

CRBLM Scientific Day

May 13, 2019

Poster Session 1 – 9:00-10:45am

1a. Is category learning linked to perceptual reasoning and long-term visual memory?

Pascal Louis (Université du Québec à Montréal), Catherine Prévost (Université du Québec à Montréal), Marie Véronneau (Université du Québec à Montréal), Stevan Harnad (Université du Québec à Montréal)

Keywords: intelligence, perceptual reasoning, categorical perception

Categorization is about doing the right thing with the right kind of thing. Since the majority of categories are not innate, we constantly learn new categories. In previous studies in our laboratory, individual differences in the capacity to learn new categories were observed, and the differences had electrophysiological correlates (Pérez Gay et al., 2017, 2018). The objective of the present study was to test whether the differences were just differences in immediate states during the learning task or they reflected individual differences in cognitive traits (and, if so, what kinds of cognitive abilities underlie these differences). Fifteen adults (aged between 20 and 30) who had participated in our prior category-learning studies agreed to take some tests of cognitive ability, including. (1) the perceptual reasoning subtests of the Weschler Adult Intelligence Scale (WAIS-IV) and (2) the Doors & People test of long-term visual memory. There was a marginally significant positive correlation between prior category learning performance and perceptual reasoning scores ($r=0.49$, $p=0.06$) and a marginally significant positive correlation with visual memory scores ($r = 0.54$, $p= 0.054$). The sample needs to be increased and further perceptual abilities need to be tested, including nonvisual ones, but these findings suggest that the differences in category learning may be due at least in part to differences in cognitive abilities.

2a. Beat Perception and Production in CI Users.

Marie-Anne Prud'homme (Université de Montréal), Sylvie Nozaradan (Western Sydney University), Alexandre Lehmann (McGill University)

Keywords: Cochlear implants, Multisensory integration, synchronization

The capacity to process and integrate information coming from different senses (multisensory integration) is altered in cochlear implant (CI) users. Multisensory integration allows complex cognitive tasks from daily life such as focusing on a particular conversation in a cocktail party or dancing to the rhythm of music. Recent studies have shown that the key mechanism of multisensory integration is impaired in implant wearers, which impacts cognition on a daily basis. Brain plasticity during the sensory deprivation period has also been shown to be related to the observed multisensory integration deficits. However, most studies to date have focused on the passive aspect of multisensory integration and have ignored the motor component. The present study is a behavioral assessment of visual, motor and auditory information in 22 CI users with their matched normal hearing control group. Participants were instructed to actively synchronize themselves with auditory and visual signals. Synchronization performances are computed and compared to the normal-hearing matched controls. Tapping time series will be analyzed using circular statistics, where measures of accuracy and characterizing the relation of successive taps will be computed. A superior performance for the CI users group in the visual condition is expected. We use statistical analysis such as a split plot design Anova to ensure a group effect from the computed results. Preliminary results indicated that CI users do not have a deficit in either perceiving, nor producing a rhythm.

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3a. Pigio™: A Mobile Gaze Tracking Software Technology to Assist Communication

Francis Arseneau (Innodem Neurosciences), Alex Drouin-Picaro (Innodem Neurosciences), Patrice Voss (McGill University), Etienne de Villers-Sidani (McGill University)

Keywords: eye-tracking, research applications, medical technology

Several incapacitating neurological and medical conditions also result in an inability to adequately communicate, such as stroke and amyotrophic lateral sclerosis (Lou Gehrig's disease). Fortunately, patients retain eye movements that make it possible to communicate with family and caregivers by blinking; however, the current standard of care for communication with these patients is via a letterboard, which is slow and inefficient. Alternatively, expensive hardware solutions exist to track the patient's gaze, but these require infrared cameras and additional third-party hardware, making them inaccessible to most. As a solution to these issues, we have developed a mobile application called Pigio™ that allows a patient to control a mobile device (such as a tablet or smartphone) using only the movement of their eyes. The application captures images of the user's eyes with the device's camera, which are then fed to a machine learning algorithm that estimates where the user is looking on the screen. The patient can select pre-defined words or phrases, which are then played out loud through. Pigio™ is now entering its beta testing phase, with the application being deployed for use in select Montreal healthcare institutions in Spring 2019. Patients will be able to test Pigio™ and provide feedback that will be used to adapt the algorithm and improve the user experience. We believe that Pigio™ is an intuitive, easy-to-use, and affordable mobile solution that will significantly improve the speed of communication and quality of life for patients and caregivers alike.

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4a. Studying Morphological Processing Via Lexical Decision Tasks

Gregory Theos & Timothy J. O'Donnell (McGill University)

Keywords: Morphology, Morphological Processing, Lexical Decision

A basic question for theories of morphology is what parts of words are stored in memory and which structures are composed on the fly. One potential source of evidence about computation and storage is lexical decision data, in which reaction times are known to correlate with frequency. In morphologically complex forms, different notions of frequency (frequency of the parts together or individually) can have subtly different effects on reaction time. Different models of morphological storage and computation make different predictions about which forms are stored, and therefore which accesses to memory must be performed in order to produce a word. It has often been presumed that which types of frequency best correlate to reaction times in a corpus are illustrative of which accesses to memory have been performed, and therefore which model of computation/storage is making the correct predictions. In this project, we look at results from a previous paper which advertises methodological improvements in detecting frequency effects within this framework. We find that while many of the improvements are genuinely useful, their combination is not statistically powerful enough to detect the effects of frequency.

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5a. Can rhythmic abilities distinguish neurodevelopmental disorders?

Mélody Blais (BRAMS, University of Montreal), Camille Gaillard (BRAMS, University of Montreal), Simone Dalla Bella (BRAMS, University of Montreal)

Keywords : neurodevelopmental disorders, beat perception and production, cognition

The majority can easily track the beat of rhythmic auditory sequences (e.g., a metronome or music) and move along with it. There is evidence that these rhythmic abilities are impaired in children with neurodevelopmental disorders, such as developmental dyslexia or ADHD. These impairments are shown with a variety of tasks and measurements. However, due to this diversity, it is unclear whether rhythmic difficulties are an hallmark of a particular disorder or rather the result of a common cognitive deficit in memory, attention, or executive functions. We hypothesize that profiles of rhythmic abilities exist that characterize neurodevelopmental disorders as compared to healthy children. This possibility is tested in a large group of individuals with neurodevelopmental disorders with the Battery for the Assessment of Auditory Sensorimotor and Timing Abilities (BAASTA). The battery tests perceptual and sensorimotor timing abilities. Preliminary results will be

presented, that will pave the way to new methods for identifying different rhythmic profiles in children with neurodevelopmental disorders with the goal of individualizing a rhythm-based intervention.

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6a. Working Memory and Second Language Proficiency Moderates the Use of Visual Speech Cues and Sentence Context During Bilingual Speech Perception in Noise.

Anna-Francesca Boatswain-Jacques (Concordia University), Alexandre Chauvin (Concordia University), Jean-Louis René (Concordia University), Natalie Phillips (Concordia University)

Keywords: bilingualism, aging, speech perception

Background noise is often present during speech perception. Nevertheless, most people perceive speech successfully, suggesting the existence of supporting mechanisms. In native listeners, contextual information and visual speech cues (e.g., lip movements) can improve speech perception in noise. However, it remains unclear how this unfolds in non-native listeners. Additionally, older bilinguals may be at a particular disadvantage, as they have to contend with sensory changes such as presbycusis and/or a decline in visual acuity. We are investigating the extent to which young (18-35 years) and older (65+) French-English/English-French bilinguals benefit from context and visual speech cues in their first (L1) and second language (L2). Participants were presented with audio-video recorded sentences in noise and asked to repeat the terminal word of each sentence. Half of the sentences offered a moderate level of context (e.g., "In the woods, the hiker saw a bear."; MC) while the second half offered little context (e.g., "She had not considered the bear."; LC). The sentences were presented in three modalities: visual, auditory, and audiovisual. Preliminary results show greater accuracy in L1 compared to L2. Participants were more accurate for MC compared to LC sentences. Additionally, participants were most accurate in the audiovisual modality. The benefits associated with sentence context and visual speech cues were moderated by working memory and L2 fluency. These results suggest that individual differences in cognitive abilities influence speech perception in noise and should be considered when choosing optimal ways of communicating important information to non-native listeners.

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7a. The Effects of Tinnitus on Mismatch Negativity Responses to Gaps in Noise.

Victoria Duda-Milloy (Université de Montréal), Don Nguyen (University of Ottawa), Ken Campbell (University of Ottawa), Daniel L. Benoit (University of Ottawa), Amineh Koravand (University of Ottawa)

Keywords: Tinnitus, gap detection, temporal resolution, mismatch negativity, P3a, electrophysiology.

This study compared electrophysiological and behavioural measures to gaps in noise in various masker conditions for tinnitus and normal hearing subjects. Mismatch negativity (MMN) and P3a responses were measured for gapped stimuli in high, low and no masking conditions in five tinnitus subjects. Peak to peak amplitudes were averaged and compared to behavioural accuracy rates to each of the gaps. Behavioural accuracy rates and peak to peak amplitudes were also compared to previous data from five normal hearing subjects. The peak to peak measurements of the MMN to P3a did not show significant changes to gaps at the Fz or Cz electrodes. However there was a significant difference in the amplitude measures of the tinnitus subjects compared to the normal hearing subject for all supra-threshold gap widths. The average amplitude measures were significantly lower for the tinnitus subjects. This contrasts with the behavioural data showing no significant difference between the accuracy rates of the two groups. The peak to peak measurements of ERPs to gaps in noise may be a more sensitive tool for measuring temporal resolution impairments than behavioural measures. This may suggest that previous literature using behavioural measures of gap detection showing non-significant findings between tinnitus and non-tinnitus populations may need to be revisited.

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8a. Electrophysiological Correlates of Auditory Discourse Processing in Bilinguals across the Lifespan

Angela Grant (Concordia University), Tristin Best (Concordia University), and Natalie Phillips (Concordia University)

Keywords: bilingualism, discourse, aging

Our study examines auditory discourse comprehension in highly proficient English/French bilinguals. We compare a capacity view of language comprehension, which predicts reduced sensitivity to discourse compared to lexical cues in the second language (L2) due to increasing working memory demands, with the noisy channel model, which predicts the reverse. We tested young (18-35 yrs; n=32) and older (60+ yrs; currently n=13) bilinguals, as increasing age is associated with declines in working memory. The two groups are matched on education and the older adults (OAs) were screened for normal vision and hearing. The OA performance on the operation span task is both lower (M=69.4%) and more variable (SD=27.5%) than younger adults' (YA; M=82%, SD=16%). Our ERP paradigm uses three-sentence stories with prime and target words in the final sentence whose lexical association is manipulated, as is the congruence of the target with the preceding discourse. For YAs, we found that the N400 effect was sensitive to discourse congruence in both languages, but sensitive to lexical association only in the L1. For OAs in their L1, we observe N400s to stimuli that are discourse incongruent regardless of lexical association. In their L2, we observe N400s to single violations (of either discourse congruence or lexical association) but not to the combined condition. The differential sensitivity to L2 discourse cues with age provides partial support for both models, indicating a need for a more nuanced view of each that accounts for age-related changes in cognition.

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9a. Contextual Effects on Case in Japanese Copular Constructions.

Masashi Harada (McGill University)

Keywords: syntax-pragmatics interface, morphological case assignment, ellipsis, Japanese

This paper examines a new type of case connectivity effects in Japanese copular constructions. I observe the predicate nominal in (1) (i.e., *hanbaagaa-o futa-tu*) can show accusative case (i.e., -o) in context (2) but not in context (3). The contextual variability is surprising because case assignment is generally considered to be a morpho-syntactic phenomenon.

(1) kyoo-wa hanbaagaa-o futa-tu-dayo today-
Top hamburger-Acc 2-CL-Cop '(lit.) Today is two hamburgers.'

(2) [Ryo and Ai are father and daughter. Ryo always cooks lunch for Ai. It is 6am. Ai has come to the kitchen, seeing Ryo preparing for making lunch. Ryo says (1) to Ai.]

(3) [Ryo and Ai have long been examining when different food they put in a showcase goes bad. Ryo always checks which food goes bad and how many they are. It is 10am. Ai has come to the showcase. Looking at the food condition, Ryo says (1) to Ai.]

To explain the contextual variability, I propose different structures for (1) in different contexts. I argue the predicate in (1) is a full clause where everything except *onigiri-o mi-ttu* is elided, and that the context indirectly affects whether the elided clause contains an accusative case assigner (i.e., transitive verb). Though there seems no linguistic antecedent to license such an ellipsis, I propose (1) involves a phonologically null subject (i.e., pro) that licenses the ellipsis. This analysis supports the syntactic case assignment, linguistic antecedent requirement, and the idea that ellipsis generally solves connectivity puzzles (e.g., Ross 1972, Schlenker 2003).

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10a. Phonetic Evidence for the Emergence of Phonological Contrasts

Jeffrey Lamontagne (McGill University)

Keywords: Sociolinguistics, Phonetics, Phonologisation

In final syllables, speakers of Canadian French produce predictable variants for high vowels: high vowels are tense before specific coda consonants ("lengthening consonants", /v z ʒ r vr/) and in open syllables, otherwise high vowels are lax (Poliquin 2006), as in (1). In non-final syllables, however, laxness is highly variable. High-vowel laxing often requires a final lax vowel (Poliquin 2006), as in (2), which has led to

allophonic laxing being described as laxing harmony when it occurs in non-final syllable, though a lax vowel is not always present to trigger laxing, even in morphologically related words (redacted). This variability and partial predictability has led to the phonemic status of high vowels becoming uncertain. This predictability in final syllables and variation in non-final syllables has sparked disagreement in the phonemic status of lax high vowels (c.f Poliquin 2006 and Côté 2012). We argue based on the presence of contrast in phrases that laxing is expected to phonemicise in Laurentian French as it can be associated with meaningful distinctions, and then demonstrate using a corpus study on 26000 mid vowels that other vowels in the system are sensitive to the laxing of high vowels that is not predictable if laxing is not a phonemic contrast available to speakers. Specifically, lax mid vowels are realised as higher when preceding lax high vowels than when preceding tense high vowels, despite that tense high vowels are acoustically higher. We argue this suggests a reorganisation of the vowel system alongside the introduction of three new phonemes.

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11a. A Comparison between Traditional and Musical Working Memory Assessments and the Associated Cognitive and ASD Behavioural Correlates

Gwenaëlle Philibert-Lignières (McGill University), Barbara Tillmann (Université de Lyon 1), Armando Bertone (McGill University), Eve-Marie Quintin (McGill University)

Keywords: autism spectrum disorder, working memory, music

Autism Spectrum Disorder (ASD) is often associated with working memory difficulties. Music perception is considered a strength in ASD, with most studies investigating perception of music-evoked emotions, pitch, and long-term musical memory. One aspect of music-related cognition that has yet to be systematically assessed in ASD is musical working memory. The objective of this study is to compare the performance on traditional and musical short-term working memory tests to examine whether music could be used as an alternative assessment modality of working memory in ASD. Fifty-nine children with ASD participated in this study. The Digit Span and Picture Span subtests of the WISC-V were used as measures of traditional working memory. To assess musical working memory, sequences of 3, 4, and 5 pitches were presented in pairs to participants who were asked to identify whether sequence-pairs were similar or different. Paired sample t-tests revealed that participants performed significantly better on the MWM task ($M=.52$, $SD=.32$) than on the Digit Span ($M=.12$, $SD=1.09$, $p = .013$) and the Picture Span ($M=.14$, $SD=1.02$, $p = .009$) subtests of the WISC-V. Our findings reveal that children with ASD performed better on a MWM task in comparison to traditional verbal working memory tasks. Results provide preliminary evidence for the use of music as a strength-based modality to assess the working memory abilities of children with ASD, which may be underestimated by traditional cognitive testing relying on verbal skills often impaired for this population.

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12a. The role of sleep in phonetic boundary learning

Reyan Restani (Université Paul Sabatier à Toulouse), Aurelien DelaChapelle (ENS Paris), Camille Bouhour (Université de Concordia), Khashayar James Zardoui (Université de Concordia), Emily Coffey (Université de Concordia).

Keywords: neuroplasticity, phonetic contrast learning, sleep

Sleep is known to affect the consolidation of new information into long-term memory. However, it is not yet known if sleep can influence other forms of plasticity, such as the tuning of sound representation within the auditory system. In a recent study (Reetzke et al.), training on categorizing speech tones improved perceptual accuracy and reaction time on a perceptual discrimination task, and in sensory encoding using the frequency-following response (FFR), which is a measure of the auditory nervous system's representation of periodic sounds. The greatest improvement occurred between the first and second day. The aim of this study is to see whether the accuracy of sound encoding is modulated by sleep. In the first part of the study, participants are asked to do a set of tasks including perceptual discrimination and categorical learning of tones, and the FFR is recorded. Subjects are then randomly assigned to a Nap or No-Nap condition, during which the Nap group has the opportunity to sleep (180min), and the No-Nap group engages in a quiet activity for the same length of time. Polysomnographic data are recorded to quantify sleep depth and duration. Participants then redo the

same set of tasks. Both the perceptual and electrophysiological results will be reported from a preliminary sample of ~20 subjects. This study will improve our understanding of sleep as a potential contributor to auditory plasticity, extend our exploration of the types of learning upon which sleep-dependent memory consolidation has an effect.

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13a. Perceptual and ERP changes induced by visual category learning

Tomy Sicotte (Université du Québec à Montréal), Fernanda Pérez-Gay (McGill University), Nicolas Goulet (Université du Québec à Montréal) & Stevan Harnad (Université du Québec à Montréal)

Keywords: categorical perception, category learning, EEG, perception, language

Acquired categorical perception (CP) occurs when members of different categories are perceived as being less similar (between-category separation) and/or when members of the same category are perceived as being more similar (within-category compression) after a new category has been learned when compared to how it was before learning. Two similarity judgment tasks were used to assess CP, one before and one after a categorization task with feedback (learning). Based on their performance, participants were separated into two groups: learners and non-learners. Some non-learners received the categorization rule before the second similarity judgment task, the rest received it after. Stimuli were composed of many binary and local features but only one feature allowed correct categorization. The relevant feature and its position (side) would vary across two versions. Visual event-related potentials (ERPs) during categorization trials were registered using an electroencephalogram. Only learners and non-learners who received the rule have shown CP effect. Category learning through practice and through verbal instruction (language) was associated with more positivity in the amplitude of P1 (100-140 ms) and P2 (150-210 ms) both early occipital ERPs associated with perceptual processing. The P1 effect was lateralized to the contralateral side of the relevant category feature. For learners through practice, the difference of ERPs amplitude before and after learning was correlated with their level of between-category separation. These behavioral and physiological results support the hypothesis that learning new categories and language can alter perceptual processing.

14a. Activation of the visual cortex by a salient sound modulates temporal order judgements

Amour Simal (Université de Montréal), Pierre Jolicoeur (Université de Montréal)

Keywords: electrophysiology, crossmodal, attention, perception

Previous ERP research showed that a salient lateral sound presented with speakers activates the contralateral visual cortex, reflected by the ACOP component (auditory-evoked contralateral occipital positivity). Interestingly, the amplitude of the ACOP correlated with an enhancement in perceptual processing on the side cued by the sound. We aimed to replicate the ACOP using earphones and to test if this auditory cuing can influence temporal order judgements (TOJ) for two visual stimuli (horizontal arrangement) as well as if the ACOP would predict the amplitude of this influence. We presented a 100 ms pink noise (0.5-15kHz, 80dB) stimulus synthesized to appear to originate 20° to the left or right of straight-ahead, via earphones, followed by a short (150 ms), or long (630 ms) delay. We then presented a grey disk 15° left or right of a fixation cross followed by a disk on the other side with an ISI of 0, 30, or 60 ms. The task was to indicate which disk appeared first or which disk appeared second (to control for response bias). We observed an ACOP at posterior electrode sites and confirmed our hypothesis that the lateral sound influenced TOJ by accelerating the perception of the disk presented on the cued side, even though the sound was irrelevant to the task. Furthermore, preliminary evidence suggests that a larger ACOP creates a greater acceleration of the perception of the disk presented on the cued side.

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15a. Investigating the Entrainment between Music and Movement using Pupillometry: A Pilot Study

Johanna Rösch, Yue Zhang (BRAMS), Simone Dalla Bella (BRAMS-CRBLM, Université de Montréal), Alexandre Lehmann (BRAMS-CRBLM, McGill University)

Keywords: groove, rhythm, movement, pupil, arousal

Evidence shows that variation in pupillary response is associated with the activity of the Locus Coeruleus, and consequently the noradrenergic system. Therefore, pupillometry (the measure of pupillary response) has been used as an objective measure of arousal, cognitive effort and attention. Based on recent findings, we intend to replicate and further investigate the entrainment of motor action to rhythmic auditory stimulation using pupillometry. We hypothesized that stronger pupillary response was associated with high-groove versus low-groove music, and enhanced by entrained movement (tapping).

Firstly we assessed participants' individual differences in rhythmic perception. Participants then listened to several blocks of various musical excerpts. Blocks randomly varied in their groove property (high or low) and movement condition (tapping to the beat or not). Participants' pupil dilation was recorded during the blocks. Analyses are still ongoing.

This study serves as a foundation for further research on the relation between music perception and movement in healthy and clinical populations, like cochlear implant users or Parkinson's disease patients.

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16a. How many children grow up bilingually in Canada? Analysis of the 2016 Census data

Esther Schott (Concordia University), Lena V. Kremin (Concordia University), Krista Byers-Heinlein (Concordia University)

Keywords: bilingualism, infant language acquisition, Canada

How many children grow up with a *maman* who speaks *français* and a daddy who speaks English? Growing up bilingually presents children with the unique challenge of learning two languages at the same time, and many researchers in Canada and elsewhere are studying how bilingual children learn language. There is, however, little information about how common child bilingualism actually is. Our approach is to use publicly available data from the 2016 Canadian Census to investigate the rate of child bilingualism and the different languages (e.g., English-French, English-Cantonese, ...) children are exposed to. Across Canada, at least 16% of children between 0 and 4 years were exposed to two or more languages, with larger rates of bilingualism in larger cities (e.g., Toronto: 25%, Montreal: 26%). Regarding the language pairs children were exposed to, Quebec showed a unique pattern compared to other provinces. In Quebec, combinations with French were most common (e.g., French-English, French-Arabic), whereas in British Columbia, Alberta, and Ontario the language combinations included English and different non-official languages (e.g., English-Punjabi, English-Chinese, English-Tagalog). The present work contributes to a better understanding of the rates and types of infant bilingualism, which ultimately will benefit language researchers, policy makers and advocacy groups.

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17a. Effect of a personalized musical intervention on perioperative anxiety and pain in adult dental implantology: Phase I randomized controlled feasibility study.

Morgane Bertacco (Université de Montréal), Orelle Soyeux (Université de Montréal), Robert Durand (Université de Montréal), Pierre Boudrias (Université de Montréal), Teresa Gomes (Université de Montréal), Stéphane Guétin (Université Paris-5 René Descartes), Pierre Rainville (Université de Montréal), Elham Emami (McGill University) & Nathalie Gosselin (Université de Montréal).

Keywords: dental anxiety, music, pain

Dental anxiety is a significant barrier to the acceptance of a dental treatment plan such as implants. It can therefore lead to oral problems, exacerbate pain perception and the use of antibiotics and analgesics. It is therefore important to develop intervention strategies to promote adherence to dental implantology treatment. In this sense, music has been shown to be effective in reducing anxiety and pain in various clinical populations, but its effectiveness has been little studied in the context of dental implantology. This research project aims to verify the feasibility of a controlled study comparing the effect of listening to music and an audio book (control group) on anxiety and pain during implant surgery. It is predicted that listening to music will further reduce anxiety and postoperative pain compared to listening to an audio book. Patients receiving

implant surgery will be selected. They will be randomly assigned to the music intervention or to the control group (audio book). Each patient will choose the music (MUSIC CARE application) or the audio book, depending on their group, from 7 choices. Self-reported (anxiety, pain) and physiological (heart rate and electrodermal conductance) measurements will be collected. Preliminary results of self-reported anxiety and music will be presented.

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18a. Données de potentiels évoqués adultes sur la compréhension de l'accord sujet-verbe en français

Mélanie Weiss (École d'orthophonie et d'audiologie, Université de Montréal), Émilie Courteau (École d'orthophonie et d'audiologie, Université de Montréal), Karsten Steinhauer (École des sciences de la communication humaine, Université McGill), Phaedra Royle (École d'orthophonie et d'audiologie, Université de Montréal)

Mots-clés : Potentiels évoqués; accord sujet-verbe; adultes francophones

Ce projet explore les processus neurocognitifs qui sous-tendent la compréhension orale de l'accord en français, à travers l'enregistrement d'électroencéphalogrammes (EEG). Nous évaluons le traitement d'incongruités de l'accord en nombre sujet-verbe, en présentant des images d'agents et d'actions simultanément avec des phrases auditives grammaticales. Les marqueurs d'accord étaient de deux types: (1) le déterminant du sujet (*le/la/les*) et (2) la flexion verbale (*il rugit /ilkyzi/ ; ils rugissent /ilkyzis/*) deux indices acoustiques importants pour la compréhension de l'accord. Dans le cas des incongruités auditives-visuelles, nous attendions une onde biphasique LAN-P600, c'est-à-dire une négativité antérieure liée au traitement d'erreurs d'accord, suivie d'une positivité liée à la réparation d'erreurs. Les données de 22 adultes neurotypiques francophones monolingues ont été recueillies. Chaque participant entendait 120 phrases, congruentes ou non avec une image présentée à l'écran, et devait en juger la congruité pendant l'enregistrement d'EEG. Les potentiels évoqués extraits de l'EEG démontrent que les incongruités induisent une onde biphasique N400-P600 pour chaque condition. Dans le cas des flexions verbales incongrues, la N400 reflèterait une recherche lexicale pour la forme du verbe au pluriel, alors que dans le cas des déterminants incongrus, elle reflèterait la discordance de la prédiction lexicale basée sur l'image. Ces données originales, car utilisant des phrases grammaticales pour induire des composantes reliées aux erreurs d'accord, serviront de référence pour l'étude du développement du langage chez les francophones avec ou sans trouble du langage.

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19a. Sensory loss and cognitive function in older adults at different stages of cognitive impairment

Faisal Al-Yawer (Concordia University), M. Kathleen Pichora-Fuller (University of Toronto), Walter Wittich (University of Montreal), Paul Mick (University of British Columbia), Nathalie Giroud (Concordia University), Sana Rehan (Concordia University), Natalie Phillips (Concordia University)

Keywords: aging, hearing, sensory loss, cognitive testing

Sensory loss in older adults has been associated with declines in cognition and, in some cases, with the development of dementia. Using preliminary data from the COMPASS-ND study, we examined sensory differences (hearing, vision, olfaction) and the potential associations of sensory with cognitive function in groups with Alzheimer's disease (AD; N=17), mild cognitive impairment (MCI; N=55), and subjective cognitive impairment (SCI; N=18). The SCI group scored better on most neuropsychological measures compared to the other groups, as did the MCI group compared to AD. Controlling for age, sex, and education, we observed differences in contrast sensitivity (SCI, MCI>AD; $\eta^2=.08$), and olfaction (SCI, MCI>AD; $\eta^2=.11$). There were no differences among groups in reading acuity, audiometric hearing loss category nor speech-in-noise threshold on a digit triplet test (DTT). Partial correlations were analyzed for the MCI group. Olfaction (Brief Smell Identification Test) was associated with measures of memory (Rey Auditory Learning Test), executive function (Stroop), and working memory (digit span forward & backwards). Measures of vision were associated with measures of visual attention (Trial Making A). Cognitive measures were not associated with

audiometric category nor DTT thresholds. These results highlight sensory-cognitive interactions in individuals at prodromal stages of dementia.

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20a. The effect of corrective feedback frequency on L2 pronunciation learning

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Keywords: corrective feedback, pronunciation, L2 teaching

Corrective feedback is a common teaching technique in second language (L2) pronunciation learning. However, how often teachers should provide corrective feedback has not been clear. Although one might think that correcting learners upon every mispronunciation (i.e. 100% feedback) would be the most effective, correcting every learner at every time may not be feasible in practice. The current study investigated the effect of the reduction of feedback frequency on the most common corrective feedback methods, recast and prompt. 78 English speakers were randomly divided into five groups – 100% recast, 50% recast (i.e. providing recast for only half of a participant's mistakes), 100% prompt, 50% prompt, and control – to learn Japanese geminate-singleton contrast /tt/ and /t/ through a short laboratory training session. Participants' pronunciation accuracy was judged at the pre-training, during training, and the post-training (one week later). Results show that 100% recast improved pronunciation accuracy quickly and largely during training but it was followed by a large decrease in retention, resulting in the similar level of post-training accuracy as 50% recast, which showed a modest training effect but an excellent retention. On the other hand, there was a significant post-training difference between 100% prompt and 50% prompt, the latter being the same level as the control group. These results suggest that recast is resistant to frequency reduction, while prompt needs to be frequent and consistent to enhance learning.

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21a. Neural correlates of processing ambiguity and threat in non-linguistic vocalizations and faces: An fMRI study

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Keywords: fMRI; psychometrics; threat; ambiguity; emotion processing

The neuroimaging literature of socio-emotional processing has largely focused on the visual domain, particularly facial expressions. The current project aims to bridge the gap in our understanding of auditory emotional processing and, moreover, assess how the amygdala responds to each of these two modalities. To do so, we measured behavioural and neural correlates of graded perceptions of threat, namely, anger (direct threat), fear (indirect threat) and, most interestingly, subject-specific perceptions of ambiguous threat, expressed through non-linguistic vocalizations and faces. Healthy subjects (N=29) were first presented with morphed stimuli of each modality, created along a fear-anger continuum while performing a two-alternative forced-choice task (fear/anger). Subject-specific psychometric curves were built, and the morph level corresponding to maximal perceived ambiguity calculated. Visual and auditory subject-specific stimuli representing clear anger, fear and ambiguity were then presented while subjects underwent fMRI with a fast (TR=529ms), high-resolution (2 mm³ isotropic) multiband sequence. Behavioural results showed a bias towards auditory anger and visual fear, as well as greater task-difficulty for ambiguous stimuli of either modality. Imaging results revealed increased activity in the saliency and central executive networks and deactivation within the default mode network for ambiguous stimuli. Additionally, amygdala activity reflected biases observed in the behavioural findings, with stronger activity for auditory anger and visual fear conditions. Results provide a first look into the neural perception of emotional ambiguity and subject-specific biases of threat perception across modalities. They also give new insights into amygdala function in tasks requiring simultaneous recruitment of emotional and cognitive processes.

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22a. Neural correlates underlying time perception and temporal predictability in ageing: Preliminary Data.

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Keywords: temporal predictability, timing, ageing, EEG

Grasping the temporal structure of auditory rhythms is essential to predict future events and to optimize behavior. Timing abilities are hypothesized to systematically change with age. To thoroughly investigate perceptual and sensorimotor timing abilities and its variability, the Battery for the Assessment of Auditory Sensorimotor and Timing Abilities (BAASTA) has been developed. However, little is known about the underlying neural correlates of timing abilities in healthy older adults. Hence, the objective of the present project is to disentangle the influence of age on timing abilities and its underlying neural correlates, while paying special attention to inter-individual differences. Age-related changes for early auditory event-related potentials (ERP), as expressed by increases in the P50 amplitude and N100 latency, are expected as well as reduced pre-stimulus alpha band suppression. We also expect correlations between behavioral performance in specific BAASTA tasks involving temporal predictions and the EEG signals.

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23a. Effects of pharmacogenetic modulation of auditory cortical inhibition on the acquisition and consolidation of learning.

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Keywords: auditory cortex, learning, plasticity, parvalbumin-positive cells

Neural activity in the auditory cortex (ACx) contributes to make sense of the auditory world and perform specific auditory tasks. Auditory cortical processing is a plastic process; i.e., it adapts and changes depending on the behavioral and environmental conditions an individual finds itself in. Here, we studied ACx plasticity using a rodent model in two auditory contexts: passively listening to pure tones and performing a sound discrimination task. We found that altering the cortical excitatory/inhibitory balance by specific pharmacogenetic manipulation of parvalbumin-positive (PV+) interneurons can lead to increased or decreased plasticity depending on the auditory context. Down-regulation of PV+ cell activity during passive sound exposure re-activated plasticity and increased the proportion of ACx responding to the exposure tone, a change not observed in controls. During auditory training, up-regulation of PV+ cell activity in ACx restricted plasticity, as evidenced by slower learning and impaired sound discrimination performance. In contrast, down-regulation of PV+ cell activity resulted in accelerated perceptual learning but sub-optimal perceptual acuity by the end of training when compared to controls. Our results suggest that, while transiently enhancing plasticity through PV+ cell inactivation early in training may be beneficial, a subsequent increase in PV+ cell activity is needed to consolidate learning and prevent further plastic changes.

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24a. Using Music to enhance verbal recognition

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Keywords: music; distributed learning; memory consolidation; verbal recognition memory

Even though it is widely agreed that music is an excellent memory support of verbal information, the mechanism underlying this phenomenon remains quite unknown. In this behavioral study, we analyzed the differences between recognition memory of sung or spoken words. We have set up a protocol including sung or spoken words memorization, distributed in several presentations and memory tests (item recognition – word itself, then context recognition – if it was sung or spoken) to focus on memorization dynamics. Thirty-nine healthy French participants accepted to take part of the experiment. During the first session, we presented them the first list of words, then during the second session (twelve hours later) we presented them

the second list of words, a reactivation of both lists, and memory tests. We divided the participants into two groups: those having a night sleep during the twelve hours delay and those having a regular waking day. We have shown that item and associated context recognition scores are significantly higher for sung words than spoken words. Furthermore, we observe a significant performance improvement for item as well as context recognition when participant slept between the item presentation and the memory test. This results show that adding associated information such as context to a verbal task, and sleeping during the learning phase can have a significantly positive effect on recognition memory.

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25a. Sensorimotor integration in Autism spectrum disorders: a meta-analysis

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Keywords: autism spectrum disorder, motor coordination, motor impairments, motor skills

Sensorimotor skills are often reported as atypical in individuals with autism spectrum disorder (ASD). Little is known about how atypical sensorimotor skills in ASD may vary across development and with clinical symptom severity. This study used quantitative meta-analyses to assess sensorimotor skills in ASD across a total of 139 studies that represent 3436 individuals with ASD and 3618 individuals with a typical development. Results strongly support the presence of deficits in overall sensorimotor abilities in ASD (Hedges' $g=1.22$, $p<0.001$) and these atypicalities extended to both fine and gross motor abilities. Sensorimotor abilities increased with age, but did not appear to covary with symptom severity. These results broaden the understanding of sensorimotor atypicalities in ASD, and highlight the importance to design interventions to target these deficits and consider their impact across research, therapy, and educational settings.

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26a. Impaired Sensory Temporal Processing in Autism Spectrum Disorder and Dyslexia: A Meta-Analysis

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Keywords: temporal processing, sensory integration, neurodevelopmental disorders

Autism spectrum disorder (ASD) and developmental dyslexia (DD) are neurodevelopmental disorders associated with deficits in sensory temporal processing. Temporal processing is commonly measured in these disorders using the temporal order judgment (TOJ) and the simultaneity judgment (SJ) tasks. It is not well understood how consistent these temporal deficits are in ASD and DD, nor whether they remain present across different contexts (unisensory, multisensory, and language content). This study used quantitative meta-analyses to examine the TOJ and SJ tasks to answer the following questions: 1) is temporal processing consistently impaired both ASD and DD?, and 2) do impairments in temporal processing depend on variables such as sensory modality, language content, or multisensory integration? A total of 32 studies ($n_{asd}=376$, $n_{dd}=424$; $n_{dd}=422$, $n_{dd}=335$) were retrieved from five online databases and were independently coded by two researchers. Analyses were performed on study effects (Hedges' g) using random-effects models. Visual inspection of funnel plots and a trim-and-fill procedure were used to assess the presence of publication bias. Results indicate that a general deficit is present in ASD ($k=18$, $g=0.61$, $p<0.001$, $CI=0.38-0.84$) and DD ($k=14$, $g=0.80$, $p<0.001$, $CI=0.66-0.95$) compared to the control group, regardless of the context of the task. Future work should investigate the relationship between temporal processing and symptom severity in ASD and DD, as it has been suggested that temporal processing deficits can impair higher-order skills such as language and social communication.

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