


# Présentations par affiche / Poster Sessions

**27 octobre 2026 / October 27, 2026**
**12:00–1:30 p.m.**
**Lunch & Session #1**
**Université de Montréal**
**Pav. Roger-Gaudry, Hall d'honneur**
2900, boul. Édouard-Montpetit
Montréal, QC H3T 1J4

**28 octobre 2026 / October 28, 2026**
**12:00–2:00 p.m.**
**Lunch & Session #2**
**McGill University**
**Montreal Neurological Institute (The Neuro)**
**Jeanne Timmins Foyer**
3801 University Street
Montréal, QC H3A 2B4

## Session # 1 – Mardi 27 octobre / Tuesday, October 27, 2026

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| 2 | The effects of social feedback on music performance and performance anxiety | Emmanuel Adam-Marsolais |
| 3 | Plastic effects of musicianship on FFR metrics: Understanding FFR changes across scalp and source levels | Thomas M.D. Augereau |
| 4 | Rhythmic Synchrony and Social Cohesion in Group Drumming | Bradley Austin-Keiller |
| 5 | Music Listening Through Touch: User Experience and Social Acceptability of Multichannel Vibrotactile Gloves | Alex Bégin |

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# Abrégés des affiches / Posters abstracts

# Session # 1 – Mardi 27 octobre 2026 / Tuesday, October 27, 2026

## 1. Enhancing Music Perception Through Auditory-Vibrotactile Training

**Etienne Abassi**, Philippe Albouy, Emily Coffey, Andréanne Sharp, Robert Zatorre
*McGill University, Concordia University, Universite Laval*

Hearing loss limits the ability to process complex sounds, such as speech or music in noisy environments. Although hearing aids and cochlear implants improve audibility, they often fail to convey fine acoustic details, reducing speech understanding and access to music, an important source of cultural and emotional engagement. Auditory–tactile integration offers a promising way to address these challenges. Vibrotactile feedback can complement auditory input by conveying rhythm, intensity, and frequency through the somatosensory system, potentially supporting everyday listening. Our research investigates whether vibrotactile information delivered through a novel Multichannel Vibrotactile Glove can enhance auditory perception of short musical excerpts in noise. The glove converts complex acoustic signals into high-fidelity vibrotactile stimulation, tonotopically mapped across the fingers to mirror the frequency organization of the auditory system. In a behavioral and EEG study, 30 healthy young adults completed a five-session protocol over two weeks, including baseline testing, three days of training, and post-training assessment. Auditory perception was measured using the Music-in-Noise Task (MINT), which assesses discrimination of repeated musical excerpts embedded in noise. Neural correlates of sound processing were examined with EEG, focusing on reconstruction of the music envelope as an index of neural encoding. Participants showed improved MINT performance in the auditory–tactile condition compared to audio-only listening, with additional gains following training. EEG results suggested enhanced neural encoding for auditory–tactile stimulation relative to unimodal input. Together, these findings indicate that vibrotactile feedback can enhance auditory perception, support learning, and engage multisensory plasticity, highlighting its potential for auditory rehabilitation.

**Keywords:** Vibrotactile perception, Hearing loss, EEG, training

## 2. The effects of social feedback on music performance and performance anxiety

**Emmanuel Adam-Marsolais** (1,2,3), Nicholas Foster (1), Alex Nieva (1), Simone Dalla Bella (1,2,4)
*(1)BRAMS, (2)CRBLM, (3)Université de Montréal – Département de Neurosciences, (4)Université de Montréal – Département de Psychologie*

Background: Music performance, a highly complex sensorimotor activity, relies on the interplay of auditory and motor systems. These interactions are regulated by both feedforward and feedback mechanisms. For example, there is evidence that feedback manipulation in auditory and visual modalities can disrupt performance. Less is known about the effect of social feedback in the context of public performance. This component is an important factor for musicians, as it is potentially linked with performance anxiety (MPA). Depending on the musician, MPA can prove energizing or debilitating. In this study, we manipulate effect of social feedback - the presence and reactions of an audience - on both piano performance and the associated MPA. Methods: Pianists aged 18-35 with at least 5 years of formal musical experience performed 2 piano excerpts in an immersive room, equipped with a large screen and a

multichannel audio system, in which a virtual public reacted to their performance. Mistakes were induced in the performance by speeding up the tempo of the excerpts, prompting vocal reactions from the public, such as cheering, gasping or sighing. These reactions belong to four categories in different blocks of recordings: no reaction (control), neutral, positive, and negative feedback. We recorded each performance along with physiological data (ECG, EDA, respiration and salivary cortisol level). We used questionnaires before, during and after the performance to collect self-reported measures of anxiety. Results: Preliminary results will be presented, including physiological, performance and self-reported data. The following measures will be compared between blocks: physiological means (HR, RR, RA, SCR, SCL), number of mistakes, and questionnaire scores. Implications: This new method, deployed in a controlled simulated environment, allowed us to recreate a natural performance environment, thus potentially contributing to pinpoint the role of social factors in influencing music performance as well as inducing MPA.

**Keywords:** Music performance, Auditory-motor skills, Music cognition, Performance anxiety, Cognitive neuroscience

## 3. Plastic effects of musicianship on FFR metrics: Understanding FFR changes across scalp and source levels

**Thomas M.D. Augereau**, Marcel Farrés-Franch, Jessica Grahn, Robert J. Zatorre, Emily B.J. Coffey
*Concordia University, McGill University, BRAMS, CRBLM, Neuro, NSERC*

The claim that musical training enhances the neural encoding of sound, as indexed by the frequency-following response (FFR), has recently been challenged: earlier reports of musician advantages contrast with recent a large-scale null finding (Whiteford et al., 2025). These discrepancies may partly reflect methodological choices. Most studies analyse the FFR at the scalp, where cortical and sub-cortical generators are mixed, and rely on a few metrics whose sensitivity to experience-dependent plasticity has never been systematically compared.

This project aims to identify which FFR metrics, and at which level of analysis, best capture musicianship-related plasticity. We use data from the OMMABA multimodal dataset, which is currently being extended. It includes FFRs to a 120-ms /da/ syllable (F0 = 98 Hz), anatomical MRI, and musical training history. It also includes behavioural measures of fine pitch discrimination, speech-in-noise perception (HINT), music-in-noise perception (MINT), and auditory working memory (currently N = 69 before quality control).

We will extract FFR metrics (F0 and harmonic amplitudes, inter-trial phase consistency, pitch-tracking accuracy, stimulus-response correlation, onset timing, in-noise condition) at the scalp and source levels. MRI-guided source modelling will help disentangle cortical from subcortical contributions (medial geniculate body, inferior colliculus, cochlear nucleus). Mixed models including age and musical training will relate each metric to musicianship and to behaviour.

Initial scalp-level analyses show only weak associations between FFR metrics and musical training. This is consistent with the mixed literature and underscores the need for the source-level analyses now underway.

By mapping how the various FFR metrics and generators relate to musical experience, this work aims at clarifying conflicting findings and guiding the choice of FFR biomarkers for future studies, including interventions in aging populations.

**Keywords:** Frequency-following response; Musicianship; Neuroplasticity; EEG source modelling; Speech-in-noise perception

## 4. Rhythmic Synchrony and Social Cohesion in Group Drumming

**Austin-Keiller, B.**, Foster, N., Lazzari, G., Van Vugt, F., Dalla Bella, S.

*Department of Psychology, University of Montreal, Pavillon Marie-Victorin, Outremont, QC; International Laboratory for Brain, Music and Sound Research (BRAMS), University of Montreal, Pavillon Marie-Victorin, Outremont, QC; Centre for Research on Brain, Language and Music (CRBLM), Montréal, QC.*

Playing music in an ensemble, rowing in a crew or marching in step all require individuals to coordinate their actions to a shared rhythmic pattern. Aligning movements between people – behavioural synchrony - promotes cooperation, empathy and prosocial behaviour. However, most evidence comes from research on dyads. Synchrony has rarely been manipulated experimentally within groups, despite most real-world coordination involves larger groups. In this study, we introduced a novel behavioural perturbation paradigm using a group drumming task to examine how the timing stability of each member of the group and of the overall group relates to perceived group cohesion. Thirty-nine adults (divided into 9 groups) performed a modified group synchronisation–continuation task on electronic drum pads. In some trials (perturbation trials), one randomly selected participant, unknown to the others, heard a metronome that accelerated or decelerated by 8% or remained unchanged, while the rest of the group continued without external cues. In other trials (control trials) all participants followed the same metronome. Timing variability and synchronisation consistency were computed both at the individual and at the group levels. After each trial, participants rated felt closeness to the group (Inclusion of Other in the Self), working together, perceived leadership and enjoyment. Preliminary results revealed that the behavioural perturbation destabilised group timing, which recovered once the metronome was removed. Greater timing variability was associated with reduced closeness, a weaker sense of working together and a stronger perception that someone was leading, while synchronisation consistency showed the opposite pattern. These effects held at the individual level: a participant's own variability during the perturbation predicted their own cohesion ratings. Enjoyment was unrelated to timing. These findings suggest that the stability of individual timing shapes how cohesive a group feels and provide a controlled paradigm for testing whether reducing timing variability, for example through rhythm training, can strengthen group cohesion.

## 5. Music Listening Through Touch: User Experience and Social Acceptability of Multichannel Vibrotactile Gloves

**Alex Bégin**[1,2], Loonan Chauvette[1,2], Viktoria Gagnon[1,3], Jérémie Voix[4], Matthieu J. Guitton[1,2], Andréanne Sharp[1,2]

*1.CERVO Brain Research Centre, Quebec City, QC, 2. Faculty of Medicine, Université Laval, Quebec City, QC, 3. Faculty of Music, Université Laval, Quebec City, QC, 4.École de technologie supérieure (ÉTS), Montreal, QC*

Introduction: Vibrotactile devices have emerged as promising tools for rendering music through touch, potentially enhancing musical engagement and accessibility. While previous research has demonstrated that vibrotactile stimulation can contribute to instrument discrimination and timbre perception, the qualitative experience and social acceptability of such technologies remain underexplored. This study investigated the user experience and social acceptability of familiar music presented through Multichannel Vibrotactile Gloves in musicians and non-musicians with and without hearing loss.

Method: 129 participants listened to familiar songs of their choice through gloves equipped with 10 vibrotactile actuators. The sample included 86 non-musicians and 43 musicians, including 14 participants with hearing loss. Participants completed an adapted version of the Quebec User Evaluation of

Satisfaction with Assistive Technology, rating eight characteristics of the technology on a 5-point scale and identifying the three most important characteristics. Four open-ended questions further explored their impressions, tactile experience, willingness to use the technology, and suggestions for improvement. Quantitative questionnaire data and qualitative responses were analyzed using mixed methods.

Results: Ratings were generally positive, with mean scores above 4/5 across all dimensions. Three main themes emerged: (1) embodiment and immersion, with participants describing a richer and more immersive musical experience resembling live music; (2) complementarity of sound and vibration, with vibrations providing additional information about musical nuances and genre differences; and (3) interest and curiosity, reflecting the novelty and uniqueness of the experience. Participants generally perceived the technology as useful and complementary to auditory listening, particularly for people with hearing loss. Improvements related mainly to connectivity, style, ergonomics, and portability.

Conclusion: Vibrotactile music rendering appears to offer a rich, engaging, and socially acceptable means of experiencing music. Findings highlight affective benefits such as embodiment and immersion, as well as users' interest in novel experiences with familiar music. Design improvements include ergonomics, portability, and connectivity.

**Keywords:** Vibrotactile, Music, Hearing Loss, Timbre

## 6. Impact de la musique de fond sur l'intégration relationnelle en fonction de la charge cognitive chez les jeunes adultes et les personnes âgées

**Olivier Boulianne**, Guillaume T. Vallet et Simon Rigoulot
*UdeM, BRAMS, CRIUGM*

L'intégration relationnelle est la capacité à créer des associations entre des caractéristiques distinctes, soit entre plusieurs objets ou un objet avec son contexte. Cette capacité est essentielle pour former et maintenir des représentations unifiées en mémoire à court terme. Elle requiert des ressources attentionnelles, ce qui pourrait expliquer pourquoi elle est altérée dans le vieillissement normal. L'ajout d'une musique de fond pendant une tâche a conduit à des résultats contradictoires sur la performance cognitive. Cela pourrait s'expliquer par la charge cognitive, la quantité de ressources attentionnelles nécessaire pour réaliser la tâche. Lorsqu'elle est élevée, la musique pourrait aider à la concentration ou surcharger cognitivement l'individu. Cette étude vise alors à comprendre l'influence de la musique de fond sur l'intégration relationnelle et à analyser si elle varie en fonction de la charge cognitive. Sur les 48 personnes prévues, 21 jeunes adultes et 13 personnes âgées ont dû mémoriser des associations entre des formes vides et des couleurs, présentées pendant quatre secondes dans une condition de charge cognitive faible (trois associations) et élevée (quatre associations), en présence ou absence d'une musique de fond. L'ANOVA mixte révèle un effet principal de musique, la performance est meilleure en sa présence, et un effet de l'âge, les personnes âgées performent moins bien que les jeunes adultes, sans interaction entre ces deux facteurs. Ces résultats suggèrent que, peu importe l'âge ou la difficulté de la tâche, la musique pourrait permettre à l'individu de maintenir ses ressources attentionnelles sur la tâche, facilitant son engagement et améliorant sa performance.

**Keywords:** Intégration relationnelle; charge cognitive; vieillissement normal; musique de fond

## 7. Neural encoding of melodic expectations during wakefulness and sleep

**Anne Calvel**, Basem Abu Shamleh, Giacomo Novembre, Emily Coffey, Roberta Bianco
*Concordia University, Italian Institute of Technology, Concordia University, University of Pisa*

Music provides a framework for studying the development of cognitive processes underlying humans' unique auditory perception and communication abilities. The ability to track rhythmic patterns in music has been observed in adults, rhesus monkeys, and newborns, suggesting that it is a skill shared across species and development. However, of those, only adult humans show evidence of melodic prediction (Bianco et al., 2024, 2026). The combination of methods used in these papers, i.e., non-human primate and human adult recordings in the wake state and human baby recordings in the sleep state, makes it impossible to discriminate the cause: ontology or philogeny.

To address this question, the present study aims at comparing neural responses to music during wakefulness and sleep in 40 healthy young adults with normal hearing (and no prior musical training). Each session involves recording brain activity using 64-channel electroencephalography while participants are presented with piano excerpts. A 1-hour awake listening period and a 2-hour nap opportunity are scheduled in counterbalanced order. During the nap, sleep is monitored in real time to present the melodies specifically during N2 and N3 sleep. We evaluate surprise and entropy associated with each note's timing and pitch to quantify rhythmic and melodic expectations using the IDyOM model (Pearce, 2018).

Preliminary results (N=10) suggest similar temporal response function profiles for pitch surprise and entropy during wakefulness and the nap, suggesting that melodic expectations persist during sleep. Should these results hold in the final sample (N=40), it would indicate that the absence of neural tracking of melodic expectations in newborns reflects neurodevelopment rather than state of consciousness.

**Keywords:** melody prediction, sleep, electroencephalography

## 8. Contextual Speech-Rate Flexibility in Four-Year-Old Children and Its Association with Phonological Awareness

**Cantin, Corinne**; Gagnon, Claudie; Falk, Simone
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At four years old, children go through a significant period in the development of their social and communicative skills. Yet, few studies have documented how temporal aspects of speech are managed at this age across various conversational contexts. This study examined whether four-year-old children modulate their speech rate according to their conversational partner and whether individual differences in this contextual flexibility are associated with phonological awareness, a skill essential for academic development.

Speech data from 19 four-year-old children were collected in their home using the Language ENvironment Analysis (LENA) system. Based on pre-established criteria, conversational exchanges with familiar household interlocutors (HI) and non-household interlocutors (NHI) were manually identified from approximately 20 hours or recordings per child. Speech rate was estimated in syllables per second using automated and manual coding procedures through Praat and Python scripts. Phonological Awareness was measured using the French Preschool Test of Phonological Awareness (Test de conscience phonologique

préscolaire) at ages 4 and 5. Linear mixed-effects models and correlational analyses examined conversational temporal coordination and its associations with phonological awareness.

Children showed a tendency to modulate their speech rate across contexts, with faster speech in interactions with NHI than HI. However, substantial individual variability was observed in the magnitude and direction of this contextual modulation. Children's speech rate covaried with their adult interlocutors' speech rate, suggesting emerging flexibility in the temporal coordination during interaction. Among the 17 children with longitudinal data, greater contextual speech-rate modulation at age 4 was positively associated with phonological awareness at age 5.

Theses findings suggest that as early as 4 years old, children are beginning to adjust their speech rate depending on their conversational partner, with important individual differences. Contextual speech-rate modulation may be related to subsequent phonological development, highlighting a potential link between children's conversational timing and emerging language skills.

**Keywords:** Conversation, Speech Rate, Phonological Awareness, Early Childhood, Corpus-Based Study

## 9. SEEG-Based Mapping of Epilepsy and Cognitive Brain Function

**Gotti C.1**, Martineau L.2, Lessard Bonaventure P.2, Borderie A.1, Ginzburg J.1, Labelle C.1, Laureys S.1, Hoyer R.S.1, Albouy P.1,2

*1. CERVO Brain Research Centre - Université Laval, Québec, Canada; 2. CHU de Québec - Université Laval, Québec*

Epilepsy affects nearly 1% of the world's population, corresponding to more than 70 million people. Approximately 30% of patients do not respond adequately to anti-seizure medications and are considered drug-resistant. Most of these cases are focal epilepsies, in which seizures originate from a localized region of the cerebral cortex. For patients with drug-resistant epilepsy, surgical resection of the epileptogenic zone may be considered. However, in Canada, very few patients undergo such procedures each year, partly because of the difficulty in precisely identifying the epileptogenic zone and assessing the potential cognitive consequences of its removal.

Stereo-electroencephalography (SEEG) involves recording brain electrical activity through the implantation of depth electrodes. It combines excellent spatial and temporal resolution and enables functional mapping of brain regions that may be included in the surgical resection. This approach is traditionally performed using electrical stimulation, which can assess relatively simple primary functions, such as language and motor function, but is less suited to evaluating complex cognitive processes such as memory and attention.

Our laboratory combines clinical and basic research approaches. Our work aims to better define the epileptogenic zone, understand the mechanisms underlying seizure onset and propagation, and improve surgical planning through the identification of more precise biomarkers. In parallel, we investigate brain function during a range of cognitive tasks, including language, memory, attention, and perception, with the goal of better anticipating the potential cognitive consequences associated with surgery.

**Keywords:** Focal drug-resistant epilepsy, intracranial electroencephalography, Cognitive neuroscience, Brain functions

## 10. Virtual Acoustics in Your Pocket: An XR iPad Application for Singer Rehearsals with Real-Time Convolution Reverb via Bone Conduction Headphones

**Gilles Grenon**, Andrea Gozzi, Caroline Traube
*Université de Montréal, Université de Sherbrooke*

Professional singers often rehearse in studios or small rooms whose acoustics differ substantially from those of the performance venue. Gozzi et al. (2025) proposed and implemented a real-time convolution reverb system delivered through bone conduction headphones, enabling musicians to perceive both the direct sound of their instrument or voice through air conduction and the virtual acoustics of a concert hall through bone conduction, creating an augmented auditory reality experience.

The portable iPad application presented here extends this approach to a mobile platform. Developed using JUCE, it connects to an audio interface and a microphone. The instrument or voice signal is convolved in real time with the impulse response (IR) of a performance hall, while only the reverberated signal is sent to the bone conduction transducer. The application provides access to four acoustic spaces: Salle Claude-Champagne (Université de Montréal), Plateau 1 at the École de musique (Université de Sherbrooke), Teatro della Pergola, and Teatro del Maggio Musicale Fiorentino (both in Florence).

The demonstration will present the system in operation and examine key design features, including feedback prevention, a multilingual touch interface, and audio compression. The prototype also includes an illustrated hall library, saved configurations, level meters, dynamics processing, and equalization.

**Keywords:** Audio augmented reality, bone conduction headphones, virtual acoustics

## 11. Does the ADHD brain have a favorite soundtrack? Background music, task difficulty, and ADHD symptoms in adolescents

**Emma Head**, Nathalie Gosselin
*BRAMS, CRBLM, UdeM*

Background music (BM) accompanies daily activities among adolescents, but its perceived effects may vary according to neuropsychological profile and activity difficulty. This online study aims to compare BM listening habits between adolescents who screen positive and negative for Attention-deficit/hyperactivity disorder (ADHD) according to activity difficulty. A total of 197 adolescents aged 12–17 years who were able to understand French participated in this survey study. Participants with a neurodevelopmental disorder (other than ADHD for the ADHD group), a neurological or mental health disorder, severe uncorrected hearing impairment, or use of medication affecting the nervous system, other than psychostimulants were excluded (n = 83). Participants included (N=114) were then classified into two groups based on their ASRS screening score: an ADHD screening-positive group (score ≥ 12) and an ADHD screening-negative group (score < 12). Participants first rated the difficulty of different activities (e.g., studying, reading, tidying their room), then, for the same activities, reported their BM listening frequency, musical preferences, and reasons for not listening to BM. They also completed measures of anxiety and depressive symptoms. Preliminary results show that adolescents who screened positive for ADHD reported higher anxiety ($p < .001$), depressive symptoms ($p < .001$), and overall perceived difficulty ($p < .001$) than those who screened negative. No between-group differences were observed in BM listening frequency, or musical preferences, or reasons for not listening to BM. These preliminary results suggest that between-group differences primarily concern perceived activity difficulty rather than BM listening habits or characteristics.

**Keywords:** adhd, background music, attention

## 12. Cross-linguistic Comparison of Brain Response to Speech Predictability in English, Mandarin Chinese, and French Narratives

**Yanan Liu**, Paul Masset, Robert Zatorre
*McGill*

Recent research suggests autoregressive large language models (LLMs) share three computational principles with the human brain: continuous expectation formation before word onset, surprise responses to prediction errors after word onset, and context-dependent representation. These parallels allow LLMs to serve as a computational framework for studying language processing. However, previous neuroimaging evidence remains largely confined to single-language studies, typically identifying responses to surprisal in the temporal lobe and entropy in the frontal and parietal cortex. Here, we investigated the universality of these mechanisms across four LLMs in English, Mandarin, and French narratives. We analyzed the trilingual 'Le Petit Prince' fMRI dataset using four multilingual LLMs (Llama, Qwen, Mistral, and Bloom) to estimate word-level metrics. A conjunction analysis across all languages and models identified shared neuro-computational bases. Surprisal positively modulated the superior temporal gyrus (STG). Regarding uncertainty, we observed a divergent pattern: high uncertainty (entropy) was associated with increased activation in the STG, precuneus, and posterior cingulate cortex, whereas low uncertainty tracked with the activity in the inferior frontal operculum, middle frontal gyrus, medial superior frontal gyrus, and inferior parietal lobule. Additionally, high entropy reduction modulated activity in the STG and Heschl's gyrus. These findings suggest the brain's predictive architecture for natural language is remarkably consistent across typologically diverse languages, supporting a universal computational basis for speech processing.

**Keywords:** multilingual comprehension, predictive processing, fMRI, large language model

## 13. Affective Responses to Chord Quality: Strong Subjective Ratings but Weak EEG Power-Spectrum Effects

**Giovanni Mazzaferri**, Marco Costa
*University of Bologna*

Chord quality is the classification of chords based on the intervals between their tones. In Western music, triads (three-tone chords) can be major, minor, diminished, or augmented; we also included dense tone clusters as a non-triadic dissonant condition. Using chord sequences with the same progression across all five qualities, we assessed felt pleasure, tension, valence, and arousal (labeled as energy) while recording EEG. Participants also completed the eBMRQ, testing associations with the Emotion Evocation and Musical Seeking subscales and the BMRQ total score. We expected consonant sequences (major, minor) to elicit higher pleasure and lower tension than dissonant ones (diminished, augmented, cluster). Valence was expected to dissociate from pleasure for minor chords, consistent with pleasure-valence dissociation in aesthetic contexts. Arousal was expected to dissociate from tension, based on the three-dimensional model of emotion. EEG analyses were exploratory and were conducted on the absolute power spectrum.

Ratings strongly confirmed our hypotheses. Pleasure, tension, and valence showed a clear gradient distinguishing major and minor chords from the three dissonant conditions, while arousal was explained mainly by pitch rather than chord quality, dissociating from tension. Minor chords also showed high

pleasantness relative to their valence, consistent with the well-documented enjoyment of sad music. EEG power-spectrum effects were weak: pairwise comparisons found narrow-band alpha differences. Individuals with higher Emotion Evocation, Musical Seeking, and BMRQ total scores differentiated more between consonant and dissonant conditions, suggesting general music reward sensitivity may heighten perceived dissonance. Further EEG analyses, using different approaches, are needed to better characterize the neural correlates of chord quality. Future work could apply ERP or time-frequency analyses to capture rapid, millisecond-scale dynamics.

**Keywords:** Chord Quality, Consonance/Dissonance, EEG, Power Spectrum, Music Reward

## 14. Listening to the Heart: Investigating Relationships Between Cardiac Activity, Spontaneous Rhythm Production and Synchronization

**Manon Palmer**, Mihaela Felezeu, Véronique Martel, Nicholas Foster, Isabelle Peretz
*Université de Montréal*

Rhythm is present both within our bodies and in our environment, from the continuous beating of the heart to the temporal patterns of music and movement. Despite the widespread idea that heartbeats influence musical experience, empirical evidence remains limited. Spontaneous rhythm production and synchronization rely on internal timing processes that allow to anticipate and flexibly adjust to external rhythms. Heartbeats provide a continuous, quasi-periodic signal that can interact with perceptual and predictive processes. Yet, it remains unclear whether heartbeats can influence the timing processes underlying rhythmic behaviour. This project investigates these relationships during spontaneous motor production and auditory-motor synchronization. Our hypothesis is that more regular cardiac activity will be associated with more stable spontaneous rhythm production and better synchronization performance.

We developed a paradigm in which cardiac activity is continuously recorded using electrocardiography while participants finger-tap at a chosen pace, sing “Happy Birthday” using /da/ syllables, synchronize taps with metronomes at three tempi (450, 600, and 750 ms inter-onset intervals), and synchronize taps to 10 musical excerpts. Spontaneous motor production is characterized through spontaneous motor tempo and variability, and synchronization performance through synchronization consistency. Cardiac activity is characterized using heart rate, heart rate variability (RMSSD), and heart-rate fragmentation. We also examine the phase relationship between heartbeats and musical beats.

In 47 older adults, heart rate differed across metronome tempo conditions and was significantly higher during fast than slow tempi. We found no significant relationships between heart-rate variability and spontaneous or synchronized tapping performance, heart rate and spontaneous motor tempo, or heartbeats and musical beats. This initial study characterizes cardiac and rhythmic measures and their relationships in healthy older adults, providing a reference for subsequent investigations in populations with disrupted cardiac rhythm regulation or musical beat processing.

Ultimately, this research could help elucidate the role of physiological processes in musical experience.

**Keywords:** Heart-brain interactions, musical beat processing, auditory-motor synchronization, spontaneous motor production, aging

## 15. Comment l'intensité émotionnelle des voix et des visages influence le traitement attentionnel ? Résultats préliminaires en traçage oculaire et EEG

**Simon Paradis**, Sherwin Chiu, Émile Mercier, Simon Rigoulot
*UQTR*

Plusieures études utilisent des expressions émotionnelles intenses, alors qu'elles sont généralement modérément exprimées au quotidien. Cette étude vise à explorer les dynamiques visuelles et électrophysiologiques de l'attention envers des visages et voix émotionnelles modérées et intenses; conditions plus représentatives du quotidien. Il est attendu qu'une augmentation de l'intensité émotionnelle des stimuli augmentera la proportion de temps passé sur les visages émotionnels que les neutres, ainsi que l'amplitude moyenne des composantes évoquées d'intérêt (EPN et LPP). Les participants devaient regarder des paires de visages (un neutre, un émotionnel) accompagnés d'une voix. Des ANOVAs à mesures répétées comprenant l'émotion (joie ou colère), l'intensité émotionnelle de la voix (neutre, modérée ou intense) et l'intensité du visages émotionnel (modérée ou intense) on été faites avec 15 participants. Les résultats comportementaux indiquent une interaction de l'intensité de la voix et du visage, ainsi que de la voix et de l'émotion ($ps < 0.001$). Ces résultats sont partiellement corroborés par des amplitudes conséquentes en potentiels évoqués ($ps \leq 0.041$). Ces analyses préliminaires indiquent une capture attentionnelle proportionnelle à l'intensité de l'expression et que la colère capture davantage l'attention que la joie, contribuant donc à améliorer les connaissances des mécanismes sous-jacents à l'attention envers les émotions.

**Keywords:** Attention, Émotion, Audiovisuel

## 16. PolyRNN: A time-resolved model of polyphonic musical expectations aligned with human brain responses

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Musical expectations shape how we perceive and process music, yet current computational approaches have been limited to monophonic or simplified stimuli. The study of the underlying neural processes in real-world music therefore requires significant advances in our statistical modeling of these stimuli. We present PolyRNN, a recurrent neural network designed to model expectations in naturalistic, polyphonic music using symbolic representations. We recorded neurophysiological activity non invasively (MEG) and within the human brain (intracranial EEG) while participants listened to naturally expressive piano recordings. The musical expectations estimated by the model are encoded in evoked P2- and P3-like components in auditory regions. Comparing PolyRNN to a state-of-the-art generative music model, we show that piano roll representations are best suited to represent expectations in polyphonic contexts. Overall, our approach provides a new way to capture the musical expectations emerging from natural music listening, and enables the study of predictive processes in more ecologically valid settings.

**Keywords:** Music, Predictive coding, Computational modeling

## 17. Timing Is Everything: How Age of Start of Musical Training Influences Auditory Abilities

**Juan Manuel Velez**, Maria Psomas, Paula Berry
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Musical ability appears to be shaped by experience during a sensitive period, with early-trained musicians (starting before age 7) showing behavioural and neuroanatomical differences from late-trained musicians. This preliminary study examined whether age of start (AoS) of music training influences performance on melodic and rhythmic discrimination tasks and on a beat alignment task (CA-BAT). Using a convenience pilot sample of 37 participants divided into early-trained musicians, late-trained musicians, and non-musicians, we compared performance across groups on each task. Groups differed on rhythmic discrimination, with early-trained musicians outperforming non-musicians. A similar trend emerged on the CA-BAT, whereas melodic discrimination did not clearly differ between groups. These pilot findings suggest that the tasks are performing as intended and that group differences are trending in the expected direction. The dissociation between rhythm and melody, however, raises questions about the mechanisms underlying these abilities and how they are shaped by early training. Future work will test a sample of conservatory musicians and incorporate additional variables, including working memory (WAIS) and detailed musical experience measures (years of training, current weekly practice, and cumulative lifetime experience), to clarify what drives individual differences in musical ability.

**Keywords:** sensitive periods, musical training, age of start, musical ability, rhythm perception

## 18. Neural Entrainment to Naturalistic Music Perception and Imagery: Evidence for Endogenous Predictive Representations

**Thomas Vigneras**, Miyoung Chung, Robert Zatorre
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Neuroimaging research consistently demonstrates that perception and imagery of sensory stimuli share common neural substrates. In music neuroscience, however, this overlap has been explored primarily in the context of pitch and timbre, with less attention paid to metrical structure. While previous electroencephalography (EEG) studies have confirmed tracking during meter imagery, these findings rely largely on artificial stimuli such as metronomes. The present study investigates whether endogenous metrical representations persist during the imagery of ecologically valid music. We analyzed EEG data from 10 participants listening to and imagining excerpts from naturalistic 4/4 songs. We hypothesized that if perception and imagery share neural mechanisms for rhythm, both conditions would elicit similar selective enhancement of metrical frequencies in amplitude and phase-locking.

Results revealed remarkably consistent neural profiles across perception and imagery conditions. Frequency-domain analysis showed significant amplitude enhancement at the half-note and quarter-note (pulse) levels compared to non-meter frequencies. Conversely, whole-note and eighth-note frequencies were dampened relative to unrelated frequencies. Phase-locking analysis indicated that all metrical levels exhibited significantly higher phase-locking values (PLVs) than non-meter frequencies, with the quarter-note level showing significantly stronger phase-locking than other metrical levels.

These findings extend the known perception-imagery overlap to the domain of metrical structure, demonstrating a shared neural mechanism for musical time-keeping in real-world music. This suggests

that the brain utilizes top-down predictive processes to maintain neural enhancement at behaviorally relevant metrical frequencies, even without sensory input.

**Keywords:** predictive coding, imagery, music, meter

## 19. Cognitive and Motor Dynamics of Walking and Speech Processing: an Embodied Approach

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Classical cognitive neuroscience minimized movement during experiments to control variance, but new imaging methods now let us integrate movement into neural measurements, making the motor system's contributions to cognition explicit. We present a walking-while-listening (WLL) paradigm that combines over-ground motion capture with concurrent fNIRS to test how semantic processing of action words interacts with physical locomotion. Specifically, we assess whether WLL produces a dual-task effect and whether action-semantic processing yields a facilitatory effect on behavior and/or brain responses. Healthy young adults walked naturally while (i) walking only, (ii) listening passively to words, and (iii) actively processing action verbs versus city names. We assessed cadence, step length, and step duration via motion capture; we measured hemodynamic changes over prefrontal and motor cortices using fNIRS. Our technical setup resulted in joint movement–brain co-recording, using shared timestamps and event markers to synchronize audio delivery, mocap, and fNIRS. Short-separation channels on fNIRS recorded movement-related physiological noise, which was regressed out to keep cortical data unbiased by extracerebral signals. Preliminary results indicate that locomotion does not lead to dual-task costs during passive speech listening, consistent with its automatized nature. Yet when participants actively process action verbs, motor cortex activity is reduced relative to non-action words despite minimal kinematic change, suggesting resource redistribution or interference between concurrent motor and action-meaning processes. This result aligns with Embodied Cognition accounts in which conceptual meaning is tightly connected to sensorimotor experiences, underscoring the need to involve motor system measurements when assessing the neural representation of language.

**Keywords:** embodied cognition; embodied language; dual-task gait; fNIRS; action language

## 20. Respiration affect perceived social relationships and inter-brain dynamics in dyadic musical synchronization

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Social coordination facilitates behavioral and neural synchronization and shapes perceived social relationships; however, the interrelationships among these levels remain poorly understood. We examined dyadic behavioral and neural synchrony during a music production task while experimentally manipulating respiratory alignment. Eighty-eight previously unacquainted participants, randomly assigned to 44 dyads, synchronized melody production with a partner under natural breathing, instructed in-phase breathing, and instructed anti-phase breathing conditions while electroencephalography (EEG) was recorded. Ratings of perceived social relationships were collected after each condition. Results

showed that partners' musical synchrony decreased during both instructed respiratory conditions relative to natural breathing. In contrast, both in-phase and anti-phase breathing significantly increased partners' perceived connectedness and Inclusion of Other in the Self (IOS) ratings. Interbrain synchrony, indexed by dyadic phase-locking values applied to the partners' EEG signals, increased in the delta, theta, and alpha frequency bands during both in-phase and anti-phase respiratory coordination. Together, these findings suggest that respiratory coordination can strengthen perceived social connectedness during dyadic synchronization, and this affiliative effect is reflected in enhanced interbrain synchronization. Respiration may be a potential embodied mechanism that can link neural coupling and social bonding across individuals.

**Keywords:** Hyperscanning, EEG, Respiration, synchronization

## 21. Social presence shapes sensorimotor synchronization: a behavioral and fNIRS study of virtual-partner interaction

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Background and Objective. Sensorimotor synchronization (SMS) to auditory rhythms relies on coupling between auditory and motor brain areas. Advanced synchronization skills are thought to be in interpersonal interaction and to support social bonding. Yet, evidence of the beneficial effect of the social context on synchronization and rhythm learning is scarce. This study investigates how a virtual partner's social presence modulates audio-motor and socio-cognitive brain networks during synchronization to and learning of rhythmic sequences.

Methods. Seventy-eight (40 young adults, 18–35; 38 older adults, 65–85) drummed in synchronization with auditory rhythmic sequences across four conditions varying in socio-communicative interaction: interactive (facial features), intermediate (no face), non-interactive (virtual drumsticks), and auditory control (no partner). After the synchronization phase, participants had to repeat the sequence from memory. Cortical hemodynamics in motor (M1, SMA, PMd) and frontal (mPFC, rTPJ) regions are recorded using fNIRS (ΔHbO), alongside tapping asynchrony and variability and heart rate variability.

Hypotheses and preliminary analyses. We hypothesize that the social conditions (interactive and intermediate) will elicit reduced temporal variability in synchronization and in sequences repetitions, especially in the older adults sample. fNIRS data should reveal significantly increasing activation (ΔHbO) in both motor planning regions and frontal areas as the level of socio-communicative interaction increases. Data analyses are ongoing. Preliminary analyses of sample reveal that partner presence strongly reshaped that participants in the young adults sample synchronize less accurately in the auditory control condition.

Conclusion. This ongoing study addresses key questions on the behavioral and neurophysiological dynamics of interactive SMS by manipulating the degree of socio-communicative interaction. The findings may indicate how the social context enhances audio- motor coordination, offering insights for future rhythm-based motor rehabilitation strategies.

**Keywords:** sensorimotor synchronization, social cognition, fNIRS, motor control

## 22. Singing or Conversing About Songs? Supporting New Immigrants' Language Learning, Social Inclusion and Well-being: A Multisite Randomized Controlled Trial

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Limited proficiency in a host country's official language can hinder newcomers' integration and well-being. We compared group singing and song-listening-based conversation group - in which participants listened to and discussed songs - with a waitlist control, as approaches to support language learning, mood, and social inclusion.

Eighty-four newcomers in Montréal and Toronto were randomly assigned to choir (n = 33), conversation (n = 30), or waitlist (n = 21) groups for 10–12 weeks. Language outcomes were assessed pre- and post-intervention; mood and perceived social inclusion were assessed before and after sessions at the beginning, middle, and end of the study. Participants also indicated which activity they would choose to continue.

No site effects emerged. Choir and conversation participants reported increased confidence and perceived competence in speaking the target language; however, the magnitude of these changes did not differ significantly between groups. Both active groups showed significant immediate increases in positive mood and perceived social inclusion across all sessions. Inclusion gains were larger at the end than at baseline, whereas mood showed no longer-term change. Between-group differences remained limited, though. When asked which activity they would choose to continue after the intervention, 67.1% (47/70) selected choir, including 71.9% of choir, 59.3% of conversation, and 72.7% of waitlist participants.

Singing and conversing about songs in groups may both support newcomers' mood and social inclusion, with longer-term benefits for inclusion and a preference for singing across all groups. However, neither activity showed specific evidence of supporting language learning.

## 23. A Spatial Gradient in the Human Temporal Pole: Multisensory Overlap, Auditory Processing, and Clinical Validation

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Background. The human temporal pole contributes to sensory processing, music, language, and semantic cognition. However, whether these functions occupy separate anatomical regions or overlap within a continuous cortical organization remains uncertain. We investigated the distribution of the five senses

within the temporal pole, with special attention to auditory processing, music, and speech, and assessed its relationships with anatomical organization, functional connectivity, and neurodegeneration.

Methods. We analyzed 200 source-verified neuroimaging coordinates from 87 studies using study-balanced principal component analysis, spatial permutation tests, and robustness analyses. Sensory distributions were compared along the resulting spatial axis, including an expanded 86-study sensory sensitivity analysis. Exploratory comparisons examined auditory, musical, and speech/language findings. Independent anatomical parcellations, connectivity measures, and structural findings from semantic variant primary progressive aphasia (svPPA) were used for validation.

Results. A reproducible gradient extended from a superior-lateral anchor (C1) toward an inferior-medial anchor (C2), separated by 19.57 mm, with the first principal component explaining 55.97% of the study-balanced spatial variance (spatial-null $p = 0.0005$). Sensory modalities overlapped substantially; the expanded three-band sensory analysis did not support distinct spatial territories ($p = 0.3981$). Auditory studies tended toward C1, but their difference from other categories was not statistically significant ($p = 0.0636$). Music and speech/language subgroups showed nearly identical mean positions ($p = 0.995$). Independent functional connectivity showed stronger auditory/language coupling toward C1 and stronger default/semantic coupling toward C2. Disease-related coordinates from seven independent publications were on average 5.49 mm closer to C2 (two-sided $p = 0.0156$).

Conclusions. The temporal pole is best described as a graded, multimodal cortical field rather than a set of sharply separated sensory modules. Its continuous anatomy coexists with differentiated connectivity and greater svPPA-related vulnerability toward C2. A progressive relationship between sensory representations and semantic cognition is plausible but remains a hypothesis rather than a demonstrated causal sequence.

**Keywords:** temporal pole; sensory integration; auditory processing; music; language; semantic cognition; svPPA; neuroimaging meta-analysis

## 24. Understanding Misunderstanding: Empathy in Service of Democracy Under Pressure

**Laura Bonafini**; Élise Donner; Martin Kaloshi; Kaiya Schade; Giorigio Lazzari; Floris T. Van Vugt
*Université de Montréal*

A functioning democracy relies on dialogue between opposing perspectives on sensitive topics, like abortion or immigration. However, such dialogue often gives rise to ideological misunderstanding: the tendency to perceive others' positions as more extreme than they actually are. This phenomenon is generally explained by a lack of empathy, which comprises a cognitive component (understanding others' emotions) and an affective component (sharing others' emotions).

This study therefore examined how empathy relate to ideological misunderstanding during a polarised conversation. Forty-eight participants (24 dyads; aged 19–50, M = 28.9) completed questionnaires at home, including the Basic Empathy Scale in Adults (BES-A) and the Multifaceted Empathy Test (MET). They then discussed a polarised topic for twenty minutes. Before and after the discussion, they reported their own stance and emotions and estimated those of their interlocutor. Ideological misunderstanding was computed as the absolute difference between the inferred and actual stance of the other. Emotional misunderstanding was the mean absolute difference between inferred and actual emotions of the other. Dyadic affective contrast was the mean absolute difference between both participants' emotions.

Ideological misunderstanding was positively associated with both emotional misunderstanding ($r = .443$, $p < .01$) and dyadic affective contrast ($r = .522$, $p = .022$): the less participants understood or felt what the other felt, the more they misjudged the other's ideas. Trait empathy measures (BES-A; MET) were not significantly correlated with ideological misunderstanding. This suggests that empathy in a polarised context may depend more on momentary engagement than on a fixed disposition, a possibility that future work should test directly.

Such findings would open avenues for interventions that foster constructive dialogue at a time when democracy is under increasing pressure. Future analyses will also investigate physiological synchrony and affective sharing, in particular whether dyads with highly contrasting affective states show lower synchrony.

**Keywords:** political polarisation; ideological misunderstanding; empathy; emotional misunderstanding; affective contrast

## 25. Pressing Play: A Qualitative Perspective on Children's Understanding and Use of Music in Everyday Life

**Anne Cabildo**, Christina Vanden Bosch der Nederlanden
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Children encounter music across a variety of everyday contexts, where musical experiences may be initiated by caregivers, teachers, peers, or children themselves. Less is known about how children perceive their own role in these experiences, and whether this changes across development. We conducted semi-structured interviews with thirty children aged 5 to 9 to elicit first-person accounts of when, why, and how they engage with music.

Ongoing thematic analysis of these interviews reveals that children across ages describe music as serving multiple functions, including routine, emotion regulation, learning, enjoyment, and social connection. Preliminary findings also suggest age-related differences in children's musical agency. Younger children more often describe musical experiences initiated or shaped by external sources such as caregivers, teachers, or other family members, whereas older children provide more examples of choosing, initiating, and creating musical experiences themselves. These patterns raise the possibility that children's role in shaping their everyday musical experiences changes across childhood.

To complement children's first-person accounts, caregivers completed existing measures of children's musical engagement, reward, behaviour, home musical environment, and music-based mood regulation. Exploratory analyses will examine how these caregiver-reported dimensions relate to children's descriptions of their own musical experiences. Together, these perspectives may reveal not only what music is for across childhood, but how children perceive their own role within these experiences.

**Keywords:** qualitative methods, development, music

## 26. Similarities, differences and interactions between auditory and vibrotactile perception of timbre-related acoustic features

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This study examines how spectral and temporal acoustic features associated with timbre are perceived across auditory, vibrotactile, and combined auditory–vibrotactile stimulation, and whether musicianship influences unimodal and bimodal timbre perception abilities and its relationship to musical scene analysis.

Thirty non-musicians and fifteen musicians with normal hearing and screened to ensure clear perception of vibrotactile stimuli were included. Discrimination thresholds were measured for 3 spectral (number of harmonics, harmonic roll-off ratio, odd-to-even harmonic ratio) and 3 temporal (attack time, amplitude modulation depth, amplitude modulation frequency) acoustic correlates of timbre perception. Thresholds were estimated using an ABX paradigm with an adaptative staircase procedure. A subset of participants (n=34) also completed the Music-in-Noise Test (MINT). For both tasks, stimuli were presented in auditory, tactile, and auditory-vibrotactile conditions via earphones and the Multichannel Vibrotactile Gloves.

Participants could discriminate all timbre-related acoustic parameters using vibrotactile stimulations alone. Spectral features, however, yielded significantly poorer vibrotactile thresholds, whereas temporal features showed similar thresholds across both modalities and some evidences of multimodal integration. Musicians generally outperformed non-musicians, with the largest advantage in the auditory-vibrotactile condition, suggesting enhanced cross-modal integration. Finally, exploratory analyses showed that timbre perception abilities were associated with music-in-noise performance, notably in musician where MINT scores were partly mediated by their enhanced timbre perception.

Our findings support the idea that touch, like hearing, can convey a range of timbre-related acoustic cues. While temporal acoustic features can easily be conveyed through touch, spectral features may require signal processing to be efficiently rendered as vibrotactile signals in assistive or musical devices. Musicianship was linked to enhanced timbre perception abilities, which seem to translate into improved musical scene analysis, suggesting that training may enhance perceptual benefits of such devices.

**Keywords:** Timbre, psychoacoustics, vibrotactile, sensory substitution

## 27. Temporal Compensation Across (Some) Word Boundaries

**Raimundo Cox-Casals**, Paméla Trudeau-Fisette
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This study investigates how segmental reduction interacts with the temporal organization of speech in Chilean Spanish. We ask whether the reduction of domain-final /s/ is accompanied by compensatory changes to the duration of the segment at the left edge of the following domain, and whether these temporal adjustments depend on prosodic boundary strength. Using a linear mixed-effects model (N = 2963) fitted to spontaneous speech, we find that /s/ reduction is followed by significant lengthening of consonants at the beginning of the following domain, but not of vowels. This temporal adjustment is systematically conditioned by prosodic structure: consonant lengthening is robust across weaker boundaries (e.g. between phonological-words), but is greatly reduced or absent across stronger boundaries (e.g. between phonological-phrases). The absence of comparable vowel lengthening challenges a simple account in which the temporal material associated with the reduced final /s/ is freely redistributed across neighbouring segments. Instead, the asymmetric pattern suggests that residual

consonantal structure occupying the rhythmic slot constrains how temporal compensation is realized across prosodic boundaries. These findings highlight an interaction between segmental structure, prosodic organization, and speech timing, showing that temporal adjustments following lenition are sensitive to both segmental identity and to the hierarchical organization of speech. More broadly, we provide evidence that the temporal realization of spoken language emerges from the mapping between speech sounds and prosodic rhythm.

**Keywords:** Speech timing, prosody, compensatory lengthening, Chilean Spanish.

## 28. A choir who stutters – Group singing and its effects in adults who stutter

**Catherine Des Rosiers**, Geneviève Lamoureux, Simone Falk
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Several studies have shown that group singing can improve mood, self-esteem, and social cohesion. These effects have primarily been documented in patients with conditions such as aphasia or Parkinson's disease, while much less is known about neurodevelopmental communication disorders such as stuttering. Stuttering, which affects approximately 1% of the population, is a rare speech motor disorder characterized by repetitions, blocks, or prolongations of sounds during speech. These disruptions of speech called disfluencies, impact communication and cause anxiety, social isolation, and significant stigma. However, an intriguing phenomenon has long been observed: when people who stutter sing, their speech disfluencies almost completely disappear. Given this effect on speech, combined with the psychosocial challenges associated with stuttering, group singing appears particularly relevant to investigate among individuals who stutter. This project therefore examines the feasibility of a 10-week choir for people who stutter and its potential effects on well-being, internalized stigma, and the psychosocial experience of stuttering. Twenty adults who stutter separated in two groups (Montreal and Toronto) participated in weekly choirs and were assessed in comparison with two control groups (passive and active totaling 28 participants) before and after a 10-week period. Measures included a questionnaire assessing the impact of stuttering (the OASES), a self-stigma scale, and an objective measure of speech disfluencies (the SSI). Results show heightened compliance in choir groups compared to the active control condition (dance). Analyses being underway, our current results nonetheless also show that self-stigma partially decreases to a significant extent in at least one choir group. Overall, this study gives promising insights into how group singing might reduce social barriers and enhance well-being of groups with a communication handicap.

**Keywords:** stuttering; group singing; stigma; wellbeing

## 29. Temporal Theta Oscillations Encode Precision-Weighted Prediction Errors in Music Listening

**Rebecca Divarco**, Leyre Calvar Martinez, Laura Muntaner Marce, Zuzanna Kietlinska, Giulia Loriga, Josep Marco Pallarés, Ernest Mas Herrero
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Music is a powerful source of pleasure, yet the neural mechanisms linking musical structure, prediction, and reward remain poorly understood. Musical pleasure has been theorized to be driven in part by the intrinsic reward associated with learning of and predicting the statistical structure of music. Although musical surprise engages fronto-temporal networks involved in auditory prediction and cognition, and

musical reward recruits striatal circuits, theta oscillations (4–8 Hz) may provide a mechanism linking predictive processing to the experience of musical pleasure. Here, we investigated whether theta oscillations reflect predictive processing, musical reward, or both. Seventy healthy adults (M_age = 22.6 years) underwent EEG recording (63 channels) while completing the MUSICOS task, in which they made preferential choices between pairs of monophonic melodies. The melodies varied in musical predictability, such as Information Content (IC), and Entropy, and were quantified using the Information Dynamics of Music (IDyOM) model. Fourier analysis was conducted to examine theta-band activity as a function of IC and Entropy. Consistent with previous findings, participants exhibited a Wundt effect, with preferences shifting toward more or less surprising melodies depending on the entropy level. Theta power increased with IC across temporal and fronto-central electrodes, consistent with the involvement of theta oscillations in musical prediction error processing. Theta power was additionally reduced under high-entropy conditions, suggesting that theta oscillations encode precision-weighted prediction errors. Frequency-resolved analyses further revealed distinct effects within the theta range: lower theta (4 Hz) showed non-linear, inverted-U effects consistent with optimal learnability, whereas upper theta (8 Hz) showed more monotonic effects consistent with precision-weighted prediction error processing. Together, these findings suggest that theta oscillations primarily reflect predictive processing rather than musical reward and may index distinct computational stages through which the statistical structure of music shapes musical experience.

**Keywords:** Musical prediction; Theta oscillations; EEG; Reward processing

## 30. Disentangling Cognitive Contributions to Musical Learning: Working Memory and Strategy Matter

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*Concordia University*

Learning to play music requires integrating representations of sound and movement, which may vary across individuals depending on their learning approach. Previous work from our lab has demonstrated that working memory supports musical training; however, the specific individual factors that contribute to performance remain unclear. Here, non-musicians were trained to reproduce melodies on a mapping organized along a consistent left-to-right increasing pitch pattern, designed to promote awareness of the instrument's structure. Following learning, participants were trained on a second mapping that was either similar (inverted) or dissimilar (random) relative to the original configuration. To examine the contribution of cognitive strategies, participants completed a questionnaire measuring awareness of sound–movement mappings, as well as auditory working memory subtests from the Wechsler Adult Intelligence Scale-IV. Using a random forest regression approach, we found that while auditory working memory predicted learning performance, the strongest contributor was participants' level of awareness of key mappings. Performance on the second mapping was overall poorer than initial learning. However, performance was better in the inverse compared to random conditions, indicating a possible transfer across comparable mappings. Altogether, musical learning is enhanced when individuals are aware of an instrument's underlying structure, supporting a more organized approach in skill acquisition. More broadly, this appears to contribute to differences in learning outcomes, highlighting the importance of cognitive strategies in shaping performance.

**Keywords:** Auditory Motor Integration; Working Memory; Learning

## 31. Individual Spontaneous Production Rates Influence Temporal Synchronization in Quartets

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Motivation: Precise group coordination of tempos is critical for ensemble music performance. The current study investigates how individual spontaneous production rates affect temporal synchronization in groups.

Methods: Thirty-two adult participants with musical training (mean = 10 years) were assigned to one of 8 drum quartets. On Day 1, participants completed a solo task in which they performed a familiar melody at a comfortable, consistent rate; their spontaneous production rates (SPR) were computed as the mean interonset interval. On Day 2, participants completed the quartet drumming task. Participants were instructed to play binary or ternary rhythms in a simple rhythm condition in which all players drummed at the same time. In a synchronization-continuation task, a metronome sounded the downbeats of each measure at the beginning of each trial; participants were instructed to continue playing their parts after the metronome ended. In each trial, perturbation cues signaled the participants to switch between rhythms (e.g., from binary to ternary). Participants performed additional rhythmic tasks as well.

Results: Analyses focused on the relationship of the individual SPR values to group performance in the simple rhythms. Switching times between rhythms were defined as the time from perturbation cue to the first downbeat in which two of the four drummers reached stability (coefficients of variation < 10% of interonset intervals). First, the individual SPRs differed significantly across individuals but were consistent within individuals. Second, the SPR values of quartet members were correlated with their switching time from binary to ternary rhythms. Third, individual SPR values were negatively correlated with their group synchronization of binary rhythms: individuals with faster SPRs than the prescribed quartet rate tended to speed more (negative relative phase) during quartet synchronization.

Implications: These findings suggest that individual differences in performance rate impact both time for quartets to reach stability and their synchronization measures.

**Keywords:** spontaneous production rate, group synchrony, rhythm production

## 32. Differential Integration of Factual, Counterfactual, and Possible Information in Discourse Processing

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Language describes facts (“Mike grabbed the knife”), open possibilities (“maybe Mike grabbed the knife”), and counterfactual possibilities (“if only Mike had grabbed the knife”). Factual statements linking “knife” to “Mike” elicit neural responses reflecting discourse model updating and increase accessibility of associated versus dislocated objects (faster probe-recognition). However, counterfactuals appear to block updating, and both counterfactual and open possibilities have been shown to lack electrophysiological signatures of updating. We investigate how these possibilities are integrated into discourse representations and maintained in short-term memory. Forty participants completed a probe-recognition task while reading six murder mysteries in French, with reaction times (RTs) and ERPs recorded. Key sentences combined utterance type (FACTUAL, COUNTERFACTUAL, and POSSIBLE) with object status

(ASSOCIATED, e.g., “took”, or DISLOCATED, e.g., “dropped”). Target sentences appeared in six timed chunks (e.g., It was | a bottle | of wine | and Mr. Green | maybe grabbed it [target window] | from the counter), between a context and a continuation sentence. After each block, participants indicated whether a probe word (e.g., “bottle”) had appeared. RTs were analyzed using linear mixed-effects models, and ERPs using cluster-based permutation tests. RTs for associated probes tended to be shorter than for dislocated ones in factuals, with the same but significant pattern in open possibilities. Counterfactuals showed a significant reversed pattern. Probe-elicited ERPs showed neither the classic N400 nor P600 effect, but a frontal negativity for open possibilities (300–800 ms). During reading comprehension, ERPs time-locked to target window onset revealed a late frontal positivity for dislocation versus association in factuals and open possibilities, significant only for the latter. This positivity may reflect lower predictability. No similar effect emerged for counterfactuals. These findings suggest the discourse model is updated in open possibilities as in factuals, whereas in counterfactuals, implied rather than hypothetical content may be integrated later.

**Keywords:** Discourse model updating; Probe recognition; Event-related potentials (ERPs); Open possibility; Counterfactuality

## 33. Perceptual Lateralization of Speech and Music Delivered via Vibrotactile Input to the Hands

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We know speech and music perception are lateralized in the auditory cortices. Furthermore, recent studies show that vibrotactile information may provide supplementary information to support speech and music perception. Here, we asked if perception of musical or speech information presented via vibrotactile cues is also lateralized, similarly to auditory perception. We explored audiotactile lateralization by using vibrotactile gloves which can convert complex acoustic signals into tonotopically organized vibrotactile stimulation delivered to the fingers.

Using Signal-in-Noise tasks, we tested whether the perceptual benefit of vibrotactile input, delivered through the multichannel vibrotactile glove, differs between the left and right hands. The participants were 33 healthy young right-handed people with some musical experience. They were exposed to lateralized (either right hand or left) stimulation from the gloves and equivalent binaural auditory stimulation. There were 2 Signal-to-Noise Ratios (-3 and -6 dB) and 3 types of Signal-in-Noise Tasks: pitch, rhythm, and speech. On each trial the signal was embedded in a noise masker consisting of multiple voices or instruments, then repeated one time without noise, and participants were asked to identify if the repetition was the exact same or different. It could differ by the pitch/duration of one note in a short melody for the music tasks, or by one word in the sentence for the speech task.

A Repeated-Measure ANOVA showed an interaction between Hand and Task ($p=0.016$). Post-hoc t-tests indicated the lateralization was significant only for the Pitch Task in which the left hand performed significantly better than the right. These results suggest that the left hand may benefit from its more direct connectivity to the right hemisphere for a melodic task. Overall, this research will permit us to better understand how audio-tactile integration could be used to improve quality of life for people with hearing loss.

**Keywords:** Lateralization, Audiotactile Integration, Vibrotactile, Spectrotemporal

## 34. Prediction as the bridge between rhythm and language skills: rhythm reproduction skills predict better neural tracking of entropy

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Long-standing research has shown that musical training, and rhythmic training specifically, correlate with enhanced language skills; both in healthy population and individuals with language impairments (e.g.: Specific Language Impairment or Dyslexia). Multiple theories regarding this phenomenon suggest that musical training affords more precise auditory processing, enhanced entrainment of neural oscillations to external rhythmic stimuli and increased sensorimotor coupling. These factors in turn are suggested to improve language skills through improved acoustic processing and prediction of speech. In the present study, we seek to find the neural basis of the putative improved prediction by exploring whether individual differences in rhythmic skills influence neural responses to predictability in naturalistic listening of speech. We analyzed a subset of the OMMABA dataset, where healthy participants (currently 24 of 74 total) performed behavioral rhythm and timing tasks, and completed a 7T fMRI session while listening to a 10-minute narrated story. Continuous predictability measures (surprise, entropy, Bayesian surprise and entropy reduction) were calculated from the text of the story using large language models. Then, brain areas tracking the predictability measures were found. Finally, we assessed the effect of variability in rhythmic skills (rhythmic discrimination and reproduction) on the strength of the relationship. Measures of auditory working memory, general music training, English understanding and attention to the heard story were used as control variables. Results showed that higher rhythm reproduction skills predicted higher neural tracking of entropy, independently of the control variables, mainly in auditory and speech perception areas bilaterally (Temporal Pole, Heschl's Gyrus, STG and Planum Temporale). The specific effect of rhythm reproduction skills and the location on auditory cortex points towards auditory processing and sensorimotor coupling as the mechanisms driving improved prediction. Future steps will validate the relevant areas with a separate open fMRI dataset and re-evaluate the results with the complete set of participants.

**Keywords:** rhythm skills, language skills, prediction, fmri

## 35. Who Leads and Who Adapts? Investigating the Interplay Between Behavioral and Perceptual Synchronization in Dyadic Performance

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Music performance in duos involves information exchange between partners that mirrors social interactions: an individual's behavior can influence both their own perception and behavior and those of their partner. We propose adapting the Actor-Partner Interdependence Model (APIM; Kenny et al., 2006) to investigate the interplay between behavior and a latent perceptual construct of synchronization in dyadic performance.

Dyads of unacquainted participants with varying levels of musical experience (N = 17 dyads; 70.8% non-musicians) performed a duet consisting of melody and harmony. Participants independently triggered each successive tone by repeatedly pressing the same piano key. To create distinguishable dyads, they were randomly assigned to the melody or harmony role and performed a stimulus piece incorporating tempo changes at predictable points. We collected behavioral measures of IOI, signed asynchronies, and

IOI variability (RMSSD), as well as questionnaire measures of participants' perceptions of synchronization. The interplay between behavior and perception was assessed using an APIM within a structural equation modeling (SEM) framework.

While individual variability in melody and harmony performance was correlated, participants' perceptions of synchronization were not correlated. Furthermore, although melody players tended to perceive themselves as the leader, their behavioral variability did not predict either their own or their partner's perception of synchronization. In contrast, harmony players showed positive actor and partner effects, such that greater behavioral variability was associated with perceptions of better synchronization by both performers.

The APIM approach enabled us to investigate role-based asymmetries consistent with an emergent leadership effect. Although melody players tended to perceive themselves as leading, harmony players showed greater behavioral adaptation associated with both their own and their partner's perception of synchronization. This asymmetry may reflect distinct coordination demands imposed by musical roles. APIM approaches provide a useful way to unpack dyadic interactions in music performance.

**Keywords:** Dyadic Synchronization; Leadership; Actor-Partner Interdependence Model (APIM)

## 36. Effet d'amplification émotionnelle dans la perception de groupes de visages : Effet d'une présentation multimodale

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Dans l'environnement social, les individus perçoivent plus d'informations qu'ils ne peuvent en traiter. Le codage d'ensemble permet une représentation globale du contexte émotionnel perçu, comme dans une foule. Ce mécanisme peut toutefois être biaisé par une attention accrue aux visages exprimant des émotions négatives ou par un nombre élevé de visages, entraînant une surestimation de l'émotion moyenne du groupe, soit l'effet d'amplification. Cet effet a toutefois été étudié presque exclusivement en contexte visuel. Or, dans la vie quotidienne, la perception s'appuie aussi sur des indices auditifs (rires, cris) qui contribuent à l'interprétation émotionnelle d'une scène sociale.

Ce projet examine si la présence d'un son de foule module cet effet d'amplification, selon la taille du groupe et la proportion de visages émotionnels.

Quarante-huit participants (19 à 35 ans) ont estimé la proportion de visages émotionnels (joie ou colère) dans des groupes de 4, 8 ou 16 visages, contenant 25, 50 ou 75 % de visages émotionnels, avec ou sans son de foule. Une ANOVA à mesures répétées révèle des effets principaux significatifs du son, $F(1, 43) = 9{,}28$, $p = 0{,}004$, de l'émotion, $F(1, 43) = 157{,}98$, $p < 0{,}001$, et de la proportion, $F(1{,}15, 49{,}39) = 48{,}07$, $p < 0{,}001$, mais aucun effet principal de la taille du groupe, $p = 0{,}185$. Contrairement à l'hypothèse d'une amplification multimodale, le son réduisait la surestimation plutôt que de l'accroître ; cet effet était marqué pour la colère (notamment dans les groupes moyens et grands, et à faible proportion émotionnelle), mais restreint à une condition spécifique pour la joie (faible proportion, grand groupe).

Ces résultats ne confirment pas l'amplification multimodale attendue, mais suggèrent plutôt un effet régulateur du son, particulièrement marqué pour les stimuli négatifs. Le mécanisme sous-jacent reste à préciser.

**Keywords:** Émotion, perception, visage, cognition, groupes, multisensorialité

## 37. Understanding Music Listening in Later Life: Changes in Habits and Predictors of Perceived Effects During the Pandemic

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The mental health and well-being of the elderly have been a growing concern in recent years, which has been further exacerbated by the COVID-19 pandemic. The main objective of this study is to describe and examine the role of music listening during the COVID-19 pandemic. More specifically, the study aims to 1) characterize music-listening habits and 2) investigate the extent to which individual characteristics (gender, level of symptoms of anxiety and depression, and COVID-19-related stress) and music listening parameters (daily listening duration, emotional valence, and level of activation) can predict the perceived effects of listening to music in various domains of psychological health (emotional, cognitive and social). The sample selected for this study comprised a total of 239 participants aged 60 and over in Quebec. The respondents provided sociodemographic and COVID-19-related information, as well as data on their music listening habits and the perceived effects of music on psychological health. They also completed standardized questionnaires measuring symptoms of anxiety and depression. Descriptive analyses characterized music listening habits, and paired Wilcoxon signed-rank tests compared listening before and during the pandemic among participants reporting a change. The analyses revealed that, overall, music habits remained stable during the pandemic; however, when a change was observed, it was mainly an increase in listening. Results also showed that musical characteristics were predictive of the perceived effects of listening to music, whereas individual characteristics do not, or very rarely, contribute significantly to the regression model. These findings suggest that everyday music listening may represent a simple, accessible, and low-cost approach to supporting the psychological well-being of older adults. Future research should examine whether personalized music-based interventions can translate these benefits into structured clinical programs.

**Keywords:** music, music listening COVID-19, elders, mental health

## 38. MEG Evoked Power in Theta and Beta Frequency Band in Auditory Cortex Decodes Musical Perception and Imagery

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Imagery evokes perceptual-like experiences in the brain and mimics some of the neural activity of perception, resulting in shared neural activity of perception and imagery. This shared activity has been established in musical imagery studies, particularly highlighting the role of the secondary auditory cortex. In our prior EEG study, the evoked power— reflecting phase-locked activity in the brain corresponding to the event— in the theta and beta bands from temporal-lobe channels successfully decoded individual musical pitches during an imagined melody in musicians. The current study uses MEG and 3T anatomical MRI to localize the neural sources of the evoked power that contain decodable musical pitch imagery information using a dynamic Statistical Parametric Mapping method. 15 musicians were scanned with

MEG while they performed a task in which they listened to the first part of a melody, imagined its continuation, and determined if a final test tone matched the actual continuation note of the melody. Decoding analysis using a support vector machine approach was performed to classify each of seven diatonic imagined tones based on evoked spectral power in the theta and beta frequency bands from the auditory cortex. Preliminary decoding results show successful classification accuracy for imagined tones, significantly higher than the prior EEG study (average ~10% above chance). A similar trend was observed when this decoding algorithm was applied to the perceived tones. These findings emphasize the significance of phase-locked neural activity specifically in the auditory cortex, advancing our understanding of the neural basis of musical imagery.

**Keywords:** Musical Imagery, Musical Pitch, Decoding, Internal Representation, Magnetoencephalography