richness of this music-in-noise stimulus to decipher which subcortical and cortical auditory structures influence and are influenced by selective attention.

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### **21b. Multimodal emotion recognition in children with autism spectrum disorder: Vocalizations are more informative than faces or music**

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Keywords: autism spectrum disorder, emotion recognition, music, face, voice

Background: Social and communication difficulties cited among children with autism spectrum disorder (ASD) appear to be associated with problems in emotion recognition skills, as typically depicted with facial expressions or non-verbal vocalizations. The extent to which these disparities reflect a general concern may be studied with an alternative modality, such as music. The objective of the study was to provide an initial comparison of emotion recognition skills in children with ASD across the modalities of face, vocalization, or

music. Methods: Twenty-two children with ASD between the ages of 8-14 years completed tasks associated with identifying happy, sad, and fearful emotions in faces, vocalizations, and music. Results: Participants more accurately identified emotions from vocalizations than faces and music, but did not differ in accuracy for faces versus music. Further, participants more accurately identified happy emotions versus fear, but no differences were found between happy versus sad and sad versus fear. A significant modality by emotion interaction revealed that sadness was more easily identified in vocalizations than music, and fear was more easily identified in vocalizations than faces and music. No significant differences were found in identifying happy emotions across modalities. Conclusions: These findings suggest that the identification of negative emotions when conveyed through non-verbal vocalizations, rather than faces or music, may be easier or more informative for children with ASD.

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### **22b. Infant-Directed Code-Switching Habits of Montreal Parents.**

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Keywords: bilingualism, code-switching, infant-directed speech

Mixing two languages in speech (i.e., code-switching) is prevalent in multilingual settings, including in speech directed towards infants. Prior research suggests a link between parental code-switching and vocabulary size (Byers-Heinlein, 2013). Moreover, laboratory work suggests that some types of code-switching appear more difficult for infants to process than others (Byers-Heinlein et al., 2017; Potter et al., 2018). This raises the possibility that the effects of parental code-switching depend on the parents' specific behavior in terms of the frequency, location, and purpose of code-switching (Byers-Heinlein, 2017). Prior studies of parental code-switching relied on self-report or short lab observations. In this study, we analyze parental code-switching behavior in a corpus of daylong home recordings of 21 10-month-old infants from French-English bilingual families in Montréal. We will identify instances of parental code-switching, their syntactic location, the direction of the switch, and the apparent reason for the switch (e.g., teaching vocabulary, translating an entire utterance). Preliminary results indicate that the frequency of code-switching varies between families and that code-switching between sentences is more common than code-switching within a sentence. This project will provide the first in-depth investigation about the characteristics of naturally produced parental code-switching.

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### **23b. Prosodic Features of Complaints from French and Québécois Speakers**

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Keywords: Social communication, Tone of voice, Culture

Complaints are vocal expressions of social pain to obtain empathy and affiliation from our peers. To this end, complainers modulate their tone of voice, or prosody, to display affective cues that will generate empathic responses in their listener. The nature of these cues is uncertain: while some overlap with known emotional prosodies is noted, evidence suggests a more general exaggeration of several prosodic dimensions to simply convey affect and generate arousal in the listener. Still, very little research has been conducted to effectively assess what prosodic strategies complainers use, and if they arise from universal emotions or from more culture-specific attitudes. To investigate these strategies, 4 French and 4 Québécois speakers, all native speakers of French, uttered short sentences in a complaining or neutral tone of voice. After validation of the utterances by 18 listeners, 320 utterances were acoustically analyzed to differentiate complaining speech from neutral utterances in both groups. Both French and Québécois complaints showed significant increases in pitch and pitch variability, as well as enhanced voice quality and voice control compared to neutral utterances. In addition, French complaints showed changes in spectral properties and lasted longer than their neutral counterparts. Observation of pitch contours also showed important differences in complaining strategies between groups. These preliminary results suggest that while complaints present prosodic features linked to affective speech and expressivity that are consistent across cultural groups, certain complaining strategies seem more culture-dependent.

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## **24b. Cross-cultural differences in vocal expression and emotion perception**

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Key words: human communication, emotional prosody, cross-cultural study

With increasing globalization and cross-cultural communications, appropriate emotional expression and perception are critical for inter-group relationships and social harmony. From the biological and evolutionary perspective, people have innate ability to recognize vocal expressions of six basic emotions (anger, disgust, fear, joy, sadness, and surprise) with above-chance level. From social perspective, specific cultural norms from collectivistic (Eastern) and individualistic (Western) cultures also regulate and shape how people express and perceive emotions. To further investigate the cultural impacts on vocal emotion recognition, Canadian and Chinese participants were recruited to categorize and judge the intensity of emotional utterances produced in three languages: English, Chinese, and Hindi. The results showed that basic emotions can be recognized with exceeding chance levels. Moreover, in-group advantages in emotion recognition, which meant people recognize emotions more accurately in their native languages, were found for both cultural groups. The significant impacts of emotions (anger, fear, sadness, and happiness) and languages (English, Chinese, and Hindi) on intensity ratings of emotional vocalizations between groups were also found and analyzed. Nowadays, since communications between cultures become more vital for interpersonal relationships as the proliferation of globalization and immigration, this research provides valuable information on the understandings of cultural differences in vocal expression and perception of emotions in human communication.

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## **25b. Is noise-induced tonotopic map reorganization maladaptive? Behavioral and electrophysiological correlates of 7kHz over-representation within the adult rat auditory cortex**

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Keywords: auditory cortex, tinnitus, hyperacusis, plasticity, animal models

Maladaptive plasticity refers to nervous system changes that disrupt normal function. In the central auditory system, maladaptive tonotopic reorganizations are thought to contribute to the generation of hearing disorders including tinnitus and hyperacusis, yet central reorganizations are also shown to accompany a variety of other forms of auditory plasticity, including perceptual learning. We have previously demonstrated the ability to produce frequency-specific reorganizations in the primary auditory cortex of adult rats using a two-week passive sound exposure to moderate-intensity broadband white noise followed by a one-week exposure to 7kHz tone pips. This procedure leads to an over-representation of the 7kHz region within the primary auditory cortex of adult rats without causing hearing loss. Here, we investigated whether this type of reorganization could be indicative of maladaptive plasticity by assessing the electrophysiological and behavioral correlates of 7kHz over-representation. We show that 7kHz over-representation is associated with changes in receptive field bandwidths, firing rate, and neural synchronization for 7kHz-tuned neurons in primary and secondary auditory fields. We also show that 7kHz over-representation does not affect the behavioral measure of gap-prepulse inhibition of the acoustic startle (GPIAS) response, demonstrating that exposed rats do not develop tinnitus. However, over-representation leads to a moderate improvement in prepulse inhibition (PPI) of the acoustic startle response when the prepulse is a 7kHz tone, showing that exposed rats have altered sensory gating for the exposure frequency that could be indicative of hyperacusis. These results suggest that 7kHz over-representation induced by noise exposure may indeed be maladaptive, warranting further research to understand what causes this reorganization.

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## **26b. A Systematic Study of the Rate of Child Over-Irregularization Errors.**

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Keywords: Psycholinguistics, Morphology, Language Acquisition

Overregularization errors, where a regular inflection is applied to an irregular verb, as in teach/taught, fly/flied, or go/goed, is a well-documented phenomenon in English language acquisition. Conversely, over-irregularization errors, the overapplication of an irregular inflection to a regular verb like trick/truck, or the application of an incorrect irregular inflection to a non-target irregular verb, like shake/shade, or bring/brang, have been studied less thoroughly. This may be due to the difficulty of detecting over-irregularization errors in databases of child speech. Regularization can be detected simply by adding -ed (or +/d/) to irregular English verb stems, while searching for irregulars requires more complex methodology. The current study is a pilot project testing the feasibility of a novel methodology for estimating the true rate of such over-irregularization errors in child English. An endeavour of this kind has not been attempted in over 20 years, and there has since been a large increase in available data, new technologies for querying, as well as novel statistical methods for estimating the rate of rare events. Based on our pilot estimates, there are between 146 and 387 cases of irregularization errors in the North American English section of CHILDES. These findings give rates which are on the same order of magnitude as the similar 1995 Xu and Pinker study, align with our estimates, and suggest that these types of errors are rare overall.

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