The biennial meeting of the
Society for Music Perception and Cognition

SMPC | 2024

CONFERENCE PROGRAM

Banff Centre for Arts and Creativity
Banff, Alberta, Canada
July 25 -27, 2024

Contents

About

Welcome to the Biennial Conference of the Society for Music Perception and Cognition!

The Society for Music Perception and Cognition is a not-for-profit organization for researchers and others interested in music perception and cognition. The objectives of SMPC are (1) to further the scientific and scholarly understanding of music from a broad range of disciplines, including music theory, psychology, psychophysics, linguistics, neurology, neurophysiology, ethology, ethnomusicology, artificial intelligence, computer technology, physics and engineering; (2) to facilitate cooperation among scholars and scientists who are engaged in research in this interdisciplinary field; and (3) to advance education and public understanding of knowledge gained.

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Meeting Code of Conduct

The Society for Music Perception and Cognition is dedicated to providing a harassment-free conference experience for everyone regardless of gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, age or religion. We do not tolerate harassment of conference participants in any form. Sexual language and imagery is not appropriate for any conference venue, including talks. Conference participants violating these rules may be sanctioned or expelled from the conference at the discretion of the conference organizers.

Harassment includes, but is not limited to:

- Verbal comments that reinforce social structures of domination (related to gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, age, or religion)
- Sexual images in public spaces
- Deliberate intimidation, stalking, or following
- Harassing photography or recording
- Sustained disruption of talks or other events
- Inappropriate physical contact
- Unwelcome sexual attention
- Advocating for, or encouraging, any of the above behavior

Enforcement

Participants asked to stop any harassing behavior are expected to comply immediately. If a participant engages in harassing behavior, event organizers retain the right to take any actions to keep the event a welcoming environment for all participants. This includes warning the offender or expulsion from the conference. Event organizers may take action to redress anything designed to, or with the clear impact of, disrupting the event or making the environment hostile for any participants. We expect participants to follow these rules at all event venues and event-related social activities. We think people should follow these rules outside event activities too!

Reporting

If someone makes you or anyone else feel unsafe or unwelcome, please report it as soon as possible. Harassment and other code of conduct violations reduce the value of the SMPC meeting for everyone. You can make a report either personally or anonymously.

Anonymously You can make an anonymous report by filling out the form provided on the SMPC Website. We can't follow up an anonymous report with you directly, but we will fully investigate it and take whatever action is necessary to prevent a recurrence.

Personally You can make a personal report by emailing any of the SMPC Board members or by emailing our Anti-Racism and Equity Committee <equity@musicperception.org>

When taking a personal report, we'll ask you to tell us about what happened. This can be upsetting, but you won't be asked to confront anyone and we won't tell anyone who you are. SMPC leaders will be happy to help you contact hotel/venue security, local law enforcement, local support services, provide escorts, or otherwise assist you to feel safe for the duration of the event. We value your attendance.

Expected and Encouraged Behavior

In addition to our policies outlined above regarding harassment and other unacceptable behavior, we have adopted the following guidelines of expected and encouraged behavior:

1. Exercise respect and consideration in your speech and behavior.

2. When offering criticism, comment on ideas and content, not individuals.

3. Share the space. Watch how long you have been speaking and give lesser heard voices a chance to speak.

4. Think before you speak. Are you adding depth and direction to the conversation? Or are you derailing the conversation or just repeating what someone already said?

5. Be an ally. If someone who shares your privileges is exerting them over someone who doesn't, intervene and call them in to consider their behavior.

6. Be mindful of context and the highly variable backgrounds and experiences of your fellow participants. Don't assume that everyone has the same experiences as you.

Overview of Schedule

Society for Music Perception and Cognition 2024
Schedule Overview

Thursday, July 25

		Track 1 - KC 101	Track 2 - KC 105	Track 3 - KC 201	Track 4 - KC 205
7:30	Breakfast	Breakfast, Vistas Dining Room			
9:30	Talks	Audiovisual Processing	Harmony/Tonality	Memory I	Synchrony I
10:10	Break	Coffee Break			
10:30	Talks	Crossmodal Correspondence	AI	Memory II	Synchrony II
11:45	Lunch	Lunch, Vistas Dining Room + welcome tables for new SMPC members			
1:15	Talks	Movement	Timbre Semantics	SingWell	Reward I
2:15	Symposia		Research Grants Symposium		The Musicultural Brain
3:15	Break	Coffee Break			
3:45	Talks	Cognition I	Psychoacoustics	Clinical I	Social
4:45	Talks	Language I	Consonance	Clinical II	Rhythm
6:30					
7:00	Reception	Welcome Reception & Opening Remarks			

Friday, July 26

		Track 1 - KC 101	Track 2 - KC 105	Track 3 - KC 201	Track 4 - KC 205
7:30	Breakfast	Breakfast, Vistas Dining Room			
9:30	Talks	Entrainment	Timbre/Pitch Perception	Development I	Reward II
10:10	Break	Coffee Break			
10:30	Symposia	Dynamical Systems	Teaching Music Cognition	Data Gathering with Special Populations	Sound Health Network
11:45	Lunch	Lunch, Vistas Dining Room + Mentor-Mentee Lunches			
1:15	Panel	Anti-Racism and Equity Panel Max Bell Building			
2:15		*walk back from Max Bell Building*			
2:30	Talks	Perception	Absolute Pitch	Behaviour	Emotion
3:30	Posters	Poster Session I, KC 203 *with coffee service*			
4:45	Talks	Language II	Perspectives	Cognition II	Pleasure
7:00	Banquet	Banquet			

Saturday, July 27

		Track 1 - KC 101	Track 2 - KC 105	Track 3 - KC 201	Track 4 - KC 205
7:30	Breakfast	Breakfast, Vistas Dining Room			
9:30	Talks	Grouping	Methods and Tools	Expectation	Development II
10:10	Break	Coffee Break			
10:30	Symposia	Rhythm, Language, Reading	Corpus Studies	Neuroplasticity in Aging	Trainee Town Hall
11:45	Lunch	Lunch, Vistas Dining Room Forum for Trainees, KC 205 Forum for Junior Faculty, KC 201			
1:15	Meeting	Presidental Address, Awards, and Business Meeting Max Bell Building			
2:15	Keynote	Keynote: Mike Schutz, McMaster University Max Bell Building			
3:15		*walk back from Max Bell Building*			
3:30	Posters	Poster Session II, KC 203 *with coffee service*			
4:45	Talks		LiveLab	Learning and Memory	Cross-cultural

Timetable

Abstracts and author information can be found for each presentation at the end of this program. Abstract numbers are printed in [brackets] at the end of each title. Clicking the abstract number will take you to the page of the program where the abstract is printed.

Thursday, July 25th

07:30–09:30	**Breakfast** *Vistas Dining Room*	
09:30-10:30	**Audiovisual Processing** KC 101	*Music Consciousness and Emotional Responses to Rachmaninoff Preludes Op. 32 in Audio and Mixed Reality: New Forms of Multimedia for Classical Music [T-A1-1]* *A Schematic Model of Threat Scenes in Horror Films [T-A1-2]*
09:30-10:30	**Harmony/Tonality** KC 105	*The Role of Style in Perception of Emotion in Musical Harmony [T-A2-1]* *Measuring the Uncanny: Chromatic-Mediant Motion in Elliott Smith's XO [T-A2-2]* *Exploring the Influence of Pitch Movement on Perceived Tonal Relations [T-A2-3]*
09:30-10:30	**Memory I** KC 201	*Can Consolidation be Enhanced by Listening Before Sleeping? [T-A3-1]* *Melody Memorability: Pattern Recognition in Auditory Pitch Sequences [T-A3-2]* *Emotional Music Modulates Episodic Memory During Recollection and Induces False Traces [T-A3-3]*

09:30-10:30	**Synchrony I** KC 205	*Examining Brain Hemodynamic Responses in Piano Duo Performance Across Distinct Contexts Using Functional Near-Infrared Spectroscopy [T-A4-1]* *From Shared Control to "Acting As One": Investigating the Sense of Joint Agency in Group Music-Making [T-A4-2]* *Synchronizing Beyond One's Preferred Motor Rate Evokes Greater Pupil Sizes [T-A4-3]*
10:30–10:45	**Coffee Break**	
10:45-11:45	**Crossmodal Correspondence** KC 101	*Cross-Modal Commonalities in Evaluative Responses to Musical and Visual Complexity [T-B1-1]* *Exploring Crossmodal Associations of Sun and Moon Themes in Art and Music [T-B1-2]* *Cross-Modal Correspondences Between Harmonic Intervals and Tactile Roughness [T-B1-3]*
10:45-11:45	**Artificial Intelligence** KC 105	*Musicological Interpretability in Generative Transformers [T-B2-1]* *Humans Perceive AI-Generated Music as Less Expressive than Comparable Human-Made Content [T-B2-2]* *Exploring Style Similarity Perception in AI-Generated Music: A Disguised Turing Test [T-B2-3]*
10:45-11:45	**Memory II** KC 201	*Shared Content in Music-Evoked Autobiographical Memories [T-B3-1]* *Beyond Familiarity: Neuroelectric Correlates of Autobiographically Salient Music [T-B3-2]* *Age-Related Changes in Neural Activation Associated with Semantic Details of Music-Evoked Autobiographical Memories [T-B3-3]*

10:45-11:45	**Synchrony II** KC 205	*Rhythms of Identity: Synchrony, Gestures, and Rock Music Fandom Perception [T-B4-1]* *Listener-Performer Emotional Synchrony in Musical Expression [T-B4-2]* *Information Flow in Sound as Ensemble Musicians Learn to Coordinate Musical Expression [T-B4-3]*
11:45–13:15	**Lunch** *Vistas Dining Room*	
13:15-14:15	**Movement** KC 101	*Comparing Dance and Aerobic Exercise With and Without Music on Cognitive Function in Older Adults with Mild Cognitive Impairment [T-C1-1]* *Dance Begins Early in Infancy, Even in a Representative Sample of U.S. Infants [T-C1-2]* *Entrainment to Audiomotor Feedback: Preliminary Evidence and Model [T-C1-3]*
13:15-14:15	**Timbre Semantics** KC 105	*Timbre Semantics of the Singing Voice [T-C2-1]* *A Cross-Cultural Comparison of the Timbre-Semantic Space of Chinese Instrumental Sounds [T-C2-2]* *What Makes My Synthesizer Sound Sparkly? Inventory of Timbral Associations [T-C2-3]*
13:15-14:15	**Reward I** KC 205	*'Groove and Grit': Relationships Between Musical Reward, Resilience, and Personality [T-C4-1]* *The Relationship Between Pupil Reward Response and Melody Predictability in Piano Learning [T-C4-2]* *Rewarding Music Enhances Memory for Posteriorly Encoded Information [T-C4-3]*

14:15-15:15	**Symposium I** KC 105	**Research Grants Pilot Retrospective** [S-A2] ***Presentations**: A. Rossi, S. Nyatsanga; J. Marchand Knight* ***Panel**: A. Schachner, R. Slevc, D. Vuvan*
13:15-15:15	**Symposium II** KC 201	**The SingWell Project: An Update on Insights from Studies on Benefits of Group Singing for Communication and Wellbeing** [S-A3] ***Contributors**: F. Russo, A. Good, A. Pachete, C. des Rosiers, G. Perry, W.F. Thompson, T. Raessi, D. Merrett, C.Y. Lo, B. Zendel*
14:15-15:15	**Symposium III** KC 205	**The Musicultural Brain: A Multidisciplinary Approach to Understanding the Nature of Music and Musicality** [S-A4] ***Contributors**: M. Lumaca, A. Ravignani, T. Popescu, J. Hyland Bruno*
15:15–15:45	**Coffee Break**	
15:45-16:45	**Cognition I** KC 101	*Geometric Relationships Across Notes Constitute a Primitive in Melodic Processing [T-D1-1]* *Listeners' Abstraction of Melodic Prototypes [T-D1-2]* *Room Acoustic Information Enhances Auditory Spatial Attention as Reflected by Alpha Oscillations [T-D1-3]*
15:45-16:45	**Psychoacoustics** KC 105	*Musical Microrhythm: Context Effects of Envelope Shape [T-D2-1]* *Equating Perceived Duration Between Flat and Percussive Tones Through an Adaptive Staircase [T-D2-2]* *Better Alarms Through Musical Insight: More Detectable, Less Annoying [T-D2-3]*

15:45-16:45	**Clinical I** KC 201	*Is Music Sophistication Associated with Memory Preservation in Healthy Older Adults? [T-D3-1]* *Investigating the Ingredients of Importance to Melodic Intonation Therapy: Cue Types and Beat Perception Ability [T-D3-2]* *Following the Sound of Music: Comparing the Effects of Music vs. Non-Music Based Interventions on Auditory and Cognitive Processing in Older Adults [T-D3-3]*
15:45-16:45	**Social** KC 205	*Intermodal Analysis of Emotion Inference: Examining Shared Processes in Music and Social Contexts [T-D4-1]* *Music Behind Bars: Learning About the Musicality of a Person Experiencing Incarceration Reduces Negative Social Attitudes Towards Them [T-D4-2]* *The Social Origins of Voluntary Pitch Control: An Experimental Study of Dogs Howling to Music [T-D4-3]*
16:45-17:45	**Language I** KC 101	*Melody and Lyrics Contribute to Song Recognition Among Infants [T-E1-1]* *The Predictive Role of Infants' Home Music Environment on Their Vocabulary Development [T-E1-2]* *Musical Expertise Affects the Rhythmic Perception of Sung but Not Spoken Speech Syllables [T-E1-3]*
16:45-17:45	**Consonance** KC 105	*Interactive Effects of Presentation Mode and Pitch Register on Simultaneous Consonance [T-E2-1]* *Enharmonically Equivalent Spelling Distinctions Influence Perceived Consonance [T-E2-2]* *The Influence of Sonority Dissonance and Rhythmic Complexity on Listeners' Perceived Emotions [T-E2-3]*

16:45-17:45	**Clinical II** KC 201	*Can Children with Developmental Coordination Disorder Step-Clap to the Beat? An Online Motion Tracking Study [T-E3-1]* --- *Music Engagement, Cognitive Resilience and Pathways to Optimal Aging. [T-E3-2]* --- *Synchronization of Eye-Looking to Song in Autism Linked to Individual Differences in Rhythmic Music Engagement, Parent-Child Musical Interactions [T-E3-3]*
16:45-17:45	**Rhythm** KC 205	*The Effect of Groovy Music on Multi-Limb Drum Set Performance Accuracy [T-E4-1]* --- *The Rhythm of Connection: Interpersonal Synchrony Cultivates Belonging Across Group Boundaries [T-E4-2]* --- *A Look at Rhythm as an Attention Regulator in the Visual System [T-E4-3]*
19:00–20:00	**Welcome Reception and Opening Remarks** KC 103 and Patio	

Friday, July 26th

07:30–09:30	**Breakfast** *Vistas Dining Room*	
09:30-10:30	**Entrainment** KC 101	*Predispositions Towards Integer Ratios in Rhythm Reproduction Are Predicted by Neural Oscillation and Hebbian Learning [T-F1-1]* *The Effect of Syncopation on Affect and Motor Response During Rhythm Tapping [T-F1-2]* *An Entrainment Oscillator Mechanism underlies Human Beat Matching Performance [T-F1-3]*
09:30-10:30	**Timbre/Pitch Perception** KC 105	*Perceptual Hysteresis of Pairwise Dissimilarity Judgments of Simplified Musical Instrument Sounds for MDS Timbre Studies [T-F2-1]* *On Intentionality of Single Sounds: A New Direction for Predictive Coding of Music [T-F2-2]* *In Search of an Optimal Sound Level for Pitch and Timbre Discrimination [T-F2-3]*
09:30-10:30	**Development I** KC 201	*The Development of Auditory Affective Experiences and Its Relationship to Musical and Communicative Skills [T-F3-1]* *Neuropsychological and White Matter Effects of Musical Training in Childhood [T-F3-2]* *Pitch and Loudness Influence Children's Gendered Judgments About Musical Instruments [T-F3-3]*
09:30-10:30	**Reward II** KC 205	*Musical Reward in Young Children [T-F4-1]* *Predictive Coding in Musical Anhedonia: A Study of Groove [T-F4-2]* *Musical Reward and Anhedonia in Mood Disorders [T-F4-3]*

10:30–10:45	**Coffee Break**	
10:45-11:45	**Symposium IV** KC 101	**Dynamical Systems in Music Research: Current Debates and Future Perspectives** [S-B1] ***Contributors**: E. Large, J.C. Kim, C. Palmer, A.P. Demos, B. Van Kerrebroeck, J. Cannon*
10:45-11:45	**Symposium V** KC 103	**Teaching Music Perception and Cognition: Workshop on Classroom Activities, Learning Outcomes, and Authentic Assessments** [S-B2] ***Contributors**: W.F. Thompson, S.-L. Tan, P.Q. Pfordresher, E.H. Margulis, F.A. Russo, A.D. Patel*
10:45-11:45	**Symposium VI** KC 105	**Behavioral Data-Gathering with Special Populations Inside and Outside of Clinical Settings** [S-B3] ***Contributors**: P.A. Martens, A. Belfi, J.A. Bugos, P. Loui*
10:45-11:45	**Symposium VII** KC 202	**Sound Health Network: Building a Music and Health Research Ecosystem** [S-B4] ***Contributors**: J.K. Johnson*
11:45–13:15	**Lunch** + Mentor Mentee Meetups *Vistas Dining Room*	
13:15-14:15	**Special Session** Max Bell Building	**Towards More Inclusiveness and Equity in SMPC**: An Interactive Panel Discussion Coordinated by the Anti-Racism and Equity Committee Panel (AREC) [SS-1] ***Panelists**: E.H. Margulis, J.A Grahn, P. Loui* *Moderated by R. Balasubramaniam*
14:15-14:30	*Break + Walk back from Max Bell*	

14:30-15:30	**Perception** KC 101	*Cannabis, Music Absorption, and Auditory Perception [T-G1-1]* *Pitch-Induced Illusory Percepts of Time [T-G1-2]* *The Role of Variability in Perceived Rhythmic Complexity [T-G1-3]*
14:30-15:30	**Absolute Pitch** KC 105	*Singing on and off the "Pitch Grid": How Does Pitch Memory Influence Sung Accuracy in Musicians With vs. Without Absolute Pitch? [T-G2-1]* *Context-Dependent Suppression of Absolute Pitch during Auditory Statistical Learning [T-G2-2]* *Assessing the Efficacy of a Gamified Approach to Training Absolute Pitch Categories [T-G2-3]*
14:30-15:30	**Behaviour** KC 201	*Individual Differences in Music's Impact on Pain Sensitivity [T-G3-1]* *Situational Context Modulates the Effect of Background Music on the Emotional Judgment of a Visual Artwork: A Comparison Between Museum and Online Settings [T-G3-2]* *Immersed on TikTok: Musical Repetition's Effect on Viewing Behavior [T-G3-3]*
14:30-15:30	**Emotion** KC 205	*Do We Think of Emotions the Way We Think We Think of Emotions? The Multidimensional Space of Perceived Emotions in Music and Speech [T-G4-1]* *Historic Changes in Cues for Valence: A Novel Exploration of Perceived Emotion in Baroque- to Modern-Era Music [T-G4-2]* *Plosive to Nasal Ratios in Renaissance Lyrics as a Marker of Musical Affect? [T-G4-3]*

15:30–16:45	**Poster Session I** KC 203 *with coffee service* [P-1]	
16:45-17:45	**Language II** KC 101	*Association of Musical Training with Auditory and Speech Neural Coding and Perception [T-H1-1]* *Neural Underpinnings of Effective Noise-Speech Integration in Musicians [T-H1-2]* *Exploring the Associations Among Emotional Intelligence, Auditory Emotion Recognition, and Pitch Imitation in Speech and Song [T-H1-3]*
16:45-17:45	**Perspectives** KC 105	*Looking for Variability in All the Wrong Pieces: Evaluating Musical Features [T-H2-1]* *Publication Patterns Provide Insights Into the 140-Year History of Music Psychology [T-H2-2]* *A New Theory of Evolutionary Musicology [T-H2-3]*
16:45-17:45	**Cognition II** KC 201	*Both Calming and Arousing Music Are Effective at Improving Sundowning Symptoms in Long-Term Care Patients with Dementia [T-H3-1]* *Gamma-Augmented Music-Based Intervention for Mild Cognitive Impairment: Preliminary fMRI Results [T-H3-2]* *Neural Correlates of Empathic Accuracy in Social Cognition and Music Perception [T-H3-3]*

16:45-17:45	**Pleasure** KC 205	*The Effects of Cannabis on Music Perception and Appraisal: A Musicians vs. Non-Musicians Analysis [T-H4-1]* *From Lab to Concert Hall: Live Performance Effects on Cerebro-Acoustic Tracking, Engagement and Pleasure [T-H4-2]* *Misophonia is Associated with Heightened Emotional Responses in Music [T-H4-3]*
19:30	**Banquet** KC 103	

Saturday, July 27th

07:30–09:30	**Breakfast** *Vistas Dining Room*	
09:30-10:30	**Grouping** KC 101	*Timbral Brightness as a Cue for Grouping and Prominence [T-I1-1]* *How Slow Is Too Slow: Investigating the Breakdown of Rhythmic Grouping at Slow Tempi [T-I1-2]* *Evaluating the Three-Attack Threshold for Meter [T-I1-3]*
09:30-10:30	**Methods and Tools** KC 105	*Automatic Computation of Singing Scores Based on Detected Frequencies [T-I2-1]* *Modelling the Dynamic Network Connectivity of Music Listening [T-I2-2]* *Modeling Continuous Emotion Ratings with Surface-Level, Structural, and Information-Theoretic Predictors [T-I2-3]*
09:30-10:30	**Expectation** KC 201	*Perceptual Influences on Large-Scale Repetition Structure: A Corpus Study [T-I3-1]* *The Effect of Pitch and Timing on Musical Expectancy [T-I3-2]* *Contrastive Stress in Music [T-I3-3]*
09:30-10:30	**Development II** KC 205	*Children's Agency and Engagement During Parent-Child Singing Activities in Autistic and Non-autistic Preschoolers [T-I4-1]* *Virtual Mindfulness-Based Music and Songwriting to Support Well-Being of Parents/Caregivers of Children with Intellectual and Developmental Differences [T-I4-2]* *The Child Musicality Screening: A New Short Questionnaire to Assess Musicality in 3–10-Year-Olds [T-I4-3]*
10:30–10:45	**Coffee Break**	

10:45-11:45	**Symposium VIII** KC 101	**Rhythmic and Metric Pathways Into Language and Reading Development** [S-C1] ***Contributors**: J. Zuk, A. Fiveash, M. Breen, K. Drakoulaki*
10:45-11:45	**Symposium IX** KC 105	**Computational Tools for Music Corpus Studies** [S-C2] ***Contributors**: J. Devaney, N. Condit-Schultz, D. Sears, E.A.M. Acosta, N. Nguyen, T. Dang, D. McKemie, A. Morgan*
10:45-11:45	**Symposium X** KC 201	**Music and Neuroplasticity in Aging: Sensory Connections to Cognition** [S-C3] ***Contributors**: J.A. Bugos, V. Vuong, M. Perron, R. Chow, C. Alain, M. Thaut, P. Tremblay, S. Rosenbaum, M. Mo, L. Zhang*
10:45-11:45	**Trainee Town Hall** KC 205	Discussion-based Town Hall for trainee members to share insights regarding the ongoing Trainee Needs Assessment [TTH] ***Organizer**: N. Miller*
11:45–13:15	**Lunch** + Grad School, Early Career, and Grant Meetups *Vistas Dining Room*	
13:15–14:15	**Presidential Addreess + Awards and Business Meeting** Max Bell Building	
14:15-15:15	**Keynote** Max Bell Building	Music Cognition or Musical Cognition - What Is Our Goal? [KN] *Michael Schutz, McMaster University*
15:15-15:30	*Break + Walk back from Max Bell*	

15:30–16:45	**Poster Session II** KC 203 *with coffee service* [P-2]	
16:45-17:45	**LiveLab** KC 105	*Gaze Behavior in Online and In-Person Concert and Film Viewing: A Large-Scale Naturalistic Eye-Tracking Study [T-J2-1]* *Investigating the Influence of Contextual Information on Cardiac Activity in Response to Musical Performance [T-J2-2]* *Costs and Benefits of High-Stakes, Single-Shot, Multi-Person Data Collection Events [T-J2-3]*
16:45-17:45	**Learning and Memory** KC 201	*A Longitudinal Investigation of the Development of Error Detection Skills [T-J3-1]* *The Systematic Impact of Cognitive Load on Involuntary Musical Imagery [T-J3-2]* *Participatory Music Learning Online: Investigating Older Adult Amateur Musicians' Selection and Use of Self-Regulated Learning Strategies [T-J3-3]*
16:45-17:45	**Culture** KC 205	*The "Foreign Music Effect": Listening Experience Influences Perception of Musical Tempo [T-J4-1]* *A Cross-Cultural Comparison of Individual Differences in Musical Reward [T-J4-2]* *A Cross-Cultural Study of Pentatonic Scale Systems in Japanese and Western Musical Traditions [T-J4-3]*

Keynote Abstract

Music Cognition or Musical Cognition - What Is Our Goal?*

Michael Schutz[1]

KN

[1] McMaster University, Canada

Much as scientific approaches can offer novel musical understanding, music is a fertile domain for scientists studying auditory processing. And yet despite this incredible potential, scholars from both disciplines face a perennial dilemma. Tight stimulus control is crucial for well-designed experiments, however composers routinely craft complex passages in ways famously described as "hopelessly confounded" for scientific purposes. Tension between the scientific and artistic aspects of our field presents not only challenges—but also opportunities. My keynote will discuss approaches for balancing competing desires for control and realism within the rapidly expanding field of music cognition. Additionally, it will explore how interdisciplinary connections with adjacent fields (e.g., music theory, music information retrieval, etc.) can lead to insights useful for a wide range of musicians, psychologists, and computer scientists alike.

Michael Schutz is Professor of Music Cognition/Percussion at McMaster University. Designated "University Scholar" in recognition of his work bridging music perception and performance, he directs the MAPLE Lab (www.maplelab.net), conducts the McMaster Percussion Ensemble, and leads the Canadian Percussion Network. His research is featured in multiple textbooks and has been supported by both Canadian (SSHRC, NSERC, CFI) and US (US Navy, National Institutes of Health) agencies. Michael appears regularly in the public media (CBC, Global News, On the Nature of Things with David Suzuiki, TEDx, Boston Globe), has given over 60 lecture recitals and keynotes at leading universities, and is an artist/endorser for Sabian and Innovative Percussion. During his 2022-23 sabbatical he spent the Fall as the first-ever Visiting Research Chair at the Don Wright Faculty of Music (Western University), and Winter as a Fellow at the prestigious Durham Institute of Advanced Study (working with Tuomas Eerola). Details on his musical work as a percussionst and conductor is available at www.michaelschutz.com.

The keynote lecture will be given on Saturday, July 27th (2:30 - 3:30pm) in the Max Bell Auditorium. A campus map of the Banff Centre for Arts and Creativity can be found at the end of this program.

Special Session Abstract

Towards more inclusiveness and equity in SMPC: An interactive panel discussion

Presenters:

Jessica Grahn (Western University), Psyche Loui (Northeastern University), Elizabeth Margulis (Princeton University)

Moderator:

Ramesh Balasubramaniam (University of California Merced)

SS-1

Overview:

In this panel, we will have an open discussion on issues related inclusiveness and equity in the SMPC community. Drawing from professional and personal experiences, the panel will discuss issues related to equity in how we do our science, the stimulus materials and corpora that we use for our analyses, the people we help, mentor and train, and the institutions that we work in. We are aiming for an interactive session in conversational style, to be followed by a Q&A session that is open to the entire conference.*

*The special session will occur on Friday, July 26th (1:15 - 2:15pm) in the Max Bell Auditorium. A campus map of the Banff Centre for Arts and Creativity can be found at the end of this program.

Talk Abstracts

Thursday, July 25th

Music Consciousness and Emotional Responses to Rachmaninoff Preludes Op. 32 in Audio and Mixed Reality: New Forms of Multimedia for Classical Music

Svetlana Rudenko[1,2], ***Kelly Jakubowski***[1], ***Xiangpeng Fu***[2,3], ***Mads Haahr***[2,3]

T-A1-1

[1] Department of Music, Durham University, UK
[2] Haunted Planet Studios, Ireland
[3] School of Computer Science and Statistics, Trinity College Dublin, Ireland

With the emergence of advanced multimedia technology, such as Virtual Reality (VR) and Mixed Reality (MR) and research into music consciousness and cognitive musicology, new opportunities arise for interpretation and visualisation of music analysis. We discuss insights into the design of three Mixed Reality scenes for Rachmaninoff Preludes Op. 32 and the outcomes of a pilot study carried out on an audio-only group with headphones (control, 21 participants) and MR group on Meta Quest 3 headset (experimental, 22 participants). Participants were volunteers interested in attending a free concert as a reward. The MR group experienced three mixed reality scenes in which the room was augmented with virtual objects from nature (e.g., a tree and falling leaves) and/or the fantastic (e.g., a mermaid) designed by the performer (pianist) to resonate with the music. Participants in both groups were asked to rate their emotions and experiences via several subscales of the Phenomenology of Consciousness Inventory and describe memories or thoughts that came to mind. Both groups reported being significantly absorbed by the experience and that the experience induced a state of relaxation. Listening to the music evoked a more inner-directed state of attention than engaging in the MR experience. Familiarity with MR/VR increased the enjoyment of the MR experience. The audio group also described a wide range of associative memories and images, which bear resemblance to the MR visualisations in several ways. Musical training did not affect the results. Our results suggest that MR visualisation could be a promising tool to attract new audiences to classical music. The majority of current MR experiences are games (e.g., shooting and exploration). Typical "music games" are based on the matching of rhythm patterns, but are not associative experiences. In this fashion, we are also contributing to expanding the variety of game genres by creating cognitive musicology experiences in MR where the music is primary narrative content and not a background or action template. MR experience video

A Schematic Model of Threat Scenes in Horror Films

Elizabeth A.M. Acosta[1], ***David Sears***[1]

[1] Texas Tech University, Lubbock, TX, USA

T-A1-2

Studies examining the development of expectations during music listening have identified measurable behavioral and psychophysiological responses to unexpected or surprising events. However, the experimental literature has not yet explored these effects in the context of horror, despite the genre's propensity to elicit dramatic behavioral and psychophysiological responses. Conventional threat scenes, for example, typically contain an acoustic stinger that elicits a jump scare. This study investigates how participants respond to acoustic and visual cues during threat scenes according to a schematic model of horror film threat scenes consisting of four stages: the film's baseline audiovisual levels, the anticipation of a jump scare, the acoustic stinger that accompanies the jump scare itself, and the return to baseline. Across two experiments, participants (N = 40 each) were exposed to twelve film scenes that were presented in three conditions (audio only, video only, combined audio and video), and either included all threat scene stages (conventional), excluded the stinger stage (abandoned stinger), excluded the anticipation stage (unprompted stinger), or did not include any stages (control). In each trial, participants provided retrospective (Likert-scale; Exp. 1) or continuous (slider; Exp. 2) ratings related to their emotions (e.g., retrospective: felt tension, distress, startle) and expectations (continuous response prompt: 'How strong is your expectation for a jump scare *right now*?'). Threat scenes that did not follow the conventional model were reported to be less expected and more distressing, and threat scenes that did not contain an anticipation stage were reported to be more startling than conventional threat scenes that also contained a jump scare. These effects were strongest when audio and video were combined, followed by the audio-only condition. Furthermore, continuous ratings demonstrated consistent moments of change in expectations at threat-scene boundaries. Taken together, these findings support the view that filmgoers develop temporal schemata for threat scenes in horror films consistent with the proposed model.

The Role of Style in Perception of Emotion in Musical Harmony

Mauro Orsini Windholz[1], ***Elizabeth H. Margulis***[1], ***Benjamin Kubit***[1]

[1] Princeton University, USA

T-A2-1

Motivation: Research in music cognition rarely accounts for contextual factors surrounding music appreciation (Thompson et al., 2022, Cespedes-Guevara and Eerola, 2018). Musical style is one such factor: music and emotion research focusing on harmony is often limited to classical or stylistically decontextualized stimuli. It is possible that different harmonic styles express emotions differently. This paper reports on a behavioral study that investigates this hypothesis. **Materials and methods**: Two distinct groups of undergraduate participants (n=46, n=47) listened to two sets of musical stimuli and rated how much they believed each expressed 9 emotion terms on a scale of 1 to 5. The first group listened to stimuli that harmonized melodies using blocked piano chords emulating 5 different styles, while the second group listened to the same melodies arranged with the typical rhythms and instrumentation of the same styles. The styles adopted were: classical, country, hip-hop, jazz and pop-rock, all relatively familiar to the participant pool. Lastly, participants completed the Gold-MSI survey. **Results**: Principal Component Analysis was run on participants' emotion ratings, and ANOVAs were run predicting the values of Principal Components 1, 2 and 3 (which explained 74% of the variance) by the style of stimuli, the experimental condition, and participants' musical training levels. Significant main effects of style, condition, and of the interaction between musical training and condition were found ($p < 0.001$). Several significant simple effects of harmonic style were observed (e.g. pop-rock harmonizations obtained higher values for PC1 than hip-hop, $p < 0.01$). This suggests that harmonic style alone can affect participants' rating of emotions. No simple effect of condition was observed for more musically trained listeners, suggesting that they perceive some emotions in stimuli isolating harmonic style similarly to full arrangements. **Implications**: This study suggests that style of harmony alone can impact listeners' perception of certain musical emotions, and that (Western) musical training strengthens this impact. These findings underscore the importance for harmony perception research to account for styles other than classical.

Measuring the Uncanny: Chromatic-Mediant Motion in Elliott Smith's XO

Devin Guerrero[1], ***Brad Cawyer***[1]

[1] Texas Tech University, USA

T-A2-2

Building on research that associates chromatic-mediant harmonic motion with Freud's Uncanny, this paper utilizes converging methods to examine text painting in Elliott Smith's album XO. The Uncanny generates psychological tension that makes the ordinary appear strangely threatening. In this study's context, tonality (namely V7-I voice leading) is the ordinary thing threatened by its reinterpretation within chromatic harmony. Like previous studies, we situate Smith's uncanny lyrics in close relation to his predilection for chromatic-mediant motion. Additionally, the paper compares harmonic motion in Smith's XO to that in a combined McGill Billboard and Rolling Stone-200 corpus. This research quantitatively identifies essential characteristics of Smith's harmonic language and highlights his application of paradox in lyrics and music to support the listener's empathy for songs' protagonists. Harmony data for the combined corpus was collected through the Sears/Forrest Triadic Harmony Analysis Tool and then re-encoded according to root relation and triad quality, utilizing Murphy's tonal-triadic progression classes to eliminate the question of key implied by Roman numeral analysis. Comparison of the relative frequencies of chord progression types in the combined corpus with those in an original transcription of XO revealed that chromatic-mediant progressions occur 3.33 times more frequently in XO versus the general corpus. Certain mediant progressions less frequently utilized within the general corpus occur up to 49 times more often. The conflicted inner dialogue of Smith's lyrics often expresses uncertainty and self-doubt, as well as the incongruity of personal, interpersonal, and industry conceptions of the artist himself. The troubled introspection and impending tragedy in XO's lyrics are set with a remarkably higher frequency of chromatic-mediant harmonization than is normal in popular music. Paired with the lyrics' internal conflicts, these regular harmonic contradictions destabilize listeners, drawing them sympathetically into the protagonist's psychologically and emotionally dissonant experiences. While also demonstrating the need for post-millennial popular music corpus studies, our analyses most immediately establish a unique method for the examination of progressions characteristic to subsets of the Western popular music corpus.

Exploring the Influence of Pitch Movement on Perceived Tonal Relations

Lauren H. Vomberg[1], ***Mark Schmuckler***[1]

T-A2-3

[1] Department of Psychology, University of Toronto Scarborough, Canada

Research on perception of tonality has employed a paradigm in which a tonal context is followed by a probe event (single tone, pair of tones), with listeners rating the goodness of fit of the probes with respect to the preceding context. In this paradigm, goodness-of-fit ratings appear largely driven by music-theoretic factors such as tonic triad membership, diatonic set, and so on. One common characteristic of these investigations is that the probe event employs circular tones, which have well-defined pitch chroma but lack precise pitch height information. Consequently, these investigations are ambiguous as to how pitch movement information within the probes may play a role in such perceived tonal relations. This project examined the impact of pitch movement in this paradigm by employing probe intervals consisting of complex tones containing specific pitch chroma and height information. In particular, listeners (non-musicians, amateur musicians, novice musicians, and experienced musicians, based on years of musical experience) rated all possible pitch intervals (e.g., C-C#, C-D … B-A#, B-C) in both ascending (e.g., m2: C4-C#4) and descending (e.g., M7: C5-C#4) directions with respect to goodness-of-fit following a preceding tonal context (a I-IV-I-V-I chordal cadence). Actual interval ratings for each group of musical training were correlated with comparable pitch interval ratings from Krumhansl (1990). Additionally, shortest pitch distance (SPD) ratings were also calculated from the actual interval ratings and compared to Krumhansl's (1990) ratings. Overall, the highest correlation occurred for ratings based on the SPD (for example, for experienced musicians, $r = .634$), and actual interval ratings were also correlated, though less so (experienced musicians, $r = .472$). Correlations increased with musical training, and the advantage for the SPD occurred across musical training. This study demonstrates that perceived tonal relations for pairs of tones are influenced by the direction of pitch movement within the tone pair, with listeners in Krumhansl's (1990) interval rating study likely hearing the probe intervals in terms of the shortest pitch distance.

Can Consolidation be Enhanced by Listening Before Sleeping?

Laura A. Stambaugh[1], ***Carina Cardoso de Araujo***[2]

T-A3-1

[1] Rhode Island College/Georgia Southern University, USA
[2] University of Georgia/Georgia Southern University, USA

Piano practice may benefit from consolidation, improvements happening after sleep. Neurological studies showed consolidation occurs during non-REM sleep, specifically slow-wave-sleep. The purpose of this study was exploring the impact of priming the overnight consolidation process by listening to recordings of practice immediately before sleep. A secondary purpose was to compare the effect of listening to a recording of one's own playing vs. listening to a computer-generated recording. We used a repeated measures design with three conditions (*N*=35). A digital keyboard was connected to a MacBookPro running LogicPro. Participants attended two individual study sessions approximately 24 hours apart. They practiced three short piano exercises, each exercise in a different condition, playing each exercise 15 times as accurately and quickly as possible. For the self-listening condition, they recorded the last 5 trials of their playing on their mobile phone. For the computer-listening condition, they recorded a Finale recording on their cell phone. For the control condition, they did not record anything. Participants set a reminder alarm on their phone for their anticipated bedtime to cue them to listen to the recordings right before going to bed. They were told to not move their fingers while listening. The next day, they played three trials of all tasks. The mean number of wrong pitches played per trial was .65 (*SD*=1.10) in the control condition, .66 (*SD*=1.12) in the Finale condition, and .39 (*SD*=.86) in the self-listen condition. IOI per trial was *M*=613.47ms (*SD*=200.74) for control condition, *M*=645.66 (*SD* = 307.06) for Finale condition, and *M*=.609.40 (*SD* = 212.09) for self-listen condition. The mean co-efficient of variation was .27 or .28 in all conditions; no further analyses were conducted for evenness. Omnibus ANOVAs indicated no significant difference among conditions for accuracy (*p*=.239) or speed (*p*=.516). While hypothesis testing did not reveal significant consolidation advantages for listening to music prior to sleep, differences in error rates and speed would be perceptible by musicians, favoring the self-listen condition.

Melody Memorability: Pattern Recognition in Auditory Pitch Sequences

Nathan A. Zak[1], ***David Temperley***[2], ***Peter Pfordresher***[1]

T-A3-2

[1] University at Buffalo, State University of New York, USA
[2] Eastman School of Music, University of Rochester, USA

This study investigated short-term memory recognition in auditory pitch patterns. Participants (*n* = 54) completed a same/different task in which they listened to two consecutive melodies for 72 trials that could be identical or could differ by one pitch. Melodic sequences were each twelve notes in duration, consisting of either three or four-note subsequences. Pitch alterations would occur in various locations to alter the pattern structure, not corresponding to metrical accents. On different trials, melodies could comprise patterned subsequences based on diatonic pitch intervals, melodic contour, or no pattern structure. Sensitivity to the alteration of pitches was measured using d', which functioned as our measure of recognition. There was a main effect of pattern type on d', $F(2, 106) = 24.89, p < .001, \eta^2 = 0.32$. Listeners were most sensitive to pitch changes for melodies with interval-based patterns (*M* = 1.410, *SD* = 0.788), intermediate for contour-based patterns (*M* = 0.980, *SD* = 0.624), and least sensitive for the no-pattern condition (*M* = 0.672, *SD* = 0.658). Years of musical training was associated with improved recognition for patterned melodies (interval, $r(52) = .53, p < .001$ or contour, $r(52) = .35, p = .013$), but not for unpatterned melodies, $r(52) = .12, p = .188$. These findings imply that pattern structure facilitates encoding of melodies in short-term musical memory in a graded fashion, with musical training leading to enhanced encoding of pattern structure. The results also suggest that the more effective recognition memory observed for musicians may be based on their ability to encode melodies based on patterned subsequences, and not enhanced memory span for unpatterned pitch sequences.

Emotional Music Modulates Episodic Memory During Recollection and Induces False Traces

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T-A3-3

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[2] School of Psychology, Georgia Institute of Technology, USA
[3] College of Music, University of Colorado Boulder, USA

While music's influence over both emotion and memory is relatively well-known, limited studies have explored interactions between musically induced emotion and memory modification. We investigate whether music can infuse episodic memories with altered emotional details, effectively "rewriting" their emotional content. Participants (*N* = 44) completed a three-day episodic memory task with separate encoding, recollection/reconsolidation, and retrieval phases. Using emotionally neutral word sets from the Affective Norms for English Words (ANEW) database (Bradley & Lang, 1999), we created fictional scenarios simulating autobiographical memories. On day 1, participants experienced these scenarios, forming true (laboratory-based) memories. On day 2, we recorded fMRI while participants recalled each scenario, paired with positively-valenced music, negatively-valenced music, or silence, and selected words on a screen that aligned with their recollections. Music was from the "Film Soundtracks" dataset (Eerola & Vuoskoski, 2011). On day 3, participants completed a final retrieval test. Scenarios paired with music during memory recollection (day 2) exhibited a more emotional tone when subsequently retrieved on day 3, congruent with the paired music's valence, ($F(2) = 8.927, p < 0.001, \eta^2_G = 0.074$). Behavioral and neuroimaging data from day 2 supports that music enhanced attention towards and encoding of emotional content (amygdala, anterior hippocampus, and inferior parietal lobule activity, all $p < 0.001$), and possibly impacted recollection vividness (enhanced functional connectivity between the amygdala and visual cortex). These findings demonstrate intricate interactions between music cognition, emotion processing, and episodic memory, and provide insight into how memory might be reshaped as it is re-experienced. This work provides support and new perspectives for therapeutic applications of music, particularly regarding mood disorders, emotional biases, and stressful memories.

References

[1] Bradley, M. M., & Lang, P. J. Affective Norms for English Words (ANEW): Instruction manual and affective ratings. *Tech. Rep. C-1, The Center for Research in Psychophys., Univ. of Florida* **49** (1999).

[2] Eerola, T., & Vuoskoski, J. A comparison of the discrete and dimensional models of emotion in music. *Psychol. Music* **39**(1), 18-49 (2011).

Examining Brain Hemodynamic Responses in Piano Duo Performance Across Distinct Contexts Using Functional Near-Infrared Spectroscopy

Thenille B. Janzen[1]**, *Bruno M. Gaidargi***[1]**, *João R. Sato***[1]**, *Patricia Vanzella***[1]

T-A4-1

[1] Center for Mathematics, Computing and Cognition, Federal University of ABC, São Bernardo do Campo, SP, Brazil

Temporal coordination during joint musical actions requires complex cognitive and motor processes that enable musicians to represent shared action goals and adapt to a partner's actions in real-time. Recent research also indicates that social processes engaged in understanding others' mental states and predicting their intentions are crucially involved in interpersonal coordination. The "virtual partner" paradigm, involving real-time interactions with a computerized partner simulating human behaviors, is a prominent method in joint action research. It effectively addresses practical constraints, particularly in neuroimaging research with functional magnetic resonance imaging, where capturing simultaneous brain activity from all individuals in a task is challenging. However, it remains unclear whether differences in brain activity emerge during interactions with live and virtual partners. This study used functional near-infrared spectroscopy (fNIRS) to examine neural correlates of interpersonal temporal coordination in ensemble music performance across different interaction contexts: live performance, muted partner, or virtual partner. Pianists (n = 12; 6 males; age: 32±11 years; years of training: 9±7 years) performed the right-hand part of twelve pieces (adapted chorales by J.S. Bach) in synchrony with a complementary left-hand part played by a co-performer or a standard computer-generated recording. Pianists had an unobstructed view of the co-performer and were aware of the experimental manipulations. The analysis compared the hemodynamic response across interactional contexts during solo versus duo performances. Significant differences in brain activity in the sensorimotor cortex and temporoparietal junction were observed across all interaction contexts when comparing solo and duo conditions. This finding supports previous studies showing that action coordination during a joint task imposes greater demand on regions involved in motor planning and mentalization than on individual tasks. Moreover, no significant differences in hemodynamic response were observed in these regions when comparing live, muted, and virtual contexts. This result may be due to the task's relatively low difficulty level and participants' expertise, suggesting that the performance contexts examined in this experiment may not have required significantly distinct levels of interaction and temporal coordination.

From Shared Control to "Acting As One": Investigating the Sense of Joint Agency in Group Music-Making

Janeen Loehr[1]

T-A4-2

[1] University of Saskatchewan, Canada

Coordinating actions with others during activities such as group music-making has fascinating implications for people's sense of agency, i.e., their feelings of control over actions and their consequences. When coordinating with others, people can experience agency not only at an individual level (a sense that "I did that" or "You did that") but also at a collective level ("We did that together"). The latter, joint agency, can range from a sense that agency is shared among co-performers to a powerful sense that co-performers are "acting as one". We have completed multi-methods studies across three research lines to elucidate the musical contexts that elicit different forms of joint agency and its links to individual and social benefits. We investigated shared agency by having partners (*n*=29 dyads) produce musical duets or repeating-pitch sequences together using electronic music boxes. Participants rated stronger shared agency for duets and reported that shared agency was influenced by the duets' musical structure, familiarity, pleasantness, and performance ease. A subsequent EEG study (*n*=32 dyads) showed that neural markers of attention and aesthetics (auditory N1 and P2 ERPs) better accounted for the relationship between sequence type and shared agency than markers of predictive timing or inter-brain coupling, supporting familiarity and pleasantness as key drivers of shared agency for duets. We investigated *united agency* ("acting as one") by collecting detailed accounts (*n*=77) of its occurrence during group music-making. Thematic analysis revealed consistent phenomenological characteristics (including positive emotions, powerful feelings of connection, and physical sensations), common facilitating contexts (e.g., small-to-medium groups and public performances), and long-lasting impacts of united agency. Finally, we developed electronic music boxes that allow people to play commercial recordings as duets as a therapeutic tool for spousal couples living with dementia. Mixed-methods feasibility testing (*n*=8 couples) demonstrated that playing meaningful songs together was enjoyable, elicited shared agency, prompted musical reminiscence, and supported spouses' relationship continuity. Together, these findings further our understanding and underscore the positive impacts of joint agency during group music-making.

Synchronizing Beyond One's Preferred Motor Rate Evokes Greater Pupil Sizes

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T-A4-3

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[3] Department of Psychology, Concordia University, Montreal, Canada

Performing music requires precise coordination of movement with external sounds at various tempi. When performing at slow or fast rates, movement stability and synchronization accuracy are usually reduced. This could be related to individuals' preferred motor rates, typically tested in unpaced, spontaneous production tasks. Synchronizing movements is easier when the tempi of rhythms are closer to one's preferred motor rate than with ones that are faster or slower. This more efficient coupling at one's preferred rate should be associated with lower cognitive demands and better attentional entrainment, tested here by measuring participants' pupil sizes, a proxy for noradrenergic attention. First, participants were instructed to tap their finger at a spontaneous tempo that felt the most comfortable (preferred motor rate). Then, they were presented with metronome sequences set at their preferred motor rate, at a slower, and at a faster rate. In one condition, they passively listened to the metronome sequences. In another condition, they had to synchronize their finger taps with the metronome sounds. Results showed that synchronizing (relative to listening) to the faster and slower metronome rates evoked larger pupil sizes whereas there was no difference at participants' preferred rate. Furthermore, pupillary phase coherence increased while synchronizing compared to listening to all three metronomes. We interpret these data in terms of dynamical systems theory, where internal oscillators couple to external rhythms; this coupling is more efficient the closer the external rhythms are to the preferred rates of the internal oscillators. In line with this theory, our results demonstrate that synchronizing is more cognitively demanding than listening only at tempi beyond one's preferred rate. Beyond their theoretical implications, our findings suggest that musical performance is dependant on individual's preferred motor behavior.

Cross-Modal Commonalities in Evaluative Responses to Musical and Visual Complexity

Ronald Friedman[1], ***Sijia Song***[1], ***Douglas Kowalewski***[1]

T-B1-1

[1] University at Albany, State University of New York, USA

Motivation: Recent studies have shown that there are substantial individual differences in the impact of harmonic and melodic complexity on music preference. However, the question remains: Are evaluative responses to complexity in the musical domain associated with or independent of evaluative responses to complexity in other sensory modalities? **Methods and Materials**: To address this empirically, we conducted two studies, each using distinct musical/visual stimuli as well as measures of either subjective or objective complexity. In Study 1, participants were presented with a series of 56 unique color pairs—squares in one hue embedded within larger squares in another hue—as well as a set of 44 12-TET triads (three-note chords), varying in their harmonicity, roughness, and normative frequency. Participants were asked to rate their liking for as well as the complexity of each stimulus in separate blocks. In Study 2, participants were presented with and asked to rate their liking for each of a set of 24 Western melodies as well as a set of 24 dynamic light displays that were precisely matched with the melodies in terms of their objective complexity (i.e., event density and entropy). **Results**: Study 1 revealed a reliable correlation between preferences for subjectively simple versus complex color pairs and chords ($\rho = .22, p < .002$). Likewise, Study 2 revealed a significant correlation between preferences for objectively simple versus complex musical melodies and light displays ($\rho = 0.37, p < .001$). **Implications**: These findings demonstrate that there are meaningful commonalities in the impact of both subjective and objective stimulus complexity on evaluative responses to musical sounds and visual images. This supports theories of aesthetic preference that are based on domain-general cognitive mechanisms of prediction and processing fluency and suggests that individual differences in music preference cannot be properly understood without accounting for these cross-modal contributions.

Exploring Crossmodal Associations of Sun and Moon Themes in Art and Music

Patricia Vanzella[1,2], ***Daniel Q. Bertuzzi***[2]

T-B1-2

[1] Center for Mathematics, Computing, and Cognition | Universidade Federal do ABC, Brazil
[2] Interdisciplinary Unit for Applied Neuroscience | Universidade Federal do ABC, Brazil

Crossmodal correspondences involve observers forming systematic associations between features in different pairs of sensory modalities. Notably, visual and auditory pairs are extensively investigated. Research confirms crossmodal links between basic audito ry and visual stimuli, while studies with complex stimuli show consistent associations between music color and music abstract paintings. Here we explore how thematic similarities between paintings and musical excerpts influence crossmodal associations usin g semantic differential and direct association methods. We expect to observe crossmodal correspondences between paintings and musical excerpts, analyzing association strength, participant response patterns, and task consistency. This study involved 377 participants (245 women, 130 men, and 2 undisclosed). Materials included nine paintings (sun, moon, and diffused light themes) and nine instrumental musical excerpts chosen based on a pilot study and thematic relevance that associat ed them with the sun, the moon, or neither. In the semantic differential task participants evaluated paintings and musical excerpts on 15 bipolar adjective pairs (slow/fast, agitated/calm, happy/sad, warm/cold, heavy/light, continuous/rhythmic, strong/weak , dark/clear, flushed/faded, static/dynamic, figurative/abstract, harmonic/disharmonic, monotone/vivid, pleasant/unpleasant, and low/high), and in the direct association task participants matched musical excerpts to paintings. In the Semantic Association Task, stimuli associated with the sun were characterized as bright, warm, happy, and vivid, while those linked to the moon were described as slow, calm, sad, and dark, confirming dissimilarity between contrasting themes, support ed partly by the direct association task, showcasing participant consistency. In conclusion, the study revealed distinct semantic associations and dissimilarities between sun and moon themed stimuli, supported by Euclidean distances and direct association patterns. The weak correlation between tasks could be attributed to factors beyond semantics, including subjective interpretation, contextual influences, and other crossmodal correspondence mechanisms such as structural, statistical, and emotional. This study reveals music visual patterns and potential applications in personalized therapy, emotional design, and AI for immersive cross modal experiences. Exploring sensory pairings, brain roles, and individual differences promises deeper insights and ad vancements across various domains.

Cross-Modal Correspondences Between Harmonic Intervals and Tactile Roughness

Ilan Sofer[1], ***Zohar Eitan***[1]

T-B1-3

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Associations of sound and touch are intrinsic to music-making and are prevalent in musical and auditory terminology (e.g., sound “roughness”). However, few studies have investigated the association of music-specific features, such as Western harmonic intervals, with tactile properties; and even fewer have examined such associations without conceptual or visual mediation. This study investigates how musicians and nonmusicians associate consonant and dissonant harmonic intervals, across different pitch registers, with physical objects varying in tactile roughness, deliberately avoiding visual and explicit conceptual mediation. 51 participants (21 musicians) listened to 30 trials of a synthesized piano sound, each presenting one of five harmonic intervals (m2, m3, P5, M6, M7) in one of three pitch registers (Octaves 2, 4, 6), and one of two transpositions, a minor second apart. Participants matched each auditory stimulus to one of four 3D-printed physical objects, differentiated by tactile roughness, which they could touch but not see. Analysis reveals a striking difference between musicians and nonmusicians: only the former associate tactile roughness with dissonance, such that for musicians only, more dissonant intervals were matched with rougher objects. For both groups, tactile roughness was associated with pitch register: middle register stimuli were associated with smoother objects, compared to low- and high-register stimuli. While musical-tactile correspondences are widespread, musicians and nonmusicians may associate tactile features with different auditory features. Notably, the apparent “natural” association of dissonance with tactile roughness may actually be contingent upon professional music training.

Musicological Interpretability in Generative Transformers

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T-B2-1

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What might a large language model learn about chord syntax in chorale-style, Western-European-style chord progressions? In this paper, we implement a novel chord representation to explore the behavior of such a model with a proprietary corpus of chorale-style church hymns. Our model is a decoder-only autoregressive transformer with 4 layers, 4 attention heads, and 64-dim embedding vectors. At various benchmarks during the model's 1 million training steps, we extract information for an explainability study. For example, we extract the model's token embedding vectors as it trains and visualize the resulting embedding spaces. This tells us what syntactic relationships are learned between chords. We then study chord progressions generated by the model early and late in its training, and we identify what musicological concepts are being learned at each stage. Our model learns basic syntactic categories of chords, and these categories resonate with some musicological discourse surrounding chord behavior in this style. The model also learns several components of harmonic behavior in this repertoire and learns these concepts in an order that approximates undergraduate harmony textbooks. However, the model shows no evidence of learning broader organizational principles, like phrase structure, repetition, and meter. These findings suggest a few things about transformer-based models of music. First, such models are highly influenced by the statistical frequency of different musical events, but this influence is mediated by the nature of the data. Accordingly, transformers may be used to model and study concepts like harmonic function, but researchers should take care to define how their data representation scheme might enable these models to learn such concepts. Second, language models of music cannot handle all musical parameters equally, meaning information often gets lost. We point to the model's apparent inability to comprehend meter and phrase structure as examples. That said, we acknowledge that these shortcomings may also owe to factors like our choice of data representation, relatively small dataset size, and relatively short length of training.

Humans Perceive AI-Generated Music as Less Expressive than Comparable Human-Made Content

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T-B2-2

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Our paper explores how listeners' perceptions of music change based on whether they believe it to be human- or AI-generated. Drawing on recent empirical (e.g., Shank et al. 2023) and historical work (e.g., Benjamin 1968), we propose that a work's perceived origin influences listeners' assessments of its creativity and expressiveness. To test this hypothesis, two experiments were conducted. In Experiment 1, 120 participants evaluated the same human-made piece of music "about the loss of a loved one". Half of participants were told the piece was composed by a human and half were told it was generated by an AI in response to a text prompt. An ANOVA shows perceived origin to be a significant factor on ratings of expressiveness: participants found the piece less expressive when attributed to AI. The second experiment further examined whether listeners attribute more expressiveness to human-composed music, particularly when technical distinctions from AI-generated music are eliminated. 400 participants were given two excerpts and were asked to determine which was created by a human versus by an AI, justifying their choices using a slate of technical or expressive qualities. Half of participants were shown actual AI/human pairs, while the other half were presented with two excerpts from the same source, either AI or human-composed, thus forcing them to choose between two technically identical pieces. According to chi-square tests, the deception condition elicited more responses about the music's expressive qualities: when there were no observable technical differences, listeners believed that the (supposedly) AI-generated content was less expressive. Our findings indicate that users perceive AI-generated music as less expressive when in technical parity with human creations. While these findings have broader implications for the reception of AI-generated artistic outputs, music provides a particularly evocative test case given the artform's historical/aesthetic associations with human experience and emotion (Piilonen 2024).

Exploring Style Similarity Perception in AI-Generated Music: A Disguised Turing Test

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T-B2-3

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AI music generation—designing AI systems to generate original music—has flourished in the music informatics community in recent years, and has often been conceptualized through style imitation, where the goal is to produce compositions that stylistically match a training corpus. However, the musical features that contribute to the perception of style have not been evaluated systematically. Accordingly, this study presents the results of an experiment in style similarity perception, using AI-generated jazz and folk music. To investigate the salient musical features that shape listeners' discernment of style, we effectively carry out a study employing a Turing test disguised as a style-discrimination task. The experiment comprises two phases: training and testing. During training, participants are presented with ten audio clips explicitly labeled as either 'composer A' or 'composer B', where the composer A samples are actually human-composed (i.e., training data) and composer B is an AI system. Participants are instructed to familiarize themselves with the style of each composer. Subsequently, during testing, participants performed a style-matching task where an audio clip from each composer was presented. Participants were asked to indicate which audio belonged to which composer via a 5-point likert scale from -2 ("definitely composer A") to 2 ("definitely composer B"), simultaneously rating both their choice and the level of confidence. The stimuli were generated using Folk-rnn and Jazz Transformer. Separate logistic regression analyses were conducted for each genre using a suite of symbolic musical features (e.g., meter, melodic motion, repetition) to predict participants' responses. We found that specific musical features, such as note length structure in jazz and repetition structure in folk music, significantly influenced the participants' ability to distinguish between human and AI. These results suggest that while some stylistic elements can be mimicked by AI, listeners can still discern differences based on key compositional traits. This insight might aid the advancement of AI-generated music by incorporating human perceptual attributes.

Shared Content in Music-Evoked Autobiographical Memories

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T-B3-1

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Research indicates that fictional narratives evoked by instrumental music show similarities in semantic content for within-culture participants. Although music-evoked autobiographical memories (MEAMs) may seem more idiosyncratic, broad cultural patterns constrain the typical pairings between music and particular events, settings, and activities. This study investigates whether there might be comparable culture-bounded semantic similarity for MEAMs. Undergraduate participants (*n*=233) listened to short clips of 32 Billboard chart-topping songs from three genres and two time periods, writing free-response descriptions of their evoked memories for each. We used both a semantic embedding space model and Latent Dirichlet Allocation (LDA) topic modeling to evaluate semantic similarity of memories within and between songs. We then chose representative memories for 12 of the songs, two from each genre/time period, selecting the memories closest in embedding space to each song's average response (the averaged embedding vectors for all responses to that song). Another set of participants (*n*=165) completed a two-alternative forced-choice "matching" task in which they listened to these song clips and selected which of two memories was associated with each clip. Participants chose between the correct representative memory and a foil corresponding to another song clip. A k-means clustering analysis of the free-response memory corpus shows that the average responses cluster according to genre and time period; memories for country songs tend to be similar regardless of time period, while memories for pop and hip-hop songs are similar within each time period. Similarly, the LDA topic modelling shows significant differences in the distribution of certain topics throughout the corpus based on genre/time period. In the matching task, participants performed above chance levels for 10 of the 12 songs. Together, these results suggest ties between musical features and the semantic content of memories. This is likely driven by listening habits, whereby certain music becomes strongly associated with specific events or settings.

Beyond Familiarity: Neuroelectric Correlates of Autobiographically Salient Music

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T-B3-2

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Autobiographically salient (ABS) music, (associated to one's past, including people, locations, and events), is posited to engage memory processes more efficiently than familiar (FAM) music, (music that is recognized, but lacks personal significance). This hypothesis was tested in two experiments where we explored behavioural, followed by neural responses, using event-related potentials (ERPs). The Late Positive Complex (LPC), a known neural correlate of recollection, was used as an index. 37 older adults (70.4 $\pm$ 5.8 yrs, 18 F) participated in both experiments. In Experiment 1, we measured response times (RT) during a listening task of ABS, FAM, and unfamiliar (UFAM) music. Participants were quickest in identifying ABS music, intermediate for FAM, and slowest for UFAM music, indicating faster recollection for ABS music than FAM and UFAM music. In Experiment 2, we measured high-density scalp recordings of ERPs during the same task, but with shortened stimuli to increase the number of trials for analyses. Clustered-based statistics identified differences in ERP amplitude and estimated source activity using Classical LORETA Analysis Recursively Applied (CLARA). All music conditions generated transient evoked responses at onset. Importantly, we observed a significant cluster with a more positive amplitude over the left centro-parietal regions for ABS than FAM music from 1008-1090 ms, similar to the LPC. These findings were accompanied by source activity in the right hippocampus and right ventral anterior cingulate cortex. Taken together, the graded effect in RT (ABS < FAM < UFAM) and ERPs (ABS > FAM > UFAM) suggest that ABS music is associated with faster and stronger memory-related activity that is distinct from FAM music. The results offer insight into the neural underpinnings of ABS music which is particularly relevant for the development and application of music-based interventions, such as people with dementia.

Age-Related Changes in Neural Activation Associated with Semantic Details of Music-Evoked Autobiographical Memories

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T-B3-3

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Nostalgic music can unlock past emotions and memories, facilitating access to autobiographical memories (AMs). AM shifts as adults age, with fewer specific and more general details during recall accompanied by alterations in the AM neural network. However, no work has examined neural activation related to music-evoked autobiographical memories (MEAMs) as healthy adults age. Our group found robust differences in neural activity between Nostalgic and Familiar-Control music listening using fMRI, motivating us to examine if there is an effect when predicted by memory. We examined neural activation during memory-evoking (Nostalgic) and familiar but non-nostalgic (Familiar-Control) music listening in healthy older (N = 29) and younger (N = 28) adults. Participants recalled a memory in response to a Nostalgic and Familiar-Control piece of music outside the scanner. We calculated Semantic Density of each memory, with higher scores indicating a more general memory. We examined the relationship between Semantic Density and neural activation during Nostalgic music stimuli between age groups. We found higher Semantic Density scores in older adults, aligning with previous findings, and that Semantic Density did not differ between song conditions. When predicted by Semantic Density, older adults compared to younger adults demonstrated greater activity in neural regions involved in AM and song familiarity (mPFC) during Nostalgic listening compared to rest. However, when comparing Nostalgia and Familiar-Control stimuli, Semantic Density did not predict neural activation in either age group. This suggests that, in the Nostalgia condition, the relationship between semantic details of MEAMs and neural response differs based on age, but this finding does not hold when compared to non-nostalgic, familiar music. In combination with our whole-brain nostalgia-related results (previously reported elsewhere), these findings suggest that nostalgic music differs from familiar non-nostalgic music in terms of its affective qualities and related neural responses, but these differences are minimized when considering effects on AM detail retrieval. This indicates that personalized, familiar music may be sufficient to evoke AMs, offering a useful perspective for music-based interventions aimed at evoking AMs.

Rhythms of Identity: Synchrony, Gestures, and Rock Music Fandom Perception

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T-B4-1

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Synchrony of human movement, often investigated through simplistic tasks such as finger tapping on a keyboard, inadequately captures the complexity of real-world social interactions, notably those observed in communal settings like rock concerts. How individuals engage with music in such environments not only serves as a medium for expressing social identity but also influences perceptions of others. We examined how identity-relevant actions (e.g., headbanging) and identity-irrelevant actions (e.g., swaying the music) would influence observer perceptions regarding the performer's rock fandom across various perceivers with varying rock fandom. Through a series of three motion-capture studies, we varied the proficiency of the action execution (expert vs. novice headbanger) and assessed how low and high identifiers with rock music perceive the identity of the performer doing the identity-relevant and identity-irrelevant and actions. In the third study we also varied the temporal alignment of action with the music (synchronous vs. asynchronous with a 15% tempo variation). Finally, we examined how these gesture characteristics and perceivers' social identity affect stereotypes of warmth and competence of the performer. Our findings suggest that the enactment of identity-relevant action, the exhibition of action expertise, and synchronous movement to music collectively enhance the perceived identity, warmth, and competence of the performer. Observers who self-identify as hard rock fans were more inclined to recognize performers as fellow enthusiasts than those without such identification. Moreover, without other symbolic and visual identity cues (e.g., attire, physical appearance), action-based and synchrony-related cues emerged as potent indicators of social identity. These results underscore the importance of nuanced interpersonal synchrony, highlighting its role beyond mere temporal alignment to encompass the qualitative aspects of social interaction and identity expression.

Listener-Performer Emotional Synchrony in Musical Expression

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T-B4-2

We listen to music not only to maintain our cultural and social identities but also to modulate our emotions. Past research has focused on how various musical elements impact emotions through both bottom-up responses and higher-level appraisals. However, these approaches often overlook the crucial role that performers play in evoking emotions in listeners. To address this gap, we conducted a study where we measured a pianist's skin conductance (GSR) during the performance of two styles (expressive vs. deadpan) of the same musical piece and compared it with the GSR responses of the listeners. A pianist with 10 years of experience played Mozart's Fantasia in D Minor (K.397) on a Yamaha P125. A Shimmer wireless GSR was strapped to her left ankle and measurements were taken on the foot. Each performance was played at approximately the same tempo, took 2 mins, and varied in dynamic and tempo variations: the deadpan performance minimized such variations, while the expressive performance incorporated them in a manner typically deemed desirable in musical performances. Listeners (n = 92) were then asked to listen to the different styles with the GSR recorded from the same location. Between each style, they reported the perceived valence and arousal of the style, as well as their perception of the style's expressiveness. For the pianist, we observed that her GSR responses during expressive performances exhibited both significantly larger amplitude and more oscillatory fluctuations compared with those during deadpan performances. Finally, recurrence quantification analysis showed significantly higher overlap and predictability of GSR between the performer and listeners during the deadpan style compared to the expressive style. This suggests that listeners' physical responses were more similar to the performers' in deadpan performances. Future analyses will unpack the self-report of expression to listener-performer synchrony.

Information Flow in Sound as Ensemble Musicians Learn to Coordinate Musical Expression

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T-B4-3

Introduction: Ensemble musicians create a unified musical expression by aligning their playing. Even when the notes themselves are predetermined by a score, musicians must collectively arrive at a shared set of intentions for how to play them so that dynamics, tempo fluctuations, articulation and phrasing are synchronized. This requires ongoing non-verbal communication—especially when performing unfamiliar music—which can happen through both visual and auditory cues. Our previous work showed that musicians in a professional string quartet swayed their bodies more synchronously, while information flow between their body sway decreased, as they played an unfamiliar piece together eight times in succession. However, this inverse relationship between information flow and synchrony has yet to be explored in the sounds themselves. **Methods**: To investigate how musicians use auditory cues to coordinate their musical expression, we analyzed isolated audio recordings of the same eight performances and calculated the amplitude envelope (sensitive to dynamic changes) and spectral flux (sensitive to spectral content) time series from the audio of each instrument. We measured group-wise information flow using average bidirectional Granger causality (how well the past of each musician's sounds predicted others', and vice versa) and synchrony using average zero-lag cross-correlation. **Results**: Linear mixed effects models showed that average information flow between the envelopes decreased as synchrony increased across the performances, in line with the previous analysis of body sway in the same ensemble. These results are consistent with the interpretation that the formation of a learned internal model allows musicians to predict each other more accurately and therefore coordinate more effectively, because the musicians' sounds were less predictive of each other over time (decreasing Granger causality values) as they played more synchronously (increasing cross-correlation values). **Implications**: Findings will be discussed considering the sensitivity of these trends to auditory representation (amplitude envelope versus spectral flux)—which alludes to the relative importance of these auditory features in sound-based musical communication—and in relation to previous results on information flow in other modalities.

Comparing Dance and Aerobic Exercise With and Without Music on Cognitive Function in Older Adults With Mild Cognitive Impairment

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T-C1-1

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Introduction: Physical exercise is a promising non-pharmacological intervention for maintaining cognitive function among older adults with mild cognitive impairment (MCI). Although many forms of exercise are supported by music, the role of music in enhancing the cognitive benefits of exercise has not been fully explored. This network meta-analysis compares the effectiveness of aerobic exercise with music (AEwM), aerobic exercise without music (AEwtM), and dance on seven cognitive domains in older adults with MCI, employing the Bayesian statistical model. **Methods**: Randomized controlled trials were identified from individual studies from an overview of reviews and a literature search across five databases that targeted studies published within the last three years up until January 2023. Independent reviewers selected studies, assessed the risk of bias, and evaluated the quality of evidence. **Results**: Twenty-five trials from 38 papers, including 2,048 participants with MCI, were analyzed. The five included AEwM trials used music as a background stimulus. The relative rankings indicate that AEwM has the highest probability of being the most effective for improving global cognition, executive function, and processing speed. Dance is likely the most effective for enhancing three dimensions of memory – working memory, learning efficiency and retrieval fluency. The rankings for visual processing were similar across the three interventions. **Implications**: These results suggest that integrating music into exercise benefits cognition beyond aerobic exercise alone. A theoretical framework, the *Music Exercise Synergy (ME-Synergy) Model*, is proposed to explain the interactive benefits of combining music with exercise on cognition. The benefits of exercise are amplified by music through six mechanisms: overlap in brain networks, emotional impact, attentional impact, leveraging repetition in music, precision of musical timing, and musical agency. Both AEwM and dance incorporate the benefits discussed in the ME-Synergy model. Dance, as a music-coordinated exercise that requires synchronization to music, may offer additional impact on memory because of its psychological, social, cognitive, and neurobiological benefits.

Dance Begins Early in Infancy, Even in a Representative Sample of U.S. Infants

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T-C1-2

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Dance is a universal human behavior and crucial to human musicality. When and how does the motivation and tendency to move to music develop? Kim and Schachner (2023) found that most infants produce recognizable dance within the first year of life, but tested a non-representative sample that likely over-represented highly-musical, high-income families. Here, we test a representative sample of U.S. parents of infants aged 0-24 months, recruited via CloudResearch. Parents were surveyed regarding their child's current and earliest dance behavior (as in Kim & Schachner, 2023), their musical background (Müllensiefen et al., 2014), and musical experiences at home, including secondary measures of how much infants moved to music (Politimou et al., 2018). Of our preregistered sample size (*N*=360), we have currently tested *n*=349 participants (55.9% women), representative of the U.S. regarding location, race/ethnicity, household income and education level. We find that dance begins early in infancy, even in this representative sample. 77.1% of infants danced, and most produced recognizable dance behavior within the first year (80% by 11.1m), comparable to the rates found by Kim and Schachner 2023 (76.6% of infants danced; 80% by 10.4m). Demographic variables of location, race, income, education, and parent age did not predict additional variance when added to a model predicting how much infants moved to music from their age (nested model comparisons; all $ps > 0.1$). Parent musicality was a significant predictor of infants' movement to music ($p < .001$). Ethnicity (Non-Hispanic>Hispanic, $p = .05$) and parent gender (women>men, $p < .01$) were also significant predictors; this may be due to differences in amount of time spent with infants (as reported by participants), which would impact parents' likelihood of observing movement to music. Overall, these findings suggest that dance develops early in infancy and generalizes across a representative U.S. sample, requiring relatively little enculturation.

Entrainment to Audiomotor Feedback: Preliminary Evidence and Model

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T-C1-3

Humans are remarkably proficient at picking up the beat underlying an auditory rhythm and using it as a temporal scaffold for action. But do sounds we make ourselves have the same effect on us? In this presentation, we will share preliminary evidence supporting an affirmative answer, and spell out some surprising implications for our theoretical understanding of rhythm perception and production. Our experiment consists of a simple synchronization-continuation task with auditory feedback from taps. In some trials, the feedback from either the last synchronization tap or the first continuation tap is slightly delayed. Preliminary data from nonmusicians (*N*=9) suggest that these transient delays induce delays in the subsequent tap, both during continuation (20ms, $p < .001$) and during synchronization (9ms, $p = .003$), analogous to the "phase correction responses" induced by delayed metronome clicks. The continuation result is consistent with similar results from Wing (1977) but inconsistent with the classic Wing-Krisofferson "open loop" model of continuation tapping; the synchronization result is novel, and is inconsistent with classic "error correction" models of synchronization, but instead suggests a "mixed resetting" model as proposed by Hary and Moore (1987). We model these results by assuming that both the metronome and the tap feedback are providing input to the same oscillator representing our perception of a beat. This oscillator entrains partially to the metronome and partially to the tap sound and determines the timing of the next tap. Our model, based on the PIPPET model of beat perception (Cannon 2021), forms a bridge between motor and perceptual measures of entrainment. Entrainment by both external and feedback cues helps to account for motor influences on rhythm perception, and offers a new perspective on the blurring of the self/other distinction during synchronization. Further, the idea of that we entrain to our own motor feedback provides a plausible new hypothesis for the core evolutionary function of our sense of rhythm: anticipating the feedback from our own rhythmic actions (e.g., gait).

Timbre Semantics of the Singing Voice

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T-C2-1

Linguistic descriptors provide insight into how we perceive and conceptualize timbre. Timbre semantic studies have focused primarily on instruments; thus, we know relatively little about descriptive lexicons for voices. Here, we model vocal timbre descriptors, compare vocalists' and instrumentalists' vocabularies, and analyze semantic differences across genres. This work represents the first large-scale empirical study of vocal timbre descriptors, with implications for vocal pedagogy, timbre cognition, and musical meaning. Participants listened to 30-second clips of solo voice without accompaniment. After each clip, they freely described the singer's vocal timbre. Stimuli for Study 1 (N=31) included 30 excerpts performed by 12 singers (jazz, opera, and musical theatre). Participants in Study 2 (N=31) heard 24 excerpts from 24 singers (R&B, pop, rock, and country). Whereas Study 1 controlled for musical content and lyrics, Study 2 included a greater diversity of singers. Interviews were parsed into component ideas and lemmatized. Content analysis from both studies yielded a model with 65 descriptor categories and 11 thematic categories. The most significant categories include rich/round, full/strong, breathy/airy, natural/authentic, and consistent/steady. Tallying the most frequent descriptors of individual singers revealed consistencies within the seven musical styles represented in the study. We observed differences between vocalist and instrumentalist participants—e.g., vocalists more often used certain terms directly related to the feeling of producing the sound they were listening to. This identification of intersubjectively consistent timbral descriptors of singing voices supports the theory that musical communities develop shared timbral lexicons. Our data characterize common perceptions of vocal timbres in seven musical styles and offer preliminary evidence of systematic linguistic variation between participant populations.

A Cross-Cultural Comparison of the Timbre-Semantic Space of Chinese Instrumental Sounds

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T-C2-2

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Timbre, a multidimensional attribute, is difficult to define. Physical properties of a sound do not always map predictably onto perception, although they can be apprehended consistently enough to possess a shared frame of reference between people. Reymore (2020) used a 20-dimensional model to verbally characterize prototypical (imagined) Western orchestral instrument timbres. However, it is not known whether this model is useful for characterizing instrument timbres from other musical traditions in a cross-cultural context. This study investigated whether it could be similarly used to portray Chinese orchestral instruments, and if there were differences when listeners were not familiar with these timbres. Sixteen recorded Chinese orchestral instrumental sounds from the CCMusic dataset, with representatives of each instrument family, were used as stimuli. Two groups of participants, native Mandarin speakers in Beijing (n = 42) and native English speakers in Montreal (n = 43), were recruited. Participants had a range of musical experience. They had to rate on a seven-point continuous scale how well each of Reymore's 20 semantic terms (translated into Chinese for the Chinese participants) described the instrument sound presented. In general, both English and Chinese participants had similar conceptualizations of the timbre they perceived, having similar top-rated and bottom-rated terms for each sound. However, there were differences in some terms, likely related to how they were translated and differences in familiarity with the instruments. Multidimensional scaling was performed based on Euclidean distances between sounds computed from the ratings. Results suggest that three dimensions (sustained-percussive, brighter-darker, and noisy-harmonic) best describe both Chinese and English participants' conceptualization of sounds. Chinese participants show a clearer conceptualization of instrument families, again demonstrating differences due to familiarity with the instruments. This cross-cultural study extends the 20-dimensional timbre-qualia model to a different music tradition and linguistic culture, increasing the potential of applying the model to musical sounds outside of the Western orchestra. It furthers our understanding of how semantic terms are used in processing familiar and unfamiliar musical sounds.

What Makes My Synthesizer Sound Sparkly? Inventory of Timbral Associations

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T-C2-3

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Musical description is near impossible without metaphor. Certain timbral descriptors have been adopted into the common musical lexicon (e.g. “bright” and “dark), while other plausible metaphors have less standard usage as auditory descriptors (“sweet” or “bitter”) but have nevertheless been observed in previous scientific research to elicit common associations in listeners (Guetta and Loui, 2017). Despite a vast literature of systematic and empirical analysis of the timbral contributions to instrument classification and auditory scene analysis, scant research has examined the acoustic and timbral parameters that contribute to common lexical descriptions of timbral qualia. Our research aims to systematically measure correlations between specific timbral features in manually-generated audio samples and to evaluate their semantic associations with a set of descriptive words. In this study, participants were asked to choose an audio sample that best matches a given adjective (24 total). Audio samples consisted of 1s complex tones at a single pitch (C4) using different base waveforms (triangle, sawtooth, square) with varying levels of timbral alterations (low/highpass filtering, attack time, signal-to-noise ratio, reverb time). For each adjective, participants chose from the same grid of 20 audio clips (presented in three blocks, each with a different base waveform). Our findings indicate that 3 of these alterations—spectral filtering, signal noisiness, and reverb—elicit significant consistent associations with a breadth of descriptive words, especially those relating to size, shape, and weight. We predict that our results will be useful in the field of audio and music technology design, as they indicate a collection of non-technical terms which can be expected to elicit similar associations across English-speaking individuals.

‘Groove and Grit’: Relationships between Musical Reward, Resilience, and Personality

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T-C4-1

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Physician Debasish Mridha states, "Music can heal the wounds that medicine cannot touch." Yet, while younger generations have unprecedented access to music through digital platforms, research demonstrates a growing concern for mental health among young adults. Studies investigating the resilience of young adults highlight the importance of opportunities for meaningful participation that nurture self-reliance and task-oriented coping strategies. While it is well-established that music functions in emotion regulation, promotes recovery from injury, and facilitates well-being generally, the relationship between individual resilience and the specific domains of musical rewards is not as well understood. Here we investigate the role of resilience in its interaction with musical reward and personality traits. To investigate these relationships, undergraduate students (*n*=1,662) completed an online questionnaire that integrated the extended Barcelona Music Reward Questionnaire (eBMRQ), the Brief Resilience Scale, and the Big Five Personality Index (BFI). The eBMRQ was developed to examine how people experience reward associated with music along six categories: Music Seeking, Mood Regulation, Emotion Evocation, Sensory Motor Behavior, Social Rewards, and Absorption. The Resilience Scale quantifies one’s perceived ability to recover from difficulty, and the BFI distinguishes five universal personality traits: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Analysis shows a strong, significant correlation between Sensorimotor Reward (i.e., physical engagement with music) and higher resilience ($r = .767, p < .001$). Personality trait Openness shows a moderately strong relationship to musical reward overall ($r = .454, p < .001$), though not resilience. While trait Conscientiousness shows the most significant positive correlation with resilience ($r = .250, p < .001$), the Neuroticism presents a stronger negative correlation ($r = -.297, p < .001$). Higher Neuroticism is generally more associated with a range of life challenges and outcomes. Most notably, the least resilient group were those with high Neuroticism, and low musical reward from Social Connection and Absorption. In contrast, Neurotic respondents who reported musical reward from Social Connection and Absorption showed near-normal resilience scores.

The Relationship Between Pupil Reward Response and Melody Predictability in Piano Learning

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T-C4-2

Music has been documented as a pleasurable experience that can induce subjective, physiological, and neurological reward responses. This relationship is believed to rely on predictive processes that link pleasure with prediction errors during music listening. Through these predictive processes, musical reward has also been linked to motor activity during music performance due to the planning and coordination of motor movements necessary to play music. Given that reward value can affect motor learning and that prediction plays a role in motor planning during music performance, it's possible that predictability and reward interact to influence motor learning. To test this interaction, we developed a paradigm in which non-musicians (*n*=36) learned to play melodies that vary in their level of predictability and by extension, induced reward. Participants listened to the melodies while pupil dilation was recorded and gave subjective ratings of how much they liked each melody. Pupil dilation has been found to be a marker of reward response to both musical reward and predictability. Following the listening task, participants completed a piano task in which they learned to play the endings of the melodies. Melodies were constructed so that the first 9 notes varied in predictability, but the last 4 notes had similar predictability. This ensured that the motor requirements of the 4 notes that participants played were consistent across stimuli. Learning was assessed via accuracy and asynchrony of keypresses across 15 trials. Participants successfully learned the melodies, displaying decreased asynchrony and increased accuracy as trials progressed. Listeners showed a greater pupil response to moderately predictable melodies and diminished dilation for the most complex melodies. There was an interaction between melody predictability and pupil dilation, in which more unpredictable melodies were learned better when they were accompanied by a greater pupil response. This effect of pupil dilation suggests that motor learning of musical stimuli is influenced by subjective and physiological reward processes.

Rewarding Music Enhances Memory for Posteriorly Encoded Information

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T-C4-3

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Humans have remarkably accurate memory and imagery for music. We often also vividly remember episodic details surrounding a pleasurable musical experience – consider the case of remembering the meal you ate before or after a concert. Music, an abstract reward, is known to activate the brain's reward system and induce the release of dopamine, which is critical for encoding and consolidating memory. Relatedly, recent evidence points to a time window extending backwards and forwards in time during which a dopamine-releasing event may facilitate long-term memory for unrelated weakly learned information (a memory "penumbra"). This involves the setting of a biochemical "learning tag" by a weakly encoded event, which may enter long-term memory if paired with plasticity-related proteins (PRPs) elicited by an independent, strong event. In the current project, we explore whether listening to rewarding music induces long-term memory enhancement for posteriorly encoded images. Participants completed two encoding sessions one week apart in which they either listened to self-selected rewarding music or to emotionally neutral songs (i.e., elevator music). Immediately after music listening, participants were presented with 50 images. Participants completed an Old/New + R/K/G paradigm 24h after each encoding session. Data (N = 26) showed that, as expected, self-selected music induced higher pleasure (both continuous and overall) and a higher number of chills than emotionally neutral stimuli. We found that pleasure experienced during music listening significantly predicted both recognition (d-prime) and recall (number of remembered images) for images presented after the music, and that memory performance was higher for self-selected rewarding music ($p < 0.001$). To summarize, we found that people have better memory for images after an experience of high musical reward than after neutral music. We hypothesize that this effect occurs via dopaminergic signaling of the mesolimbic pathway, providing support to the concept of a dopaminergic penumbra.

Geometric Relationships Across Notes Constitute a Primitive in Melodic Processing

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T-D1-1

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How do the notes included in a melody affect its processing? The interactions and relationships among collections of notes are surprisingly intricate, and their impact on perception is not well understood. Theoretical accounts have suggested that musical sets - the relational structure resulting from any collection of notes bound within the span of an octave - constitute a critical aspect of music perception. However, empirical work which directly engages with this foundational construct remains limited. We introduce a simple behavioral protocol to test the hypothesis that musical sets, and their geometric structure, serve to facilitate a sense of note membership during melodic processing. Specifically, this task measured participants' ability to detect subtle note deviations in melodies generated from distinct set structures. Based on data collected from hundreds of participants across three experiments, we demonstrate that certain sets wholly alter our sensitivity to note deviations in melodies. We further show that geometric properties, including the evenness of spread of notes within the span of an octave, as well as the intervals found within a set, capture these effects across a variety of musical structures. Altogether, our results position musical sets as a primitive representation in melodic processing and uncover geometric measures that account for their role in music perception.

Listeners' Abstraction of Melodic Prototypes

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T-D1-2

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The ability to abstract underlying structure from the ongoing stream of perceptual information represents a fundamental psychological ability that observers use to make sense of their constantly changing worlds. Within audition, investigations have focused on speech information (e.g., statistical learning of non-sense syllables), or on music-theoretic structure, such as tonal hierarchy information. Here, two experiments extended such investigations, exploring an analogue of Posner and Keele's (1968) classic research on prototype abstraction. In the first experiment, four random note "prototype" melodies were created, along with varying levels of distortions of these melodies in terms of the size and frequency of pitch intervals in these distortions. Four groups of listeners (N = 24 per group, no musical training selection criteria employed) learned to categorize prototype distortions, with the different groups varying as a function of the degree of distortion initially experienced. Generalization of learning tested using melodies of a higher distortion level than the initial learning phase. Comparison of categorization accuracy in initial learning and generalization revealed that differences in performance between phases decreased systematically with increasing distortion level. Thus, the more difficult the initial learning, the better listeners were at generalizing learning to a set of even more distorted melodies. Experiment 2 more explicitly tested the abstraction of melodic prototypes, employing a recognition memory paradigm in which listeners received blocks of study-test trials. In study phases listeners (N = 24, no musical training selection criteria employed) heard varying levels of distortions of a prototype, followed by test phases in which listeners heard original study melodies, new distortions, and the original prototype. Recognition scores revealed reduced accuracy for the previously unheard prototypes, with listeners misidentifying these prototypes as being heard. This finding indicates an abstraction of prototypes based on hearing distortions of these melodies. Together, these experiments demonstrate the processes of abstraction in melodic processing, and suggest that memory for musical surface can be distorted by abstracted representational structure of these materials.

Room Acoustic Information Enhances Auditory Spatial Attention as Reflected by Alpha Oscillations

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T-D1-3

Listening to music or speech requires us to process auditory input together with sound source information. Research on visual and auditory spatial attention has revealed that hemispheric asymmetry of the alpha-band (8-13 Hz) power modulation is related to the location of the attention-capturing deviant, while the right hemisphere is generally involved in auditory attention. However, it remains unclear how room acoustic information interacts with sound localization processes during involuntary attention orienting and how those processes affect alpha oscillations. We recorded EEG from participants during passive listening to an oddball paradigm while watching a silent movie with subtitles. The standard stimuli consisted of complex tones (300Hz and 2000Hz fundamental frequency), originating in front of the listener, and convolved with the room-acoustic information of either a big or small room. We included 3 deviant types at each 7.5The EEG data were epoched into a 4-second window (-2 to 2) around each deviant. We then applied time-frequency analysis using the Morlet wavelet to extract the time course of the induced alpha power. Our results showed that standard trials resulted in alpha suppression (500ms) in the right parietal region. In contrast, deviant trials elicited an alpha power increase around the same latency and in the same region. The double-deviant condition elicited the strongest power increase, including in the left-parietal area. Furthermore, the double deviant showed significantly larger power increase compared to the summation of the two single deviants in left-frontocentral and left- and right-parietal regions. Our results support the notion of longer-lasting alpha over parietal areas related to deployment of auditory spatial attention, and extend it by showing the synergetic enhancement of the attentional resources when reverb processing is combined. These findings provide valuable insights into how spatial sound representation is constructed and used for attention orienting, when reverberation information regarding a room size and sound object distances are present.

Musical Microrhythm: Context Effects of Envelope Shape

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T-D2-1

Background and Motivation: The envelope shape of a sound affects its perceived temporal placement. Sounds with "soft" onsets have a less certain temporal location than sharp sounds. In this study, we asked if the perceived temporal location of a sound is also affected by the prevalence of soft vs. sharp envelope shapes in its sonic context. **Materials and Methods**: 35 participants (12 female) were asked to align a 1ms click to a 100ms noise burst with a 50ms rise time. This test trial was conducted as one of a series of alignment trials forming blocks of contrasting sonic contexts: In the click block, clicks were heard in every trial, while in the noise block, noise was used as the probe and a click was thus heard in the test trial only, that is, in 25% of the trials. A mixed block where click and noise probes were balanced (clicks heard in 62,5 % of the trials) was used as control. Both probe and target were presented in a looped fashion at a 600 ms interval with a random offset. **Results**: In the click block, the click was placed 15 ms after noise onset, while in the noise-probe block, it was 33 ms after noise onset ($p < .001$). Stdev of click placement was greater in the noise block (18 vs. 13 ms; $p < .001$). The effect is absent in the control block where the number of click and noise probes were balanced. **Conclusions and Implications**: In contexts where soft sounds predominate, there is greater uncertainty about their temporal location. This uncertainty may require greater temporal overlap for simultaneity. Uncertainty may also bias the listener's perception in the direction of the context due to a central tendency of judgment. Articulation-related context effects may play a role in our perception of musical simultaneity and coordination.

Equating Perceived Duration Between Flat and Percussive Tones Through an Adaptive Staircase

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T-D2-2

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The extensive literature on duration assessment generally uses tones with constant amplitude 'flat' envelopes, despite a paucity of such sounds in everyday listening (Schutz & Gillard, 2020). At the same time, a small but growing body of research documents ways in which these simplistic sounds elicit different perceptual responses than more complex, time-varying tones, particularly with decaying amplitude. This is especially true with respect to assessment of duration perception; not only do people perceive decaying tones to be shorter, but the strategy individuals use to perceive duration of complex sounds may be based on slope of decay rather than absolute duration (Grassi & Darwin, 2006; Grassi & Pavan, 2012, Schlauch et al., 2001; Vallet et al., 2014). Duration perception also differs between individuals, particularly based on musicianship due to the importance of timing in music (Güçlü et al., 2011). To facilitate future research on duration perception in sounds with time varying (vs flat) amplitude envelopes, here we used an adaptive staircase procedure to determine the precise ratio of equivalence between percussive (decaying) and flat tones. Specifically, we presented flat and percussive tones in pairs; with participants indicating which sounded longer. We administered a survey measuring musicianship beforehand. Each response changed the duration difference between stimuli on subsequent trials until responses 'converged', which we defined as four consecutive changes in response decision. One instance of these trials constituted a single staircase; we then calculated the point of subjective equality (PSE) between flat and percussive tones by finding the average point of convergence between multiple, interleaved staircases. We found a ratio of flat to percussive duration of approximately 1.66 (SD = 0.41). The ratio remained mostly constant between higher and lower starting durations. Musicians were closer to this ratio compared to non-musicians and expressed less variance in their PSEs when comparing identical envelopes. Beyond providing guidance on stimulus durations for studies comparing amplitude envelope, we shed light on duration assessment in sounds with time-varying amplitude envelopes. Future experiments aim to explore variance surrounding this ratio by running a small number of participants in-lab rather than online.

Better Alarms Through Musical Insight: More Detectable, Less Annoying

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T-D2-3

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Auditory alarms are crucial in conveying information within safety-critical environments such as hospitals, traditionally they use sustained harmonics lacking the varying amplitude envelopes seen in natural sounds. This design is problematic as they are difficult to detect, leading users to increase the volume which consequently increases annoyance (Lerner et al., 1996; Schlesinger et al., 2018). Here we explore how insights from musical instruments can improve alarm efficacy by balancing annoyance and detectability of the sounds in isolation. We used the musical triangle as it's known to "cut through" large ensembles without being intrusive. We synthesized the triangle tone by analyzing a recording of the instrument and combining its key acoustic properties to replicate the timbre. This includes complex inharmonic spectra and decaying amplitude envelope. We then tested (1) our triangle to a (2) standard alarm tone similar to those found in safety-critical devices. The standard tone follows a conventional design with a flat amplitude envelope, and a fundamental frequency at middle C with four harmonics. We conducted two experiments, assessing (1) detection and (2) annoyance. For detection, 36 participants indicated if they heard the stimuli in a range of signal-to-noise (SNR) ratios (-18, -21, -24, -27, -30 and -33) across both tone types while listening to vocal instructions acting as noise. For annoyance, 44 participants rated the relative annoyance of all tones used in the detection experiment in a two-alternative-forced choice task (presented here in pairs). Participants reported triangle tone as less annoying than their flat counterparts at every volume condition [$X^2(1, N = 5808) = 301.82, p < .001$]. Moreover, although reduction in the SNRs predictably reduced detectability for the standard tone [$F(5, 175) = 46, p =< .001$], similar reductions in SNR did not harm detectability of the musical triangle [$F(5, 175) = 5.56, p =< .001$]. Together, these results suggest that features of musical instruments such as the triangle provide a useful source of ideas for reducing alarm annoyance while preserving detectability.

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Is Music Sophistication Associated with Memory Preservation in Healthy Older Adults?

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T-D3-1

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PURPOSE: Memory loss is a leading indicator of cognitive decline in aging adults. Prior research has highlighted connections between music sophistication sub-factors (perceptual abilities, musical training, emotional response to music), verbal fluency, and executive function in cognitively impaired older adults (Petrovsky et al., 2021). This pilot study aimed to explore whether music sophistication, encompassing emotional responsiveness to music and perceptual abilities, correlates with memory recognition in cognitively intact, physically active, biologically male and female older adults. **METHOD**: Thirty-nine (complete data *n*=30) physically active and cognitively sound (based on Mini-Mental State Examination) older adults (60+ years), volunteered to participate. Participants completed the Beck Depression Inventory (BDI), the State-Trait Anxiety Inventory (STAI-Y), and the Goldsmiths Musical Sophistication Index (Gold-MSI) before completing an object recognition memory task. Separate linear regression models, with sex as a covariate, were conducted to determine if music perceptual abilities (PA), musical training (MT), singing abilities (SA), emotional response to music (EM), and general music sophistication (GM) were associated with object recognition memory performance. **RESULTS**: No statistically significant relationships were established between MT, SA, GM, and object recognition memory performance. Although positive relationships were observed between both PA ($p = 0.055$) and EM ($p = 0.074$), and recognition memory performance, they were not statistically significant. **CONCLUSION**: Our preliminary findings suggest that music sophistication may play a protective role for memory performance in healthy older adults. However, larger prospective studies are needed to comprehensively understand the impact of music sophistication on memory preservation in cognitively intact older adults.

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Investigating the Ingredients of Importance to Melodic Intonation Therapy: Cue Types and Beat Perception Ability

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T-D3-2

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Aphasia is a communication disorder that causes an individual to have trouble comprehending and/or producing language. Although their ability to speak has been affected, their ability to sing linguistically accurate words and phrases often remains intact. Melodic Intonation Therapy (MIT) has been shown to help reestablish speech and motor pathways through exaggerating the normal melodic content of speech to make phrases be produced as song. Additionally, tapping to the syllabic beat during MIT has been shown to enhance treatment, but only in those with intact beat perception. It is unclear if other cue types might be beneficial to those with varying beat perception. This case series study investigated how internal (tapping) and external (visual and auditory) cues affect MIT performance in three participants with nonfluent aphasia possessing low, medium, and high beat perception over the course of five days. For each of the five days, participants first practiced phrases during MIT tasks with no cue and then experienced the three cues in a randomized order. Trends in the data showed all participants improved in the number of correct syllables produced between pre and post-tests. When considering cues, the participant with high beat perception performed better when using both internal and external cues compared to no cue. The participant with low beat perception performed better when only using external cues compared to no cue. The participant with medium beat perception did not demonstrate any cue benefits compared to no cue, possibly due to ceiling effects. This study may be the first to demonstrate that external cues are beneficial to use during MIT for those with aphasia, regardless of beat perception ability. The findings also stress the importance of taking beat perception ability into consideration during treatment, consistent with prior work supporting the individualization of MIT.

Following the Sound of Music: Comparing the Effects of Music vs. Non-Music Based Interventions on Auditory and Cognitive Processing in Older Adults

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T-D3-3

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Age-related listening difficulties can be socially taxing and impede communication abilities in older adults. Music-based interventions involving focused music listening may have positive impacts on auditory processing and cognitive processes such as attention and working memory. These effects may in turn lead to improvements in understanding speech in noisy environments. Here, we present current methodologies of an ongoing project intended to compare the effects of music and non-music based interventions on these outcome measures. The aims of this study are to develop an active music listening intervention that models some of the cognitive interactions that would be found from learning to play an instrument, however without the physical requirements and other access issues related to playing instruments. The active music intervention will be compared to passive music listening and an active control intervention engaging in the same tasks but without musical sounds. Our goal is to determine whether experimental and control interventions differentially impact auditory processing, attention, and working memory, and how these changes in turn may mediate improvements in speech-in-competition. Feasibility and acceptability testing of music and non-music based interventions have been conducted through a combination of paper and digital pilots, with results indicating high levels of participant engagement and enjoyment. Development of the final, app-based intervention is currently underway. Here we will present both on the study design, as well as the design process. This includes both the composition of musical pieces that are appropriate for cognitive exercises and game and software design processes required to create engaging, well-controlled experiences. The game is developed using Unity and the Portable Automated Rapid Testing (P.A.R.T.) application, creating a high potential for accessibility of this intervention to the broader public.

Intermodal Analysis of Emotion Inference: Examining Shared Processes in Music and Social Contexts*

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T-D4-1

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The intricate relationship between music and emotional experiences operates at both individual and societal levels. Despite the pivotal role of emotional interpretations in these experiences, there is limited research exploring the connection between emotional decoding in music and social contexts. This study addresses this gap through two primary objectives: 1) examining shared processes of emotion inference in music and social-emotional contexts, and 2) comparing modality effects in these domains. In this experiment, the Empathic Accuracy paradigm engaged 36 participants in real-time emotion inference on a 9-point scale (1: '*very negative*' - 9: '*very positive*') while watching a video. The video comprised 18 piano performances and 18 personal autobiographical stories, with pianists and speakers portraying *joy/happiness*, *sadness*, and *anger* through improvisational music and spoken narratives. Stimuli were presented in three modalities (visual-only, audio-only, and video-and-audio), with counterbalanced orders. Each participant's accuracy was measured by comparing inferred emotions to correct answers (pianists' self-reported emotions for piano performances and speakers' self-reported emotions for autobiographical stories) using linear mixed-effect models. The data analysis was followed by the separation of data into positive (*joy/happiness*) and negative (*sadness and anger*) valence. Pearson correlations were conducted to examine the relationship between accuracy across different emotional contexts (RQ1), while a three-way repeated measures ANOVA (*context x valence x modality*) was employed to explore the modality effects (RQ2). Results indicated a positive correlation ($r = 0.38, p = 0.023$) between accuracy in decoding negative emotions in social situations and negatively valenced music, suggesting a shared ability to interpret negative emotions across contexts. The second analysis showed higher accuracy in social situations than in music, except in the visual-only condition ($F(2, 70) = 32.59, p < 0.001$). This study implies a shared emotion decoding process between music and social contexts, potentially leading to the transfer effects of musical experiences to social-emotional abilities. Additionally, the results underscore the possibility of auditory superiority over visual cues, emphasizing the significance of audio in both musical and social contexts.

Music Behind Bars: Learning About the Musicality of a Person Experiencing Incarceration Reduces Negative Social Attitudes Towards Them

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T-D4-2

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Learning about others' musicality makes us judge them as more wrong to harm, by signaling their heightened emotionality, intelligence, and prosociality (Agrawal et al., 2023). We test if these findings can be applied to reduce prejudice towards marginalized people: Does learning about the musicality of a marginalized individual (here, a person experiencing incarceration) reduce negative attitudes towards them? In a large, preregistered study (*N*=720, on Prolific), participants made social judgments about people experiencing incarceration, both before and after watching a video of a real person in prison (<2 minutes; from documentary 16 Bars). Across conditions, we manipulated whether the video demonstrated evidence of musicality, or of prosociality/emotionality without music. Musical videos featured original songs performed by the marginalized individual; Non-musical videos (matched for duration) featured the same individual in a similar setting verbally expressing prosocial emotions (remorse for actions; concern for loved ones). We predicted that musical videos would reduce prejudice as much or more than the prosocial/emotional videos. Musical videos significantly increased feelings of warmth ($t(719) = 19.08, p < .001$), reduced blatant dehumanization ($t(719) = 5.75, p < .001$), and improved judgments about the beauty, goodness, pleasantness, honesty, and niceness of people in prison ($t(719) = 11.79, p < .001$; including corrections for multiple comparisons). Musical videos also resulted in a significantly greater increase in monetary donations to a relevant charity than non-musical videos ($p = .014$; participants chose what proportion of their monetary bonus they were willing to donate). For all other measures (warmth, dehumanization, semantic scales), musical and non-musical videos were equally effective at reducing prejudice. Other factors (e.g., music genre, video duration, target/participant race) also significantly predicted social attitudes. Overall, this brief video intervention (showing others' musicality) holds promise as a tool to change attitudes and behavior toward marginalized people at a large scale, with direct applications for policy, education, and the value of music in the public sphere.

The Social Origins of Voluntary Pitch Control: An Experimental Study of Dogs Howling to Music

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T-D4-3

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Human singing involves voluntary control over pitch patterns, unlike singing in other primates (such as gibbons) whose pitch modulations are thought to be largely instinctive. Darwin theorized that human voluntary pitch control originated in the context of solo courtship songs that predated the evolution of speech, analogous to avian courtship songs. However, an alternative possibility is that our voluntary pitch control arose during coordinated group singing. Primates are highly social animals and recent work shows that group singing is the dominant form of human song cross-culturally. Is there any evidence that social animals have evolved voluntary pitch control during group vocalization? Biologists have theorized that wolves who howl together purposefully detune their pitches from each other to sound like a larger pack. To test the hypothesis that canines have voluntary pitch control when howling, we studied dogs who howl reliably to music or sirens, focusing on ancient breeds that are closer to wolves genetically. In a citizen-science experiment, dogs howled to the original version of their howl-triggering sound and to versions shifted up and down by 3 semitones. Each howl's mean fundamental frequency (F0) was measured using pitch-tracking algorithms in order to compare overall mean F0 when howling to upshifted vs. downshifted stimuli. Six dogs produced enough howls for statistical analysis (at least 30 howls/condition): four Samoyeds and two Shiba Inus. All four Samoyeds showed a significant difference in their mean F0 when howling to higher vs. lower versions of their howl-triggering songs, suggesting that domestic dogs may have voluntary control over pitch when howling with other pitched sounds. More broadly, these results suggest that voluntary pitch control could evolve in the context of group vocalization and point to canids as a promising group for research on the early stages of voluntary pitch control in animal evolution.

Melody and Lyrics Contribute to Song Recognition Among Infants

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T-E1-1

Musical recognition capabilities emerge well before the first birthday. Familiar songs elicit enthusiastic and engaged responsiveness, but how infants use different musical properties to recognize well-known pieces remain unclear. Here we explore whether infants rely on melody and lyrics to recognize music they frequently hear at home by comparing their attentive listening and movement preferences across song conditions alternating in melody and lyric familiarity. Infants (*N* = 128) familiar with the children's song Wheels on the Bus were recruited across three age groups (6-mo, 11-mo, 20-mo) to participate in a preferential listening experiment hosted over Zoom. Infants sat on their caregivers' laps during the experiment, and caregivers (instructed to avoid directing their child's attention) listened to masking music via headphones from a separate personal listening device. Infants listened to four acapella recordings across 16 trials: Wheels, an original composition matched in rhythm and pitch range, and two "mismatched" songs that contain the melody from Wheels paired with lyrics from the original composition, and vice versa. Infants' attentive listening to each trial was measured via live-coded looking time toward the screen. Infants' movements and iconic gestures (i.e., actions that match semantic meaning behind lyrics presented) were annotated post-experiment. The youngest infants did not differ in listening time or movements to familiar and novel melodies and lyrics ($ps > .12$). By 11 months, infants 'danced' more frequently when the well-known melody and lyrics were paired (Wheels, $p = .04$). In contrast, 20-month-olds preferred novel cues, listening less only to Wheels ($p = .01$). The oldest infants also demonstrated more iconic gestures. Among trials where iconic gestures were observed, over 70% saw movements aligned with the lyrics, regardless of lyrical familiarity (e.g., arm rolling to "wheels on the bus go round…" or arms extended to "plane in the sky goes up…"). Present findings suggest that infants integrate well-known melodies and lyrics to identify familiar songs by their first birthday when musical engagement is considered through multiple behavioural measures.

The Predictive Role of Infants' Home Music Environment on Their Vocabulary Development

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T-E1-2

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Informal music experiences and engagement (e.g., parent-child singing activities) are common in infancy and early childhood. However, the specific role of the early home music environment in fostering infants' language development is less clear. Emerging yet limited work has established positive links between infants' early home music environment and their later receptive vocabulary development. In the present longitudinal study, 43 parents completed the Music@Home questionnaire to capture their 6-12 month old infants' home music environment (overall home music environment measured by the general factor and parental singing measured by the Parent Initiation of Singing subscale score). They then completed the MacArthur-Bates Communicative Development Inventory at 18- and 24-month follow-up timepoints as a measure of their infants' expressive vocabulary development. Parents also completed measures of their musicality (Goldsmiths Musical Sophistication Index), parent-child attachment (Maternal Postnatal Attachment Scale) and parental verbal responsiveness (StimQ2-Toddler). Linear regression analyses including infants' enrollment age, parents' musicality, education level, verbal responsiveness, and attachment as covariates were employed to assess whether the general home music environment and parental singing were significant predictors of infants' vocabulary development. Results demonstrated that parental singing at 6-12 months significantly predicted infants' vocabulary size at both 18 months ($\beta = 4.96, p = .015$) and 24 months ($\beta = 22.7, p < .001$), even when accounting for demographic and parental factors. Infants' overall home music environment predicted infants' vocabulary only at 24 months ($\beta = 6.77, p = .012$). This relationship could be explained by multiple mechanisms, including a causal explanation where parent singing facilitates word learning due to specific properties of infant-directed singing, gene-environment interactions, whereby genetic predispositions for musicality in families may influence vocabulary development, as well as the potential role of other unmeasured factors, such as the amount of time parents spend with their child. Findings also motivate further research on how enriched home musical environments may be a potential protective factor in developmental speech/language disorders.

Musical Expertise Affects the Rhythmic Perception of Sung and Spoken Speech Syllables

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T-E1-3

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Background and Motivation: Previous research has shown that musicians with different genre-specific expertise may hear the same sound in different rhythmic locations relative to an established beat, and may also have different tolerances regarding the synchronization of those sounds. The current study extends this investigation from instrumental to vocal sounds from different genres, and compares the perception of sung versus spoken syllables. **Materials and Methods**: Female jazz and classical expert singers were recorded singing and speaking the vowels "A" and "E", as well as a "neutral" non-musician female speaker. These sounds were presented in looped fashion (ISI of 800ms) to participants, who had to align a click track to the sounds. Participants were female singers, expert in jazz or classical music. **Results**: For the sung syllables, paired mean locations for classical (*N*=18) compared to jazz (*N*=18) participants were significant for jazz A ($p = 0.006$, mean difference=62ms) and nearly significant for classical E ($p = 0.053$, mean difference=25ms) and jazz E ($p = 0.054$, mean difference=15ms). The difference for classical A was non-significant. Preliminary data for the syllables spoken by musicians (*N*=17, 9 classical) show a mean P-center for jazz participants = 24ms [SD=26ms], and classical = 50ms [SD=48ms], but no difference for the "neutral" spoken sounds (additional data and analyses will be presented re the spoken sounds). **Conclusions and Implications**: These results shed further light on the effect of musical expertise on the perception of musical and speech sounds, especially when then context in which those sounds are presented (i.e., a rhythm synchronization task) engages a musician's genre-specific expertise. These results also may inform debates regarding the relations between music and speech processing (Patel 2014; Peretz 2015; Tierney & Kraus 2014).

Interactive Effects of Presentation Mode and Pitch Register on Simultaneous Consonance

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T-E2-1

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Motivation: Recent studies have shown that simultaneous consonance—the tendency to perceive some chords as more pleasant than others when heard in isolation—is jointly influenced by the harmonicity and roughness of chord-tone partials. In this study, we explored whether these effects of harmonic structure are moderated by how chord tones are directed to the ears (presentation mode) and the pitch register within which they are heard. **Methods and Materials**: To minimize the impact of familiarity, participants were asked to rate the pleasantness of 12 synthetic dyads (i.e., intervals) generated from an unconventional musical system, the Bohlen-Pierce chromatic just scale. In separate blocks, chord tones were presented either diotically (to the same ear) or dichotically (to different ears) for 2000 ms and within a relatively low versus high pitch register (centered at C4 vs. C7). **Results and Conclusions**: Diotic presentation bolstered the positive association between harmonicity and consonance, suggesting that interactions between partials in the ear canal strengthen the auditory representation of harmonicity, thereby enhancing preference for relatively harmonic tone combinations. In addition, diotic presentation bolstered the negative association between roughness and consonance, presumably reflecting the reduction in interference between close-frequency partials engendered by channeling chord tones to different ears. However, these effects were eradicated when dyads were presented within a high register, even when controlling for potential confounds between register and loudness. As such, the marked aversion to dyads presented within a high frequency range appears to overwhelm the relatively subtle contribution of presentation mode. **Implications**: Our findings reveal the complex, yet systematic ways in which both presentation mode and pitch register shape the impact of harmonicity and roughness on simultaneous consonance judgments. More generally, they point to the need for additional research investigating how auditory features that are extrinsic to the chord's harmonic structure contribute to its perceived consonance.

Enharmonically Equivalent Spelling Distinctions Influence Perceived Consonance

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T-E2-2

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Temperley (2004) commented that the influence of enharmonic spelling distinctions on perception had not been experimentally explored. To our knowledge, this remains the case. Two harmonic intervals that are acoustically identical in 12-tone equal temperament may have different enharmonic spellings (e.g. D–F-sharp and D–G-flat) due to their differing tonal contexts. If listeners respond differently to these intervals—for example, by rating their dissonance and/or consonance differently—it shows that they attend to these spelling differences. Seventy-five participants heard 24 two-part musical passages in an 18th century idiom. Each passage contained a "target" interval somewhere in its latter half. First, each passage was heard in its entirety to establish the harmonic context of the target. The passage was then partially repeated, stopping early on the target, and the participant rated the consonance/dissonance of the target. There were two enharmonically equivalent pairs of target intervals: (1) major third and diminished fourth (4 semitones), and (2) major seventh and diminished octave (11 semitones) We modeled ratings using a two-way ANOVA with factors of interval width (4 vs. 11 semitones) and interval quality (major vs. diminished). We predicted that listeners would rate 4-semitone intervals as more consonant than 11-semitone intervals, but that within each pair of identical-width intervals, they would rate the major interval as more consonant than the diminished interval. Results showed the expected pattern, with 4-semitone intervals rated significantly higher than 11-semitone intervals [$F(1, 75.05) = 118.25, p < .001$] and major intervals rated significantly higher than diminished intervals [$F(1, 88.69) = 79.42, p < .001$]. There was no significant interaction between interval width and quality. Our results suggest that implicit harmonic knowledge shapes perceived consonance in acoustically identical dyads. To our knowledge, ours is the first work to address how the perception of enharmonically equivalent intervals may vary and thus more broadly, the cognitive reality of spelling distinctions.

The Influence of Sonority Dissonance and Rhythmic Complexity on Listeners' Perceived Emotions

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T-E2-3

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Research on perceived emotion faces a methodological problem of whether to use "real music" or "laboratory music" as stimuli for investigation. In the current study, we offer an approach that balances the need for ecological validity and the specificity afforded by controlled stimuli. In a series of three experiments, we investigate the influence of sonority dissonance and rhythmic complexity on listeners' perceived emotions using polyphonic excerpts of twentieth-century compositions from Europe and North America that feature polyrhythm (i.e., superposed rhythmic sequences based on competing reference time units). Participants listened to a series of excerpts and rated perceived mood, energy, movement, dissonance, and tension using six 7-point Likert scales. Piano and string quartet excerpts were manipulated in terms of audio generation (human/synthetic), and piano excerpts were further manipulated in terms of pitch presentation (ordered/randomized) and pitch content (randomized using pentatonic major, diatonic major, whole-tone, and chromatic scales). Rhythmic structure was held constant across all variants. Rhythmic measures based on composite rhythms (full and divided texture) were extracted and compared with participants' ratings using multiple regressions. In Experiment 1, synthetic audio and piano excerpts were perceived as more positive in mood and as conveying less tension than human performance and string quartet excerpts. In Experiment 2, pitch-randomized synthetic piano excerpts were perceived as more negative in mood, lower in energy, less likely to induce sensorimotor synchronization as well as more dissonant and tense. In Experiment 3, scale type had a significant influence on all rated emotional dimensions, excerpt for energy. Sonority dissonance was predictive of perceived dissonance and tension, and negatively correlated with mood and movement. Composite event density and event density ratio were positively correlated with mood, energy, and movement, but negatively correlated with perceived dissonance. These results show that sonority dissonance is strongly predictive of perceived emotions, and that multi-part rhythmic structure has reliable effects on listeners' experience, thus tracing a promising path of investigation into listeners' perceived emotions in polyphonic music using naturalistic stimuli.

Can Children with Developmental Coordination Disorder Step-Clap to the Beat? An Online Motion Tracking Study

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T-E3-1

Developmental coordination disorder (DCD) is a neurodevelopmental disorder involving deficits in motor coordination. Children show deficits in motor and visual-motor timing, but auditory-motor timing synchronization has not been well studied, despite its importance. In our previous study, children at risk for DCD (rDCD) and typically developing (TD) children tapped their hand on a drum during metronome tapping, continuation tapping (maintaining tapping after the metronome stops), and tapping to the beat of music. We found that children with rDCD tapped significantly less consistently compared to the TD children, but both groups tapped more consistently with the presence of an auditory cue. In our current follow up study, 55 participants aged 9-12 (nrDCD = 18) learned a more complex step-clap movement that involved whole body movements while standing, in the same condition blocks as our previous study (metronome, continuation, and music). Data were collected on the online platform LookIt at two tempos, 400 and 600 ms beat onset-to-onsets. To analyze participants' movements, we used the 2D markerless motion tracking software DeepLabCut. Morlet wavelet analyses of the tracked head, hands, and feet show that children in the rDCD group have a lower peak frequency than TD children, suggesting they are moving slower throughout all conditions ($p = .013$). In the metronome condition, cross-correlations of the head marker to a simulated cosine wave representing the auditory metronome showed the TD group to be significantly more correlated than the rDCD group at 400 ms ($p < .001$), but not at 600 ms ($p = .213$). Both groups were significantly more correlated to the cosine wave simulated at slower than faster tempos ($p < .001$). These results indicating better performance in the rDCD group for slower auditory tempi are important for informing decisions on auditory stimuli during the design of auditory-motor interventions for DCD.

Music Engagement, Cognitive Resilience and Pathways to Optimal Aging

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T-E3-2

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Background: Cognitive decline is a well-documented challenge for the aging population. Accordingly, recent emphasis has been placed on understanding how modifiable behavioural factors, including lifelong engagement in musical activities, can build resilience against cognitive decline in older adulthood. Resilience is used within aging neuroscience literature to denote outcomes of 'better-than-expected' cognitive performance relative to age- or disease-related decline, encompassing a range of theoretical concepts related to the preservation of cognitive and neurobiological function. These concepts imply that lifestyle choices such as music engagement may reduce the rate of decline, delay the onset of brain disease, and build resistance to neuropathological burden. **Aim**: The aim of this review was to examine the role of music engagement in building resilience to age-related cognitive decline in older adults with a view to understanding the underlying cognitive and biological mechanisms that may account for this benefit. Contemporary theoretical frameworks of cognitive aging were used to guide our interpretation of existing evidence. **Methodology**: The review drew upon protocols for search strategies outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols (PRISMA-P). Pubmed, PsycINFO, Medline, Web of Science, Cochrane Library, Embase, Scopus and Science Direct databases were used to identify literature investigating the associations between music engagement, training or expertise, and neurocognitive resilience. **Results and Conclusions**: We present a range of evidence suggesting that rich, lifelong involvement in music may help to maintain cognitive, emotional, and neurological functions in older adults. We propose that this widespread benefit to neurocognitive resilience arises from the social, emotional, engaging, persuasive, physical, personal, and synchronous elements of music engagement, and explain how these 'active ingredients' critically support biological mechanisms that promote healthy neurocognitive aging. **Implications**: Converging evidence suggests that lifelong music engagement can support robust cognitive health during aging. Regular participation in musical activities may maintain cognitive functions that are vulnerable to age- or disease-related decline, thereby helping to promote healthy ageing.

Synchronization of Eye-Looking to Song in Autism Linked to Individual Differences in Rhythmic Music Engagement, Parent-Child Musical Interactions

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T-E3-3

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The rhythm of child-directed singing scaffolds social attention; time-locked to the beats of natural, predictable child-directed song, non-autistic and autistic toddlers increase their looking at singers' eyes. Two recent models describe autism as a disorder of predictive coding. By manipulating the predictability of beat timing during singing, we previously demonstrated that autistic toddlers' eye gaze is closely time-locked to a slow-updating model of predictive coding, whereby stimulus variability is largely coded as noise. Here, we assess links between eye-looking timing and individual differences in rhythmic musical engagement, parent-child musical activity, and social skills. Autistic toddlers (*n*=46, 36m/10f) between 14 and 40 months of age were eye-tracked while watching videos of actresses singing nursery rhymes that were temporally jittered to reduce their beat-based predictability. We assessed temporal alignment of eye-looking by fitting a sinusoidal curve to each participants' frequency of eye-looking on and around either the observed (actual) jittered beats or predictions of beat timing using pattern-based (i.e., slow updating) or interval-based (i.e., high precision) models. Childrens' increased rhythmic musical engagement predicted substantially more accurate temporal alignment of eye-looking to the pattern-based, slow-updating model ($\beta = -0.57, p < .001$). Negative coefficients in this linear model indicate lower phase asynchrony and greater temporal alignment. In a logistic regression, both rhythmic musical engagement ($\beta = 0.90\,[0.06, 1.75], p < .05$) and parent initiation of singing ($\beta = 0.92\,[0.01, 1.83], p < .05$) predicted a propensity to synchronize more accurately with the pattern-based, slow-updating model than with a high-precision, interval-based alternative. These results indicate that rhythmic timing skills in autism, which are driven primarily by pattern-based temporal prediction, are associated with both broader rhythm skills and face-to-face musical experiences. These two components affect interrelated aspects of timing: rhythm skills impact the accuracy of temporal prediction, while face-to-face musical experiences impact the bias for pattern-based predictions over interval-based ones. Results point to potential complementary mechanisms underlying (social) musical engagement and aligns with the complex pattern of indirect relationships linking rhythm skills, social skills, and communication skills in autism (Fram et al., 2024).

The Effect of Groovy Music on Multi-Limb Drum Set Performance Accuracy

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T-E4-1

We investigated whether groove, as a pleasurable musical feature that induces sensory-motor coupling, could enhance motor control when playing multi-limb rhythmic patterns on the drum set. We hypothesized that groovier music would enhance participants' rhythmic performance. In a within-subjects experimental design, 20 music majors performed rhythms provided by the experimenters using the left hand/snare drum and right foot/bass drum on an electronic drum set in the three conditions: an isochronous Metronome, High groove, and Low groove accompaniments—which were 16 beat excerpts of popular songs drawn from an empirically-derived list ranked according to "grooviness" (Janata et al., 2012). The rhythmic tasks were performed with each accompaniment with Foot only, Hand only, and Foot and Hand together. The performances were recorded as MIDI files from the drum kit using a digital audio workstation (Reaper, 2023). Participants also rated their familiarity, enjoyment, perceptions of grooviness, and degree to which they felt "in the groove" after playing with each accompaniment. They also completed a questionnaire providing musical background information, self-perceptions of dancing ability, and self-perceptions of rhythmic ability. An ANOVA with the factors Groove (High, Low, Metronome) and Effector (Hand, Foot, Hand and Foot) and the log transformation of the standard deviation of mean normalized asynchronies (i.e., performance consistency) as the outcome returned a main effect of Effector, $F(2, 38) = 17.85, p < .001, \eta_p^2 = .48$. Post-hoc contrasts revealed that hand-only trials had significantly less variability in onset asynchronies than foot-only and hand-and-foot. For mean normalized asynchrony (i.e., performance accuracy), another ANOVA with the same factors returned a main effect of Effector, $F(2, 38) = 7.63, p = .004, \eta_p^2 = .29$, and a main effect of Groove $F(2, 38) = 10.72, p = .003, \eta_p^2 = .36$. Post-hoc contrasts revealed (a) that Hand only and Hand and Foot trials were very close to synchrony, whereas Foot only trials were early and (b) High Groove and Metronome trials were close to the beat, whereas Low Groove trials were late.

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The Rhythm of Connection: Interpersonal Synchrony Cultivates Belonging Across Group Boundaries

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T-E4-2

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Synchronizing movements with others has been shown to have a myriad of social benefits, including positive feelings, prosocial behaviors, and expanded social identity. Yet the work assessing the impact of synchrony over time, its ability to change perceptions of group membership delineation, and the importance of entrainment accuracy on subsequent social effects is more limited. In addition, the generalizability of the social benefits of synchrony is debated. The current study uses a pre-post design to investigate (1) the impact of shared synchronous rhythmic experiences on in-group/out-group belonging and cooperation over time, (2) the impact of accuracy of synchronization on the experience of belonging and cooperation, and (3) if resulting feelings of belonging generalize beyond co-actors. Two-person minimal groups were formed utilizing a Klee and Kandinsky task: participants were randomly grouped, but told their grouping was due to similarity in artistic preferences. Participants completed a synchronous drumming task in one of two conditions: drumming with their own group, or with a member of a different group. Belonging and cooperation were assessed with questionnaires and a cooperative economic game before and after the drumming task. The public goods economic game involved allocation of funds to oneself (self-interest), one's minimal group (in-group bias) or all participants (community pro-sociality), a strong behavioral measure of cooperation. Results indicate belonging and cooperation increased for participants' drumming partner following synchronization for both in-group and out-group conditions, with an especially strong effect size on out-group belonging. These effects didn't generalize beyond the drumming partner. Additionally, accurate drumming synchrony did not predict belonging or cooperation, suggesting the shared experience of music-making was enough to increase pro-sociality. As group music-making and music listening has been proposed to serve as a means of fostering social bonds and unity, our research supports and extends this idea. We find that musical experiences such as drumming can be used as a tool for building community and bridging divides between individuals taking part in this shared and engaging musical activity.

A Look at Rhythm as an Attention Regulator in the Visual System

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T-E4-3

Past research has championed audition over vision for rhythm perception and synchrony. However, recent studies utilizing motion in visual rhythms found rhythm discrimination and tapping synchronization greatly improved (Grahn, 2012; Hove et al., 2013). Research on entrainment to environmental rhythms demonstrates visual tracking increases coherence between participants' movements and environmental stimuli (Leow, et al. 2017; Richardson et al., 2007; Varlet et al., 2015, 2017). Takeya et al. (2017 & 2018) demonstrated monkeys learn to make synchronized saccades to temporally regular visual stimuli. This research lays the groundwork for examining eye movements as a measure of visual rhythm processing and synchrony. In a series of eye tracking experiments, adult eye-responses' to apparent-motion characters (Sesame Street or a tweeting bird) presented with either rhythmic or random timing (between-subjects), but with the same predictable 6-loction spatial pattern, were explored. The first fixation to each character location was classified as either anticipatory (negative time) or reactive relative to the image's appearance. In Experiment1 ($N = 32$), adults' anticipatory looks were closer to onset of the silent character in the rhythmic condition ($M = -200.26$ms) compared to the random condition ($M = -249.12$ms) ($F(1, 30) = 7.55, p = 0.01$). Adults used visual rhythm to disengage from a distractor and anticipate the character's appearance, demonstrating visual rhythm as an attention regulator. Experiment2 used a tweeting bird as audio-visual stimuli with either rhythmic or random timing. The results, thus far ($N = 37$), demonstrate the rhythmic condition produces anticipatory looks closer to the bird's onset ($M = -60.73$ms) compared to the random condition ($M = -113.42$ms) ($F(1, 35) = 7.24, p = 0.011$). The audio-visual stimuli support near synchronous eye movements to the rhythmically animated bird, again demonstrating visual rhythm as an attention regulator. Across experiments, results indicate adults' use rhythmic timing beyond spatial regularities to plan eye-movements and aid visual attention regulation. Ongoing follow-up studies will also be discussed, including infant data as comparisons for a developmental perceptive.

Predispositions Towards Integer Ratios in Rhythm Reproduction Are Predicted by Neural Oscillation and Hebbian Learning

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T-F1-1

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Recent empirical research has shown that when perceiving and reproducing auditory rhythms, humans display a preference toward rhythms in which inter-onset intervals (IOIs) are related by small integer ratios. The findings suggest that, while listeners show preferences for rhythms that are common in their own musical culture, attraction toward integer ratios may be a universal feature of rhythm perception. To date, models of rhythm perception that display integer ratio bias have not incorporated rhythm learning, and models of rhythm learning that display enculturation have not demonstrated integer ratio bias. We argue that both learning and intrinsic attraction toward integer ratios are necessary for a complete psychologically plausible model of rhythm, and both derive from constraints on physiological mechanisms. We previously proposed that oscillatory networks with Hebbian learning could work as a general model of rhythm development; in this presentation, we show that such a model is capable of learning complex rhythms by internalizing both the amplitude and phase relations between neural oscillators. By incorporating physiological constraints such that individual oscillations are either in-phase or anti-phase with one another, the networks replicate attraction toward integer ratio rhythms. Predictions for future behavioral and neural experiments are discussed, including how this research might apply to speech perception, and how EEG might be used to empirically confirm the findings of our model.

The Effect of Syncopation on Affective and Motor Responses During Rhythm Tapping

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T-F1-2

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Background: Syncopation produces an inverted U-shape effect on enjoyment, and studies are needed to investigate the effects of syncopation on movement. **Objective**: This study investigates the effects of syncopation on motor, autonomic, and affective responses during a rhythm tapping task. **Methods**: 30 healthy adults completed a rhythm tapping task with or without (i) improvisation and (ii) live accompaniment. All four conditions were completed with four one-minute piano compositions, whose melodies ranged from low to high levels of syncopation, measured using Longuet-Higgins and Lee's method. Tempos ranged from 67 bpm to 172 bpm. Motor response was characterized by accelerometry and electromyography (EMG). Autonomic arousal was measured by electrodermal activity (EDA) and electrocardiography (ECG). Reward and challenge were measured by a 12-item Likert scale. Linear mixed effects models included fixed effects for syncopation, tempo, rhythm tapping conditions (Improvisation and Live) and their interaction, and control variables for musical training and music reward sensitivity, as well as a random intercept for subject. Models were also tested including a quadratic effect for syncopation. Akaike information criteria was used to determine the model of best fit. **Results**: There was an inverted U-shape relationship between syncopation and reward, with the greatest reward occurring with moderate levels of syncopation. Muscle activation increased with syncopation and then plateaued for moderate and high levels of syncopation. Increased syncopation was linearly associated with greater total acceleration, beats played, heart rate, and challenge, and approached association with greater tonic EDA. Increased tempo was linearly associated with increased total acceleration, beats played, and tonic EDA, but decreased muscle activation. **Conclusions**: Moderate levels of syncopation produce the greatest reward. Higher syncopation increases challenge and intentional motor response during music playing. These findings suggest effects of syncopation on motor and affective responses that are independent of tempo and the level of spontaneity (i.e., improvisation and live accompaniment). Together, these findings suggest optimal levels of syncopation may be beneficial for promoting movement in music based interventions for neurorehabilitation.

An Entrainment Oscillator Mechanism Underlies Human Beat Matching Performance

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T-F1-3

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Humans possess an innate ability to effortlessly entrain to auditory rhythms which previous theories have linked to the supplementary motor area (SMA). The neural correlates of entrainment have shown frequency-specific responses in human EEG spectra, yet whether this reflects the actual processing of rhythm or simply a systematic response is unknown. Here we tested human participants (n = 23) on a novel tempo matching task, in which they listened to two simultaneous tempos and were asked to modulate the rate of a comparison tempo (1.67-2.34 Hz between trials) to match a constant target tempo (2 Hz). EEG recordings exhibited entrainment to both frequencies at frontocentral electrodes that shifted into alignment over the course of each trial. Behavioral responses were analyzed by calculating the frequency of the comparison tempo at the end of the trial when participants claimed that they had matched the comparison and target tempos. We also calculated the average matched frequency by the comparison frequency of the previous trial. Behaviorally, participants tended to anchor their perceived matched tempo to the starting comparison frequency, such that they underestimated the tempo for slower starting conditions and overestimated for faster starting conditions; further, tempo judgments were shifted away from the variable tempo on the previous trial. A model of phase-coupled oscillators, in which both tempos were pulled towards one another, replicated both effects. This model further predicted that by increasing the coupling strength of the constant tempo oscillator, both bias effects could be eliminated. To test this, a second group of participants (n = 25) underwent transcranial alternating current stimulation (tACS) to the SMA that was phase-locked to the target tempo at 2 Hz. Consistent with model predictions, tACS attenuated both behavioral effects compared to sham stimulation. Overall, we demonstrate that brain stimulation at the frequency of rhythmic auditory beats in our novel tempo matching task strengthens entrainment and reduces behavioral biases, supporting a causal role for entrainment in rhythmic processing.

Perceptual Hysteresis of Pairwise Dissimilarity Judgments of Simplified Musical Instrument Sounds for MDS Timbre Studies

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T-F2-1

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Perceptual hysteresis can be defined as the enduring influence of the recent past on current perception (Chambers & Pressnitzer, 2014). In pairwise dissimilarity judgments between two sound stimuli A and B, it is common practice to randomize the order of presentation of the stimuli under the assumption that it will not affect the dissimilarity judgments. Therefore, some participants will listen to A followed by B (denoted A $\rightarrow$ B) when judging their perceptual dissimilarity, whereas the others will listen to B followed by A (B $\rightarrow$ A). We are unaware of formal results that confirm this underlying assumption for MDS timbre studies. Thus, we investigated whether the order of presentation of the stimuli in a pairwise dissimilarity judgment influences their perceived differences due to perceptual hysteresis, potentially distorting the resulting timbre space. We selected 11 simplified musical instrument sounds from the original stimuli used in (Grey 1977) and then we collected perceptual dissimilarity judgments from 40 participants for all 55 possible pairs. We did a Lilliefors normality test for the distribution of dissimilarities for each pair separated into the two possible orders of presentation A $\rightarrow$ B and B $\rightarrow$ A. Then, we did the independent-groups t-test for each pair comparing both orders of presentation. Additionally, we did the Wilcoxon rank sum test for the pairs that failed the normality test. We applied the Bonferroni-Holm correction for multiple tests to the result of both the independent-groups t-test and of the Wilcoxon rank sum test. The statistical analysis revealed no evidence of perceptual hysteresis for the assessment of pairwise dissimilarities. Therefore, we conclude that the order of presentation of the stimuli used did not have a statistically significant effect in pairwise dissimilarity judgments of musical instrument sounds. This result corroborates a longstanding assumption in MDS timbre studies.

On Intentionality of Single Sounds: A New Direction for Predictive Coding of Music

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T-F2-2

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Musical reward is tied to predictable melodic and rhythmic structure. However, recent work has shown that listeners have preferences for isolated, non-referential sounds that do not rely on these higher-level musical features. This suggests that lower-level acoustic features, such as amplitude envelope, may also elicit predictions. Here we investigated one source of predictions that may not be captured in existing predictive models of musical structure: the perception of intentionality behind sound sources. Consistent with the idea that motor plans embody intentions that constitute a source of top-down sensory prediction (Clark, 2015), here we define perceived intentionality as "a sound made for a purpose by a human". We hypothesized that sounds with shorter attack time, as well as sounds with greater amplitude modulation, would be rated as more intentional, since they are encoded by predictable motor programs. Across three experiments (*n*=168), participants listened to isolated sounds with various amplitude modulations, timbres, and durations and rated each on perceived intentionality. Experiments 1 (500 ms stimuli), 2 (3000 ms stimuli), and 3 (1500 ms stimuli) showed main effects of timbre on ratings of perceived intentionality: periodic timbres were rated higher than aperiodic (noisy) timbres. Further, there was a negative relationship between perceived intentionality ratings and attack time for Experiments 1 and 3. In the longest tone stimuli (Experiment 2, *n*=87), we also found an interaction between depth and frequency of amplitude modulations on perceived intentionality ratings: stimuli with deeper modulations were also rated as more intentional overall. However, among sounds with shallow amplitude modulations, faster (higher-frequency) amplitude modulations were perceived as more intentional. These findings provide preliminary evidence that low-level acoustic features impact listeners' judgment of sound source and intentionality. Future experiments will collect pleasure ratings of these stimuli. Investigating how these features also relate to hedonic processing of isolated sounds offers insight into how sounds can become rewarding beyond structural musical features.

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In Search of an Optimal Sound Level for Pitch and Timbre Discrimination

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T-F2-3

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Background: Sound level impacts auditory perception. Some audio engineers recommend working at loud listening levels (typically above 80 dB SPL) because they observe, "the so-called hearing curve is flatter at that level." However, an auditory tuning curve is understood to widen as stimulus intensities increase, suggesting less accurate discrimination of fine details. In a continuation of earlier work, we examine pitch and timbre discrimination at various sound levels. **Method**: Pitch and timbre discriminations based on the Seashore test were conducted with forty-four listeners in four groups with each at a fixed sound level of 55, 65, 75, or 85 dB (A SPL). Pitch discrimination compared a 500-Hz pure tone to another pure tone (501, 502, 503, 504, 505, or 508 Hz). Timbre discrimination utilized six complex tones composed of 180 Hz and four higher harmonics with the second and third harmonics varied in intensity. Listeners indicated whether the second tone was higher or lower than the first in pitch and whether the two tones were the same or different in timbre. **Results**: A significant difference was observed at 3 Hz pitch discrimination between "mid-levels" (65 and 75 dB; $Mdn = 1.0$) and "extreme-levels" (55 and 85 dB; $Mdn = 0.9$), $U = 163, p = .03$ (one-tailed). Another significant difference was found in one timbre discrimination condition between 65 dB ($Mdn = 1.0$) and 85 dB ($Mdn = 0.8$), $U = 26, p = .034$ (one-tailed). **Conclusions**: The performance was the poorest at 85 dB, consistent with earlier observations. Considering two new intermediate levels, the discrimination "sweet spot" may be around 65 dB, which is closer to usual conversational level. This finding will inform our understanding of an optimal level for discriminating fine details required for technical aptitude and the ideal level for music appreciation.

The Development of Auditory Affective Experiences and Its Relationship to Musical and Communicative Skills

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T-F3-1

Emotion is a critical component of musical experience; however emotional responsiveness to sound, whether musical or non-musical, varies between individuals. Some auditory experiences can evoke intensely positive emotional reactions in certain individuals, such as frisson and autonomous sensory meridian response (ASMR). In contrast, other auditory experiences can be intensely negative, for example when listeners have a highly aversive reaction to some human-generated sounds such as chewing. These negative reactions can lead to experiencing "misophonia", a disorder that can significantly impair an individual's quality of life. Relatively little is known about the mechanisms underlying misophonia; however, as with frisson and ASMR, misophonic reactions to sound are surprisingly common in the general population and may arise during childhood, even in sub-clinical or undiagnosed cases. We sought to examine how individual listener characteristics might predict the extent to which individuals have intense emotional reactions to both positively and negatively valenced sounds. Children (ages 6-17; *N* = 229) and adults (*N* = 248) completed assessments of misophonia symptom severity and of musical sophistication, and they performed perceptual tasks assessing perception of musical tonality, musical emotion, beat and meter, and speech prosody. We also measured real-time emotional reactions, valence, and arousal ratings to videos intended to evoke misophonia, frisson, and ASMR. We found that self-reports of misophonia correlated with one another, and self-report scores from the Amsterdam Misophonia Scale (A-MISO-S) and Sussex Mini Pictorial Scale (SMPS) correlated with emotional reactions to misophonia videos in both children and adults. Additionally, in children and adults, misophonic reactions predicted ASMR and frisson reactions, as well as sensitivity to speech prosody. Children's misophonic reactions also correlated with rhythm perception. Trends suggest that the misophonic reactions increase and musical perception tasks improve with age. Our results shed light on the developmental time course of misophonia sensitivity and its association with the development of other emotional musical experiences.

Neuropsychological and White Matter Effects of Musical Training in Childhood

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T-F3-2

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Musical training is associated with improved cognitive and academic performance across development, with specific neural mechanisms implicated in these associations. The present study aimed to further explore the benefits of musical training in childhood using a combination of behavioral assessments and diffusion tensor imaging (DTI) in a sample of 175 preadolescents (49 musicians and 126 non-musicians) between 7-9 years old. Cognitive abilities were tested using the Woodcock-Johnson Psycho-Educational Battery (WJ III) and the Operation Span Task (OSPAN) while academic achievement was assessed using the Kaufman Test of Educational Achievement (KTEA II). In addition, cardiovascular fitness was assessed by measuring maximal oxygen consumption (VO2 max) during physical exertion. When controlling for age, sex, and SES, behavioral results revealed that participants with musical training had higher cognitive scores on the WJ III and the OSPAN ($F(15, 156) = 3.46, p < 0.001$) and greater academic achievement as measured through the KTEA II ($F(14, 157) = 3.04, p < 0.001$) when compared to non-musicians. In addition, musicians had higher relative VO2 max values ($F(1, 170) = 6.10, p = 0.01$) compared to non-musicians. For DTI analyses, the arcuate fasciculus (AF) was identified through connections from the precentral gyrus (PCG) to the posterior superior temporal gyrus (STGp) to generate left and right canonical AF tracts. An additional tract of interest was identified as right and left pathways from the posterior middle temporal gyrus (MTGp) to the posterior superior temporal gyrus (STGp). DTI results revealed that musical training was associated with higher mode ($F(1, 91) = 4.98, p = 0.03$) in right AF and lower mean diffusivity ($F(1, 91) = 4.39, p = 0.04$) in the right MTGp to STGp tract. Together, these results provide both behavioral and neural evidence for the relationship between musical training and cognition in a large sample of preadolescents.

Pitch and Loudness Influence Children's Gendered Judgments About Musical Instruments

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T-F3-3

Early in life, children incorporate gender stereotypes into their understanding of the world. From around 8.5 years old, children report that some instruments are "for boys" and others "for girls" (Abeles & Porter, 1978). Previous studies suggest these judgments are influenced by exposure to particular gender-instrument pairings (e.g., "My brother plays the trumpet, so trumpet is for boys"). Here, we investigated whether physical (size) and musical (pitch, volume) attributes affected children's gendered judgments of instruments. To avoid influence from children's experiences, we used fictional instruments. Instrument visual stimuli were combinations of simple geometric shapes. Auditory stimuli were synthesized sounds. All stimuli were designed to avoid similarity to real-world instruments. Participants were 60 North American children (31 girls, 29 boys) aged 8.5 to 11 years old ($M = 9.36, SD = .73$). Children's results were compared to a sample of undergraduates (*N* = 51). On each trial, participants saw (large or small) and heard (high or low, loud or soft) a fictional instrument onscreen. Their task was to select which of two characters (girl or boy) should play the instrument. Children selected boys more for louder (62%) than softer (52%) instruments ($p = .026$) and lower- (64%) than higher-pitched (49%) instruments ($p = .002$). In contrast, no effect of size was observed ($p = .919$). Adult participants picked the boy character more often for lower- (78%) than higher-pitched (54%) instruments, but no effect was found for volume or size ($ps > .478$). Results indicate specific instrument attributes impact gender stereotyping, and that musical gender stereotypes do not stem solely from exposure to specific gender-instrument pairings. Additionally, which elements of instruments individuals attend to when making gendered judgements may change across the lifespan.

Musical Reward in Young Children

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T-F4-1

Most people enjoy listening to music. Musical pleasure stems from an interplay of social, emotional, and cognitive factors, and listening to music activates areas of the brain associated with reward. In adults, there are large individual differences in musical reward, with some individuals even reporting a complete and selective lack of musical pleasure (i.e., musical anhedonia). However, it is unknown whether musical anhedonia is present early in life, or if it develops over the lifespan. Given that the factors involved in musical reward develop substantially across childhood, it is possible that the nature of musical reward also changes across development. Here, we investigated parents' perceptions of musical reward in their young children. Our goals were (1) to assess whether children, like adults, vary substantially on musical reward, (2) to identify which factors contribute most strongly to children's musical reward, and (3) to investigate if there exists, in children, a profile of musical reward resembling musical anhedonia. We adapted a widely-used questionnaire of musical reward for adults (the Barcelona Musical Reward Questionnaire; Mas-Herrero et al., 2013) and asked parents (N = 500) to respond to the questionnaire concerning their 3- to 7-year-old children. To control for potential differences in general reward, parents also completed a widely-used questionnaire of temperament (Children's Behavior Questionnaire - Very Short Form; Putnam & Rothbart, 2006). Our results indicate that there was a similar distribution across the spectrum of musical reward as that seen in adults. However, as a population, children derived less musical reward from emotion-related dimensions than adults. There was a subset of participants who score very low on musical reward but did not have particularly negative affectivity in temperament. These results point to substantial individual variation in musical reward in early childhood and suggest that musical anhedonia is already apparent in early childhood.

Predictive Coding in Musical Anhedonia: A Study of Groove

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T-F4-2

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Groove, or the pleasurable urge to move to music, offers unique insight into the relationship between perception, action, and emotion. The predictive coding of music model posits that groove is linked to predictions of music formed over time, with stimuli of moderate complexity being most pleasurable and likely to engender movement. At the same time, listeners vary in the pleasure they derive from music listening: individuals with musical anhedonia report reduced pleasure during music listening despite no impairments to music perception and no general anhedonia. Little is known about musical anhedonics' subjective experience of groove. Here we examined the relationship between groove and music reward sensitivity. Participants (*n*=287, $M_{age} = 34.2; SD_{age} = 9$) heard 15 drum-breaks chosen from a publicly-available set of validated drum patterns that varied in perceived complexity (Senn et al., 2023), and rated each for pleasure and wanting to move. These drum breaks were split into tertiles (low, intermediate, and high) based on perceived complexity. Musical anhedonics (*n*=13, $M_{age} = 40.3; SD_{age} = 19.5$), had significantly lower ratings compared to controls (*n*=13, $M_{age} = 33.8; SD_{age} = 8.5$) matched on music perception abilities and general anhedonia. However, both groups demonstrated the classic inverted-U relationship between ratings of pleasure & move and stimulus complexity, with ratings peaking for intermediately complex stimuli. Across our entire sample, a quadratic model best fit participants' ratings as a function of perceived complexity compared to a linear model. Further, predicted values of each participant's optimal level of complexity from these models were positively correlated with individual differences in music reward sensitivity (i.e., participants more sensitive to music reward preferred more rhythmically complex stimuli). Finally, the sensorimotor subscale of music reward was uniquely associated with move, but not pleasure, ratings above and beyond the five other dimensions of musical reward. Results highlight the multidimensional nature of reward sensitivity and suggest that pleasure and wanting to move are driven by overlapping but separable mechanisms.

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Musical Reward and Anhedonia in Mood Disorders

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T-F4-3

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Anhedonia is often found in major depressive disorder (MDD) and other psychiatric disorders. While previous studies suggested that musical reward processing could dissociate from physical reward processing (Martinez-Molina et al., 2016), it is not yet fully understood whether patients with psychiatric disorders show reduced musical reward experience. Here, we examined whether musical reward experiences were impaired in patients with mood disorders and whether the attenuation of the music reward experiences was related to physical anhedonia. We included 63 participants, consisting of 21 participants each in the MDD, bipolar disorder (BD), and healthy control (HC) groups. Musical and physical reward experiences were assessed with the Barcelona Music Reward Questionnaire (BMRQ) and Physical Anhedonia Scale (PAS), respectively. The BMRQ and PAS total scores were compared among the three groups using one-way analysis of covariances (ANCOVAs). For BMRQ, the analysis was controlled by age, sex, and musical training duration, while for PAS, it was controlled by sex and age. We also conducted correlation analyses between the BMRQ scores and PAS scores for each group. The ANCOVAs showed that the BMRQ total score ($F_{2,58} = 6.617, p = 0.003$) and PAS total score ($F_{2,58} = 6.662, p = 0.002$) significantly differed among the groups. Post-hoc t-tests revealed that the BMRQ score was lower in the MDD group than the HC group ($t_{40} = 3.774, p = 0.002$) while the PAS score was also higher in the MDD group than the HC group ($t_{40} = 3.647, p = 0.002$), indicating that both musical and physical reward sensitivities are attenuated in patients with MDD. In addition, we observed significant correlations between the BMRQ score and PAS score in the MDD ($r = -0.716, p < 0.001$) and the HC groups ($r = -0.489, p = 0.025$) while no such a relationship was found in the BD group ($r = -0.140, p = 0.545$). These findings suggest that the BD group may have a discrepancy between musical and physical rewards.

Cannabis, Music Absorption, and Auditory Perception

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T-G1-1

Research exploring the relationship between cannabis consumption and its effects on cognition and auditory perception—especially in the context of music—remains limited. The historical association between cannabis and music, and increasing prevalence due to legalization in Canada warrants exploration. This mixed-methods study aimed to explore how auditory perception was influenced while in a cannabis-induced state of consciousness. One hundred and four experienced recreational cannabis users (M = 24 years; 71 females; 33 males) completed an online questionnaire covering demographics, cannabis usage patterns, as well as auditory and music-related experiences while under the influence of cannabis. Additionally, fifteen participants (M = 29 years; 9 females; 6 males) participated in semi-structured interviews to provide deeper insights into their listening habits, emotional experiences, and perceptual and attentional differences. Results revealed that 50% of participants reported cannabis influenced their hearing, including enhanced sound clarity and attentiveness. Moreover, state music absorption was found to significantly increase while under the influence of cannabis ($p < 0.001$) compared to when sober. While auditory experiences varied widely among participants, heightened self-reported hearing sensitivity and absorption were frequently reported. Thematic analysis of open responses and interviews indicated enhanced cognitive, perceptual, emotional, and embodied sensitivity among cannabis users. These findings represent a novel contribution to the literature and offer valuable insights for generating hypotheses in future research investigating the impact of cannabis on auditory perception.

Pitch-Induced Illusory Percepts of Time

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T-G1-2

Previous findings suggest that changes in the pitch of music and speech can induce illusory changes in perceived timing. In general, higher pitches have been associated with faster timing, and our first goal was to evaluate the generalizability of this pattern to a wider range of frequencies than previously tested. We first conducted a series of four subjective rating experiments totaling 270 participants, in which we measured the perceived tempo of isochronous tones ranging in pitch from A2 (110 Hz) to A7 (3520 Hz) relative to a standard reference metronome. In these experiments, we repeatedly found that perceived tempo increased monotonically with pitch from A2 to between A4 and A5. Above this point, however, the effect reversed direction such that subjective tempo became slower at higher octaves. To assess whether this illusory tempo arises at the level of perception or decision-making, we conducted two additional experiments testing whether pitch affects timing even in the absence of an explicit rating task. Specifically, we conducted synchronization-continuation tapping experiments in which a total of 86 participants synchronized with tones from the same six octaves as used in our four subjective rating studies. Participants in the first experiment heard tones from all six octaves, whereas those in the second experiment either heard tones from the lower three octaves only or the upper three octaves only. In both experiments, we found that sensorimotor timing exhibited a similar U-shaped pattern across octaves. Pitches between A4 and A5 produced the fastest continuation tapping and most negative (earliest) asynchronies, while A2 and A7 produced the slowest tapping and least negative (latest) asynchronies. The discovery of similar patterns of illusory tempo across both subjective ratings and sensorimotor timing suggests that pitch biases timing at the level of perception, as the effect remains in the absence of decision-making. We argue that our results support the integration of pitch into existing models of rhythm perception.

The Role of Variability in Perceived Rhythmic Complexity

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T-G1-3

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Studies on perceived complexity of rhythmic patterns (VanHandel et al, 2021; VanHandel 2022; VanHandel 2023) have demonstrated tempo-dependent correlations with both syncopation (Gomez et al, 2007) and density (the number of onsets in a rhythmic pattern); syncopation is more strongly correlated with perceived complexity at slower tempos, while density is more strongly correlated at faster tempos (VanHandel 2022, 2023). This study adds to our understanding of perceived complexity by investigating the role of durational variability, measured using the nPVI (Patel & Daniele 2003), and determining how variability interacts with tempo, density, and syncopation. Rhythmic stimuli were selected to represent four densities (6, 7, 8, and 9 onsets of a maximum possible 16 onsets in a 4/4 measure), a range of syncopation amounts and types (Gomez syncopation metric 0-13), and four variability ranges (low, mid-low, mid-high, high). Over 800 participants in the online experiment completed the Goldsmith's Musical Sophistication Index (GMSI) and were assigned to one of two tempo groups (fast/slow) containing over 200 stimuli each recorded at four tempos (fast: 180 bpm/333 ms, 150 bpm/400 ms, 113 bpm/533 ms, and 90 bpm/666 ms; slow: 113 bpm/533 ms, 90 bpm/666 ms, 75 bpm/800 ms, and 64 bpm/933 ms). Each participant heard 150 randomly selected stimuli from their assigned tempo group and rated the perceived complexity of each using a Likert scale (1-6, "not at all complex" to "very complex"). Results indicate a complex relationship between perceived complexity, variability, density, syncopation, and tempo. The primary overall factors in perceived complexity are density and syncopation, but variability also contributes meaningfully to the complexity ratings; variability is negatively correlated with perceived complexity at faster tempos (at faster tempos, as variability increases, perceived complexity decreases) and significantly positively correlated with perceived complexity at slower tempos (at slower tempos, as variability increases, perceived complexity increases). Rhythmic variability interacts with all three factors of tempo, density, and syncopation, demonstrating that rhythmic variability also plays an important role in perceived rhythmic complexity.

Singing on and off the “Pitch Grid”: How Does Pitch Memory Influence Sung Accuracy in Musicians With vs. Without Absolute Pitch?

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T-G2-1

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In Western equal temperament tuning, the pitch grid, as defined by A4=440Hz, is widely used across genres. Absolute pitch (AP) perception is typically based on this 440-base grid with labeled note-associated memory. When singing unaccompanied, people with AP likely have an advantage when following the pitch grid; however, they may have difficulties in following a different grid due to their memory interferences. We compared AP and relative pitch (RP) musicians’ pitch error in singing familiar melodies (excerpts of “Twinkle Twinkle Little Star” and “Old MacDonald Had a Farm”) four times each, twice with a starting note on-grid (440-grid) and twice off-grid (0.5 semitone shift). The participants also underwent a pitch-naming task which assessed their AP ability, and an interval tuning comparison task assessing their RP ability (choosing one stimulus of an ‘in-tune’ interval from a transposed one with a 25-cent mistuning). We recorded and analyzed (Praat) participants’ singing and compared the differences between expected and sung frequencies. Self-identified AP participants made a 0.18 semitone error on average in the pitch-naming test, and both AP and RP participants performed comparably in the interval tuning test. For singing, all participants showed an increase in pitch error as melodies progressed in general. At the end of sung on-grid melodies, pitch error between groups differed by 0.2 cents, however for off-grid melodies the AP group had a 6.8 cent larger pitch error compared to the RP group. These patterns were confirmed by linear regression modeling, which showed a significant effect of note-position ($p < 0.001$) on pitch error, with a two-way interaction: grid * note-position ($p = 0.017$), and a three-way interaction: group * grid * note-position ($p = 0.012$). The results support our hypothesis that AP musicians’ memory interferes with their relative pitch singing for an unfamiliar grid as melodies progress without accompaniment. The long-term memory of the grid for AP plays an outweighed role in perception-action coupling for singing, as compared to RP.

Context-Dependent Suppression of Absolute Pitch During Auditory Statistical Learning

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T-G2-2

Absolute pitch (AP), colloquially known as perfect pitch, is the ability to name the chroma (pitch class) of an isolated tone, or produce the pitch of a specified note in the absence of an external reference. This ability contrasts with relative pitch (RP) in which pitch-processing is based upon relationships between tones. While RP involves effortful processing, AP pitch-labeling is thought to be automatic and non-suppressible. However, recent research has suggested that the suppressibility of AP may be dependent on context and task demands. The current study considered the suppressibility of AP pitch-labeling during auditory learning. Participants were screened with a test of AP prior to continuing with experimental tasks. Using a well-established auditory statistical learning paradigm, AP musicians ($n = 37$) and RP musicians ($n = 38$) were exposed to tone streams with embedded statistical probabilities to explore their ability to implicitly learn the underlying structural regularities. Two tuning contexts, one congruent with learned pitch representations and the other incongruent with past experiences, were used in order to explore the impact of context on automatic pitch-labeling in AP. Both AP and RP musicians performed above chance at test for both the congruent and incongruent conditions, indicating that they were able to learn the structural rules governing the tone streams. As expected, AP pitch-labeling conferred an advantage in the congruent condition with AP musicians outperforming RP musicians ($t(35) = -4.61, p < .001$). However, in the incongruent condition, rather than seeing a disadvantage due to nonsupressibility, AP musicians performed equally to their RP musician peers ($t(36) = -.831, p = .411$). These results suggest that when AP musicians' representations are incongruent with the task demands, they may be able to suppress automatic pitch-labeling behavior. Overall, our results demonstrate that while previously established pitch representations can impact the ability to learn from the auditory environment, there is some flexibility to the processing strategies used during acquisition.

Assessing the Efficacy of a Gamified Approach to Training Absolute Pitch Categories

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T-G2-3

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Gamification - the process of incorporating game-like elements (e.g., points, levels) into traditionally non-game domains – has been applied increasingly to auditory learning paradigms. Initial results suggest that gamification may lead to significantly accelerated learning trajectories and improved generalization compared to more traditional paradigms, particularly in challenging domains such as learning non-native speech sounds. The present experiment extends this gamification research to the domain of pitch chroma categorization – a hallmark of absolute pitch (AP). Participants were randomly assigned to complete either a gamified ($n = 50$) or a control ($n = 50$) pitch chroma categorization task. The gamified version involved participants learning to move a spaceship on a computer screen to pass through four gates, with each gate corresponding to a different pitch class (C, Eb, Gb, A). The control version involved participants learning to associate the same four pitch classes with arbitrary names (e.g., Leo). Both versions were matched on the number of training and testing trials. Training in both conditions provided participants with feedback, and both versions assessed learning through a specific test (using the same sounds as in training) and a generalization test (using Shepard tones to discourage using pitch height). Participants in both groups showed evidence of learning in both the specific and generalization tests, although performance in the generalization test was attenuated, suggesting partial generalization. Contrary to predictions, participants in the control group performed significantly better than participants in the gamified group on both tests ($ps < .001$). The current results suggest that gamification does not necessarily lead to improvements in perceptual category learning. Recommendations for future gamified paradigms will be discussed. Overall, the results fit within a growing body of research suggesting that explicit categorization of pitch chroma is at least partly trainable in adulthood.

Individual Differences in Music's Impact on Pain Sensitivity

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T-G3-1

Motivation: Music can alleviate individuals' sensitivity to pain: Listeners tolerate painful stimuli longer in the presence of preferred or pleasant music. These studies indicated large individual differences in music's pleasantness, and it is unknown which musical features alleviate pain perception. Musical tempo is a promising candidate for entrainment of neural oscillations that may explain pain reduction. Neural oscillations can be entrained by regular musical stimulus rhythms. Listeners exhibit large individual differences in their intrinsic (spontaneous) rhythms and their entrainment with musical rhythms. **Methods**: We tested the role of individual differences and musical tempo on pain perception in a within-subjects design. Sixty adults completed a standard measure of individual spontaneous rates in which participants tapped a familiar melody on a force sensor at a comfortable, consistent rate. Novel musical stimuli were generated at rates faster than, equal to, and slower than each individual's spontaneous rate. The musical stimuli were based on each participant's preferred musical style to optimize listening pleasure. A heat thermode was applied to the arm to induce pain calibrated to each individual's pain sensitivity. Each participant experienced pain-inducing stimuli with musical tempo set to the individual's spontaneous rate, 15% faster tempo, 15% slower tempo, and pain delivered without music (baseline). Dependent measures included perceived pain ratings and musical preference ratings. **Results and Implications**: Lowest perceived pain ratings occurred during the musical tempo that matched the participant's spontaneous rate, compared with all other musical rates. Pain ratings were also lower in the presence than absence of music. Musical preferences and training, pain thresholds, and original musical tempo did not alter the findings. Implications of these findings include a fundamental role of tempo and individual differences in music's influence on pain sensitivity and hold promise for music as a personalized therapeutic in clinical settings.

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Situational Context Modulates the Effect of Background Music on The Emotional Judgment of a Visual Artwork: A Comparison Between Museum and Online Settings

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T-G3-2

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Aesthetic experiences are influenced by various individual and situational factors. While it is well known that the aesthetic appreciation of visual artworks differs significantly between a museum and a laboratory context, it remains unclear whether an online setting modulates the experience of an artwork compared to an ecologically valid environment. This study examined the effect of background music on the aesthetic experience of visual art in two contexts (museum and online). In Experiment 1, 142 visitors to the Museum of Contemporary Art of the University of São Paulo appreciated an abstract painting by Wassily Kandinsky while background music played over headphones. Participants were randomly assigned to four experimental groups based on the emotion expressed in the music (happy, scary, peaceful, and sad) and a control group (silence). Experiment 2 replicated these procedures online, with 202 participants rating the emotional dimensions (valence and arousal) and aesthetic experience (beauty, liking) of a digital reproduction of the artwork. The analysis revealed a significant main effect of groups ($F = 3.341, p < .001$) and an interaction with context ($F = 2.828, p = .001$), with significant differences in arousal ($F = 4.082, p = .007$) and valence ratings ($F = 3.595, p = .01$) across groups depending on the experimental setting. Participants exposed to “scary” background music rated the painting as more agitated online than in the museum ($p = .007$), while those in the “peaceful” music group judged it as less agitated online compared to in person ($p = .03$). Regarding valence, participants in the “peaceful” music rated the painting as more positive in the museum than online ($p < .001$). These results indicate that the situational context significantly influences how background music affects the perceived emotion of visual artwork, highlighting the complex ways in which contextual factors can shape cross-modal interactions in the perception of emotion. Future research with a larger sample of paintings would be beneficial to understand how aspects of the artworks may also impact the emotional and aesthetic ratings.

Immersed on TikTok: Musical Repetition's Effect on Viewing Behavior

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T-G3-3

On TikTok, music captures viewers' attention and fosters their immersion, or "the psychological experience of being engrossed in the media world, focusing one's attention on the media reality" (Tukachinsky, 2014). This project investigates how musical repetition shapes immersion in short-form audiovisual media. By providing evidence that musical repetition can modulate immersion and shape viewing behavior, these findings expand our understanding of how specific musical characteristics can guide attention and shape our perception of media content. In this experiment, undergraduate participants ($n = 150$) watched a randomly ordered presentation of 48 short-form audiovisual clips (23-53 seconds) that systematically varied the degree of musical repetition (looping every 4, 8, or 16 seconds), musical affect (positive or negative), and visual affect (positive, negative, mixed, and neutral; Samson et al., 2016). Mimicking social media interfaces like TikTok, participants moved between the videos freely (similar to Janata et. al, 2018), with viewing time recorded as a proxy the degree of immersion for each stimulus observation. Finally, participants separately rated the perceived emotions of both the music and videos. We investigated the effect of musical repetition on viewing time through fitting generalized linear mixed effect models. These models revealed that both increased musical repetition ($\beta = -0.08, t = -10.217, p < 0.001$) and repeated exposures to the same visual content decreased viewing time ($\beta = -0.295, t = -29.370, p < 0.001$). When compared with our previous study that used explicit self-report measures for immersion, a Spearman's correlation test revealed a statistically significant positive correlation between viewing time and reported enjoyment ($\rho = 0.186, S = 959742, p < 0.01$). These findings are consistent with prior evidence of enjoyment's mediating effect on listening behavior (Janata et. al, 2018) and suggest that enjoyment is related to but distinct from immersion. These findings underscore music's influential effect on listener immersion and viewing behavior.

Do We Think of Emotions the Way We Think We Think of Emotions? The Multidimensional Space of Perceived Emotions in Music and Speech

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T-G4-1

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Many studies on emotion perception utilize conceptual frameworks such as models of basic emotions or dimensional models of affect. These models assume that emotions are natural kinds and their organization represents the actual world. The models enable scholarly discourse, however, research has demonstrated the highly variable nature of emotional phenomena, pointing towards understanding emotion from appraisal or psychological construction theories. Auditory perception of emotions is an important aspect of both speech and music communication. There is growing evidence for the function of music in understanding psychological functions and its use in rehabilitation. Most studies in these domains assume the dimensional or discrete model in representing emotions, and perceptual tasks are constructed around such representations. However, the structure of emotions, when participants are not imposed with the discrete or dimensional model, may be different. This study aims to explore this structure when participants ($N = 64$) are presented with emotional expressions through music ($n = 32$, age $M = 27.0, SD = 9.5$, 20 female, 6 male, 6 prefer not to say) or speech ($n = 32$, age $M = 20.9, SD = 1.4$, 22 female, 10 male). Participants rated the dissimilarity of all possible pairs of 12 sung or 12 spoken stimuli (6 different emotions, 2 representations of each) drawn from RAVDESS, a validated dataset of emotional song and speech recordings. Multidimensional scaling shows that three dimensions adequately characterize the emotion space of both speech and music. Whereas there is some overlap between the spaces for song and speech stimuli, the solutions do not differentiate emotions in the way they are conventionally conceptualized. Acoustic analyses performed on the 24 excerpts, however, show features that may consistently inform participants' dissimilarity judgements. The results provide a useful foundation for further studying emotions in music and speech. Future studies could gather free labelling and emotional intensity ratings, and relate these data to the dissimilarity judgments and acoustic features to better understand the conceptualization of auditorily perceived emotions.

Historic Changes in Cues for Valence: A Novel Exploration of Perceived Emotion in Baroque- to Modern-Era Music

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T-G4-2

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Since the 1930s, researchers have conducted studies linking analyzed cues in music to perceived emotion. These studies relate music's timing and amplitude to perceptions of arousal (i.e., low—high emotional intensity) and tonality/pitch content to perceptions of valence (i.e., negative—positive emotional quality). Despite the general importance of these relations for communicating emotion through music, studies from empirical musicology identify prominent changes in mode's relation to cues like pitch and timing between the Baroque and late Romantic eras (Horn & Huron, 2015; Harasim et al., 2020). Consequently, the effect of historic differences in compositional practice on these relations remains unclear. To address this gap, our team is conducting a series of studies applying regression commonality analysis to music composed over three centuries of western music. This method enables decomposing cues' emotional effects into variance attributable to individual cues vs. their relations to other cues. We focus our analyses on special musical sets comprising keyboard pieces composed in each major and minor key. To clarify how musical context moderates cue effects, here we analyzed 240 non-musicians' emotional responses to prelude sets by eight composers active in the Baroque (1600-1750), Classical (1750-1820), Romantic (1830-1900), and Modern (1900-2000) musical eras (two in each era). Across eight experiments, different groups of 30 participants rated valence and arousal of between 20 and 24 prelude excerpts by one composer per experiment (one valence and one arousal rating per excerpt). To measure effects of timing, pitch, and major/minor mode on participants' emotion ratings while accounting for potential confounds between cues, we conducted separate commonality and dominance analyses (statistical techniques robust against multicollinearity). These analyses reveal timing's importance for communicating arousal remains consistent across all eras, whereas pitch height overtakes mode as the most important cue for valence in later eras. Our findings suggest participants apply distinct strategies to judge valence in music from different eras—providing novel insight into the emotional implications of music's historic changes.

Plosive to Nasal Ratios in Renaissance Lyrics as a Marker of Musical Affect?

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T-G4-3

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Regardless of language, Auracher, et al. (2010) found that positive and high arousal affect in poetry is correlated with a high ratio of plosive vs. nasal syllables, with negative/low arousal affect correlated with low plosive:nasal ratios. This correlation was consistent across a surprisingly broad array of texts, ranging from ancient Chinese to modern Russian poetry, suggesting a universal relationship between poetic sound and affect. This study tested whether traditional markers of musical valence and arousal correlate with plosive:nasal ratios in musical settings of poems of late Renaissance Italian poet Tasso—over 650 settings from 200 composers. Specifically, this study tested the hypotheses that plosive:nasal ratios in poetic texts positively correlate with melodic interval size, pitch height, proportion of syllabic:melismatic settings, rhythmic density, rhythmic complexity (nPVI), and proportion of major vs. minor sonorities. Poems and musical settings were taken from the new "Tasso in Music" project. Italian syllables were extracted from each poem, coded "plosive," "nasal," or "other," and plosive:nasal ratios were calculated for each poem. Musical features were extracted from the kern files and calculated using the Humdrum toolkit. Subjective judgments of arousal and valence were also collected for English translations of the poetic texts without musical settings. Correlations were calculated between plosive:nasal ratios, subjective arousal/valence ratings, and the extracted musical features. Plosive:nasal ratios for Italian texts ranged from .6 to 4.6. Most ratios were positive, only 13 using more nasals than plosives. Contrary to the hypotheses, no musical features were significantly correlated with plosive:nasal ratios; all correlations were near 0, consistent with no relationship between plosive:nasal ratios and traditional markers of musical affect/valence. Even subjective arousal/valence judgments were uncorrelated with plosive:nasal ratios. These negative results problematize the claim that plosive:nasal ratios are universally expressive of affect and/or translatable into musical expression. The results would also be consistent with musicians not explicitly encoding lyrics' valence into musical settings, suggested by Palomeque & de Lucio (2021), though that idea would contradict centuries of music scholarship.

Association of Musical Training with Auditory and Speech Neural Coding and Perception

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T-H1-1

Numerous studies have reported links between musical training and enhanced neural processing and improved perception of sound. Such findings suggest a role for experience-dependent plasticity in the early auditory system, which may have meaningful perceptual consequences. However, the robustness and generalizability of any musician advantage remains unclear for several reasons. First, sample sizes have often been small and the samples have represented extreme ends of the musical spectrum; second, the nature and magnitudes of the advantages have often been small or inconsistent; and third, methodological differences and varying analytical techniques have complicated direct comparisons between studies. This multi-site study examined the robustness of the musician advantage across the adult lifespan by replicating and extending eight key experiments involving both perception and neural coding across a large sample of listeners ($n > 300$) at six universities (Boston University, Carnegie Mellon University, Purdue University, University of Minnesota, University of Rochester, and University of Western Ontario). All participants were tested on all eight experiments in a laboratory setting, including pitch discrimination, behavioral estimates of frequency tuning, speech and non-speech informational masking, speech perception in noise and babble, and two physiological measures of fundamental-frequency encoding of speech sounds using electroencephalography. Participants completed additional measures to control for potential confounding factors, including a measure of musical aptitude, a cognitive assessment (Ravens Advanced Progressive Matrices), a measure of extended high-frequency hearing, and survey questions related to personality and socio-economic status. Results demonstrate that musicians outperform non-musicians on four of nine direct-replication measures, with only two effects (pitch discrimination and speech informational masking) remaining significant after controlling for cognition and age. The results provide in-depth and highly statistically powered insights into the nature and robustness of the musician advantage across the adult lifespan. [Supported by NSF-BCS grant 1840818 and NIH grant R01 DC005216.]

Neural Underpinnings of Effective Noise-Speech Integration in Musicians

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T-H1-2

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One frequently encounters conversations in a noisy natural environment, whereby portions of the speech are masked by other sounds. Decades of research have demonstrated that the brain can make logical inferences about degraded sensory information to improve perception. One such example is the continuity illusion that occurs when a sound is perceived as continuous through noise-filled interruptions. Enhanced continuity perception has been indexed neurophysiologically by reduced auditory theta (4-8 Hz) power and phase-locking, and reduced beta (15-30 Hz) power following interruption onset/offsets. Here, we examined the behavioral and neurophysiological differences between musicians ($n = 16$) and non-musicians ($n = 16$) as they listened to trisyllabic words and classical music with noise interruptions to assess two competing hypotheses: (H1) musicians are less likely to perceive continuity because of their enhanced ability to detect acoustic gaps, thereby exhibiting more theta and beta power to interruption boundaries compared to non-musicians, or (H2) musicians are more likely to perceive continuity because specialized cortical networks would quickly take over processing and induce a perception of continuity (i.e., fill-in missing representations), demonstrated by reduced theta and beta power. On each trial (2 blocks, 180 trials per block), participants were tasked with identifying whether randomly presented auditory stimuli sounded continuous or interrupted. Behaviorally, musicians and non-musicians had similar rates of perceived continuity for music, but musicians perceived more continuity for speech compared to non-musicians. Neurophysiologically, the oscillatory results demonstrated that relative to non-musicians, musicians had weaker theta phase-locking to the interruption boundaries in both speech and music, consistent with our second hypothesis. However, musicians also exhibited enhanced alpha (9-14 Hz) and beta power for both speech and music relative to non-musicians; these results suggest differential auditory-motor activity exhibited between both groups. Taken together, the results demonstrate that musicians tend to experience more continuity perception that is reflected neurophysiologically as reduced theta phase-locking, and enhanced beta and alpha power. We conclude that musicians exhibit greater auditory-motor inhibition of the interruption, thereby heightening continuity perception compared to non-musicians.

Exploring the Associations Among Emotional Intelligence, Auditory Emotion Recognition, and Pitch Imitation in Speech and Song

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T-H1-3

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Emotional intelligence (EI) – the ability to detect and manage emotions – has shown to positively correlate with recognition of auditorily conveyed emotions. The current study sought to further examine this association by comparing EI and the ability to recognize emotions in both speech and song while also exploring potential relationships with pitch imitation. Participants ($n = 65$) completed auditory emotion recognition and pitch imitation tasks using the same audio files of emotional expressions. Both tasks included speech and song trials to determine potential domain differences. Participants' EI was measured via the Schutte Self-Report Emotional Intelligence (SSREI). Correlational analysis revealed a significant positive correlation between emotion recognition and pitch imitation, but EI scores did not significantly correlate with the behavioral tasks. Hence, a confirmatory factory analysis was run on the SSREI to see if our data fit prior models (Gong & Paulson, 2016; Ng et al., 2010). The confirmatory factor analysis with our data did not support prior models likely because of a small sample size. Due to these null results and the fact that prior models did not include a third of the SSREI, we ran an Exploratory Factor Analysis that included all items from the SSREI. Of the four factors extracted, the factor assessing for the appraisal of emotions of the self had a significant correlation with pitch imitation. Our behavioral results suggest a speech advantage for auditory emotion recognition and pitch imitation. This is a novel finding contrary to prior non-emotion related research that has observed a song advantage in pitch imitation, rather than a speech advantage. As such, further studies are required to explore these relationships and validate initial findings, such as assessing how song-like and speech-like our stimuli were. We also report differences in task performance due to individual differences.

Looking For Variability in All the Wrong Pieces: Evaluating Musical Features

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T-H2-1

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Recent advancements in computing, digital signal processing, and music research have led to the widespread use of powerful and convenient music content analysis tools. As usage of these tools in research and commercial applications grows, so to does the need for effective evaluation. This can be particularly challenging for high-level features such as tonal and rhythmic hierarchy given their subjective nature. As a proof of concept, here we illustrate the potential for use of "irrelevant transformations" (Sturm, 2014) as one approach to evaluating the quality of music analysis tools. Specifically, we examine the consistency of perceptually variant (tempo and timbre) and invariant (mode and number of onsets) features across different performance of the same composition of western classical piano music. In principle, we would expect variant features to differ across performances, while invariant features should remain consistent regardless of the performance. We extracted these features from the first eight measures of 17 commercially available recordings of the 24 preludes from J.S. Bach's Well Tempered Clavier Book 1 using Essentia, Librosa, and MIRtoolbox. We calculated the ratio of variability between versions and variability across all versions of all preludes. Analysis with pairwise permutation tests revealed that Librosa has significantly lower variability ratios than the other tools in the case of mode extraction. Analyses also indicate that despite more variability across variant features than invariant features, evaluations of mode are less consistent than evaluations of the number of onsets. These results call into question if the examined mode extraction algorithm is influenced by other variant features, such as tempo, dynamics, and sound quality. This method is also useful for evaluating high level feature algorithms such as tonality or metre in the absence of labelled datasets when an empirical or theoretical understanding of the feature is available (i.e., is a feature perceptually variant or invariant). Other potential applications include parameter optimization, algorithm selection, and benchmarking procedures.

Publication Patterns Provide Insights Into the 140-Year History of Music Psychology

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T-H2-2

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Research benefits from consideration of its historical antecedents. The question therefore arises as to the course of activity in the field of music perception and cognition from its inception to the present day. While it may seem that music psychology is burgeoning as never before, do publication indices support that hypothesis? Further, what is the shape of the publication trajectory? To answer these questions, bibliometric information was obtained for each half decade between 1879 and 2023. The APA PsycInfo abstracting and indexing database, provided the source of data, with its more than five million behavioral and social sciences bibliographic records. The number of publications and titles which included the word “music” were obtained, as was the total number of PsycInfo publications for these periods. Historical context within psychology and beyond to sociopolitical world events were considered as predictors and subsequently post hoc explanations for trajectory patterns. Results reveal that the number of music psychology publications increases from 1879 to 1933, declines for the next 30 years, and rises again after 1964.Total PsycInfo publications also decline after 1933, but, in contrast to music publications, the decline is less than half as long. The ratio of music psychology to all psychology publications across all half-decades resembles a skewed W-shape function. The highest peak ratio occurs during 1884–1888 (2.2%), coinciding with the start of the first psychology laboratories. The next highest peak ratio occurs between 1939-1943 (1.3%). The final peak is within the last decade, but at 1.1%, not yet reaching past levels. The pattern of publication of music psychology publications in both absolute and relative terms raises consciousness of the fact that evolution within music psychology is subject to forces from a system of ever changing psychological Zeitgeists and global historical, musicological, and technological developments.

A New Theory of Evolutionary Musicology

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T-H2-3

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Evolutionary musicology is a branch of biomusicology concerned with exploring the several theories of the evolutionary origins of musicality. Darwin argued that music is “a fossil of an earlier hominid communication system,” while William James argued that the human talent for music was “a mere incidental peculiarity of the nervous system, with no teleological significance.” Because music has powerful calming effects on individuals with developmental disorders (like autism) and degenerative disorders (like dementia); because the brain is capable of such remarkable musical memory, even when language ability has deteriorated; and because humans are the only primates with a capacity for beat synchronization and vocal learning, I propose a comparative discussion of competing theories. These include those put forward by Ani Patel (cultural adaptation), Tecumseh Fitch et al (coevolved system for social bonding), Samuel Mehr et al (parent-infant bonding), Robin Dunbar (vocal grooming), and Darwin (protolanguage vs mate selection). I propose a seventh theory, namely voice recognition as an engine for the acquisition of the ability to distinguish musical pitch, timbre, and timing. My analysis will focus on the comparative evolutionary advantages of facial vs voice recognition; the comparative neuroanatomy (face recognition in the right fusiform gyrus vs voice recognition in the right superior temporal gyrus); and the informative case of the clinical comparison of phonagnosia (inability to recognize voices) vs prosopagnosia (inability to recognize faces). I argue that musical memory is related to voice recognition memory, both in its component parts and its duration. A major implication is a first cogent theory of why music co-evolved with language, and secondly a new way of conceptualizing a tangible evolutionary benefit of the musical sense in defiance of Stephen Pinker’s assertion that, “As far as biological cause and effect are concerned, music is useless.”

Both Calming and Arousing Music Are Effective at Improving Sundowning Symptoms in Long-Term Care Patients with Dementia

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T-H3-1

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Previous research involving patients with dementia has shown that playing music from their late teens to early adult years may spark memories from that period of their life and can improve sundowning symptoms that tend to worsen late in the day. We explored whether long-term care residents with dementia would experience improvements in different sundowning symptoms after listening to arousing music vs. calming music. Thirty participants ($M_{age} = 82.00, SD_{age} = 8.78$) with mild to severe dementia ($M_{MMSEscore} = 11.48, SD_{MMSEscore} = 8.47$) completed 4 sessions, alternating between an arousing and a calming playlist that included the top 40 hits from the years they were 15-24 years old. Sessions occurred one to two times a week between 10 AM and 4 PM. We randomly determined which playlist the participant began with, and we observed the seven sundowning symptoms before and after each listening session. We hypothesized that disengagement, confusion, repetitiveness and unresponsiveness would improve after listening to either the calming or arousing playlist while agitation, restlessness, and aggression would improve more after listening to calming than arousing music. To analyze the results, we ran a 2 (Time: pre-music vs. post-music) x 2 (Type of Music: calming vs. arousing) x 7 (Sundowning Symptom) repeated measures ANOVA. Neither the main effect nor the interactions involving Type of Music reached significance (all $ps > .05$). However, we did find significant main effects of Time and Sundowning Symptom were qualified by a significant 2-way interaction, $F(6, 24) = 4.18, p = .005$. Follow-up analyses revealed significant improvements in disengagement ($p < .001$), repetitiveness ($p = .005$), and confusion ($p = .002$), but not restlessness, agitation, aggression, or unresponsiveness (all $ps > .05$). This pattern of changes was consistent across arousing and calming music playlists. These findings can be used to inform music programs in long-term care settings and suggest that both calming and arousing playlists are effective in improving sundowning symptoms in patients with dementia.

Gamma-Augmented Music-Based Intervention for Mild Cognitive Impairment: Preliminary fMRI Results

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T-H3-2

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Music-based interventions for healthy aging rely on the idea that listening to pleasurable music engages auditory and reward systems; however, this result has not yet been observed in cognitively impaired older adults. Here we tested older adults with mild cognitive impairment (MCI) in a music listening fMRI task. Twelve older adults (aged 54-87), who scored 0.5 or above on the Clinical Dementia Rating scale, participated in an 8-week Gamma-Augmented Music-Based Intervention where they listened to self-selected music for 30 minutes per day while viewing lights that flickered in time to the music and in gamma-band frequencies. Before and after the intervention, they listened to self-selected and researcher-selected musical excerpts and rated them on a four-point liking and familiarity scale during fMRI. The effect of self-selection (self>other-selected music) was observed in auditory and reward systems (superior & middle temporal gyrus, Heschl's Gyrus, ventral striatum), regions in the memory network (hippocampus & amygdala), and the default mode network (DMN; medial prefrontal cortex (mPFC) and posterior cingulate cortex (PCC)); this replicates previous results on healthy older adults. Post-intervention, same regions were active in the same contrast; however, there was additional activity in lateral occipital cortex (LOC, part of the theory-of-mind network [1]) and hippocampus (in an anatomically distinct cluster from the amygdala). Theory-of-mind and memory networks may add to the DMN and reward systems in augmenting the experience of music in MCI. Data collection is ongoing for a larger sample, and a non-gamma control intervention.

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Neural Correlates of Empathic Accuracy in Social Cognition and Music Perception

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T-H3-3

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The proposed link between human musicality and sociality has animated significant debate in recent years (Savage et al., 2020; Mehr et al., 2021). Supporting this connection, individual differences in empathy—an essential component to social cognition—have been shown to modulate music processing (Wallmark et al., 2018), and new behavioral evidence suggests that empathic accuracy in social cognition is associated with accuracy in music emotion recognition (Tabak et al., 2023). However, the neural processes undergirding empathic and affective processes in both social and music cognition remain underexplored. Are common neural substrates responsible for empathic accuracy (EA) across domains? To investigate this question we carried out an fMRI study (N = 34). Using a block design, participants completed two counterbalanced tasks while being scanned: a standard EA task, in which they provided continuous valence ratings (positive-negative) to videos of people discussing emotional events in their lives (Kern et al., 2013); and a novel musical version of this task, in which they provided valence ratings as they listened to original recordings by pianist-composers. Separately, the individuals in the videos and the musicians who recorded original pieces provided continuous response valence data to their own videos/recordings; these data functioned as the "true" time-series response in comparative analyses with participants' ratings. Videos and music recordings comprised both positively and negatively valenced target emotions. We examined areas of neural overlap in the processing of both social and musical stimuli. Additionally, using behavioral EA scores (time-series correlations) in a second-level analysis, we assessed whether empathic accuracy for people and music recruit similar neural architecture. Preliminary results suggest that music and social tasks, in addition to auditory cortex, draw upon neural substrates previously implicated in social perception, including temporoparietal junction, superior temporal sulcus, anterior insula, dMPFC, and dLPFC. Parametric modulation analysis, however, revealed no discernible pattern of activation related EA (i.e., behavioral data was not statistically significantly associated with BOLD signal change). Finally, we will discuss results of exploratory intersubject correlation analyses to quantify degree of synchronization between participants' neural response across the two tasks. Together, our preliminary findings shed light on the social-cognitive nature of music listening, while also prompting new questions concerning the nature of our affective and social responses to music.

The Effects of Cannabis on Music Perception and Appraisal: A Musicians vs. Non-Musicians Analysis

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T-H4-1

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The use of cannabis with music spans diverse cultures and generations, and manifests across myriad musical genres. For many musicians, cannabis's ability to alter perception and enhance sensory experiences promotes a unique state of mind that may enhance creativity, provide inspiration, and reduce stress before performance. A growing body of research suggests there may be therapeutic potential by combining music and cannabis for emotional regulation and stress reduction. Alternative treatment approaches involving music and cannabis are emerging as promising interventions for mood and emotional disorders. One challenge is that the relationship between cannabis and music, particularly in relation to mood and emotions, remains poorly understood. This research aimed to investigate the mutual interactions of cannabis and music on mood and emotions. A total of 122 cannabis users (self-reported musicians=57, non-musicians=65) completed an online questionnaire designed to gather socio-demographic characteristics, and collect information about cannabis use, emotional well-being, auditory acuity, music engagement and emotional responsiveness, noise sensitivity, and the dynamic interactions between music perception and cannabis use. As part of this survey, participants completed the Barcelona Music Reward Questionnaire (BMRQ) twice: once imagining they had not used cannabis, and once where they imagined they had used cannabis. As expected, musician's results to the BRMQ were significantly higher than non-musicians across both cannabis conditions ($p = .028$ with cannabis, $p = .010$ without cannabis). However, within both groups, no significant difference was observed between cannabis use scenarios ($p = .755$ for musicians, $p = .966$ for non-musicians). This finding was surprising, given the historical belief that cannabis has positive impacts on music perception and production, and suggests that the effects of cannabis on music-related behaviors may not be as evident as commonly believed. Overall, our findings prompt a reevaluation of the perceived impact of cannabis on music-related experiences, underscoring the complexity of this interplay.

From Lab to Concert Hall: Effects of Live Performance on Neural Entrainment and Engagement

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T-H4-2

Neural entrainment is the synchronization of measurable cortical activity to time-varying stimuli such as speech and music. It is linked to prediction, attention and encoding, which are driven by rhythmic theta and delta frequencies present in the stimulus. The present study investigates neural entrainment in the context of live performance, a medium that heightens the connection between the performer and audience. We assessed the difference between live and recorded music on neural tracking, as measured through cerebro-acoustic phase-locking and temporal response functions (TRFs). 21 participants from the New England Conservatory (NEC) community listened to 2 live and 2 recorded performances of fast and slow movements of solo Bach played by renowned violinist Joshua Brown at NEC's Pierce Hall, and made behavioral ratings of engagement, spontaneity, pleasure, investment, focus and distraction. EEG data was recorded with eyes closed using a 32-channel dry EEG system. Live performances were rated as more engaging, pleasurable and spontaneous than recorded performances. Additionally, an interaction between the perceived effect of live over recorded trials and the experience of liveness itself elicited significantly higher acoustic-EEG phase locking than recorded trials in a low-frequency, delta-band frequency range (8-9.6 Hz) associated with the salient note-rate of the fast excerpts. Furthermore, a forward temporal response function, predicting the brain signal from the stimulus, showed the highest correlation with spectral flux in the 100-200 ms time window that was highest for the live fast trials, and reflected scores on the aggregated rating scale. Results suggest that engagement and liveness affect neural-acoustic tracking in temporal and phase-based responses, reflecting musical encoding driven by salient rhythms.

Misophonia is Associated with Heightened Emotional Responses in Music

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T-H4-3

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Misophonia is a disorder characterized by strong, negative emotional responses to "trigger" sounds, such as chewing or tapping. Although misophonia has been linked previously to other conditions, including hyperacusis, elevated anxiety, and PTSD, the relationship between misophonia and musical processing remains underexplored. Working from the hypothesis that misophonia stems from altered connectivity between auditory and limbic systems, we predicted that individuals who experienced greater misophonia severity would also show stronger emotional responses to music. A large ($n = 300$) online sample of participants completed the Amsterdam Misophonia Scale (A-MISO-S) in an initial screening study. Based on responses and several data quality considerations, a subset of participants (Low Misophonia: $n = 58$, High Misophonia: $n = 43$) at extreme ends of the misophonia scale participated in a larger study examining individual differences in several domains, including musical sophistication (Goldsmiths Musical Sophistication Inventory) and musical reward (Barcelona Musical Reward Questionnaire), and several trait measures (e.g., PTSD tendencies, hyperacusis). The Low Misophonia group had a maximum score cutoff in the *subclinical* range of the A-MISO-S, whereas the High Misophonia group had a minimum score cutoff in the *moderate* range of the A-MISO-S. Groups were matched on age, gender, race, and education. Participants in the High Misophonia group scored higher than the Low Misophonia group on several musical measures, including active engagement with music and emotion evocation from music (though not musical mood regulation or music seeking behavior). Participants in the High Misophonia group also scored higher than the Low Misophonia group on PTSD tendencies and hyperacusis, replicating prior work. The present study supports conceptualizing misophonia in terms of enhanced auditory-emotional responses, to both negative ("trigger") and positive stimuli, such as music. The findings fit within a small but growing body of research highlighting the positive emotional implications of misophonia, particularly in musical contexts.

Timbral Brightness as a Cue for Grouping and Prominence

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T-I1-1

The interaction of rhythm with other musical parameters has been tested empirically since the turn of the 20th century. When sequences differ in loudness, listeners typically parse them into pairs with initial stress/prominence; when they differ in duration, they typically hear pairs with final prominence (Bolton, 1894; Woodrow, 1909). For pitch height, listeners typically hear the higher pitch as the most prominent but occurring equally as the beginning or end of a pair (Woodrow, 1911). While timbre is known to be a structuring force in music (McAdams, 2019), timbre's role in rhythm remains underexplored. Following Wagner (2022), the present study observes how listeners use brightness to parse sequences in four distinct ways according to two independent processes; grouping (Which sound is first/last?) and prominence (Which sound is stressed and/or accented?). In an experiment with 30 participants, 60 binary sequences were presented, each with a 150ms inter-stimulus interval. Sequences comprised nine baseline and nine manipulated tones differing in duration, intensity, pitch height, or brightness (spectral centroid). Each parameter had six levels of manipulation, and sequences were concatenated in two ways: baseline first/manipulated last or vice versa. Participants responded to three multiple-choice questions after listening. The study replicates previous findings and reveals how listeners use brightness for binary grouping and prominence perception. Analysis revealed a significant trend in participant responses. A higher percentage of participants consistently identified brighter tones as the end of a binary group and, to a lesser extent, as prominent. Sequences with timbral changes were overwhelmingly identified as binary groups with final stress (iamb, xX). Relative brightness emerges as a reliable cue for finality and a potential indicator of prominence. The interplay among timbre, rhythm, and meter opens a promising area for future research, exploring additional timbral characteristics and their interactions with musical parameters.

How Slow Is Too Slow: Investigating the Breakdown of Rhythmic Grouping at Slow Tempi

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T-I1-2

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Tempo is one of many factors that affects how listeners perceive musical events to be grouped in time. As music becomes too slow, events are heard as isolated rather than part of a group. Exactly how slow is "too slow?" Does context play a role in the answer? In Experiment 1, we investigated the first question by having participants ($N = 16$) listen to 2-tone sequences of brief, identical tones and decide whether the tones sounded like a group or isolated. The inter-onset-interval (IOI) between tone onsets systematically increased from 500 to 4000 msec or decreased from 4000 to 500 msec in 100-msec steps on successive trials within a block. Results showed that the overall proportion of 'isolated' responses crossed a 50% threshold when the IOI was 1.2 sec, but this threshold was longer when the IOI decreased across trials (1.5 sec) than when it increased (1.1 sec). We investigated the role of context in Experiments 2 ($N = 21$) and 3 ($N = 20$); participants first listened to 3 tones or 2 tones, respectively, at a base IOI of either 500- or 800-msec and then a variable final tone. Participants decided whether the final tone sounded like it ended a group or started a new group (isolated). The IOI between the penultimate and final tones increased or decreased in 12.5% steps between isochrony and a 400% increase (4 missing beats) from the base IOI. Results showed that 50% thresholds for hearing the final tone as isolated were relative to base tempo in Experiment 2, but not Experiment 3. In both experiments, the implied meter of the context affected responses. The proportion of "isolated" responses sharply increased in response to relatively small temporal deviations and gradually increased as rhythm perception broke down. Findings will be discussed in terms of the psychological present and listeners' use of multiple temporal criteria to determine exactly how slow is too slow.

Evaluating the Three-Attack Threshold for Meter

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T-I1-3

Music theorists disagree about the number of note onsets required to initiate a sense of metric pulse during the initial listening process. Danuta Mirka (2009) has proposed a *three-attack threshold*, whereby three equally spaced note onsets are necessary for pulse perception. David Temperley (2009) counters that in certain cases two onsets are sufficient and more onsets simply result in a stronger sense of pulse. We model these competing perspectives as logarithmic and linear, respectively. We then survey a range of production and computational studies whose results support the three-attack logarithmic model. Specifically, tapping data from Krumhansl and Snyder (2001), Toiviainen and Snyder (2003), and Cambouropoulos et al. (2006) show that participants started or synchronized their tapping after 3 beats, and computational models by Longuet-Higgins and Lee (1982) and Large and Kolen (1994) suggest that pulse is established after three equally spaced onsets. We then present our own evidence from a corpus of English and American folk and art song, in which we tally successive downbeat onsets prior to the first vocal entrance of each song. A substantial number of songs (82%) have 2- and 4-measure introductions, with the vocal entrance falling on or just prior to downbeats 3 or 5, respectively, in alignment with the three-attack model. We use a Chi-square goodness of fit test to compare observed corpus data with the expected data from both the linear and logarithmic models. The test fails to show a close fit with either model. However, when these models are adjusted to factor in tempo and a general preference for binary regularity, there is a close fit with the logarithmic model only, $\chi^2(3, N = 230) = .74, p = .995$. Our results are consistent with the idea that the three-attack threshold is one component of meter perception. This onset-based lower threshold for meter complements other well-established temporal thresholds (London 2012) and should be considered in experimental design.

Automatic Computation of Singing Scores Based on Detected Frequencies

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T-I2-1

MAST-21 is an online battery of tests developed to measure singing. Based on the AIRS Test Battery of Singing Skills (Cohen et al., 2020), and implemented with help of Sebastian Silas, the test captures participants' singing as an audio file and processes pitch with the pyin algorithm. This algorithm wraps the pYIN and Sonic Annotator libraries in R, enabling fundamental frequency and note onset estimation computation within the R environment (cf. Silas et al., 2023). When singers produce distinctly segmented notes, our analysis shows that pyin provides accurate automated note and pitch detection. However, due to participants' varying levels of vocal control, note segmentation can fail, resulting in pitch estimation errors including insertions and deletions. To circumvent these issues, we introduce a way to compute participants' singing scores based on the continuous frequencies analyzed with pYIN, bypassing issues from incorrect note segmentation. A threshold is set for segment length and frequencies allowed as a single note. Singing accuracy scores are computed based on both a weighted average of absolute pitch difference from the correct pitch chroma and relative pitch distance for multi-note trials. Applied to a dataset ($N = 55$; 120 target notes/participant), scores correlated positively with the Goldsmiths Musical Sophistication Index: Active Engagement (.47), Perceptual Abilities (.46), Musical Training (.62), Singing Abilities (.55), and General Musical Sophistication (.69), all $r(53), p < .001$.The battery of tests in MAST-21 is still undergoing development. Although currently based on the Western music tradition, there is potential of extension to non-Western cultures. The algorithm can be easily adapted for non 12 TET tuning systems. Deriving these singing scores automatically and quickly poises MAST-21 for expansion to a wide variety of applications such as tracking changes in vocal control longitudinally, for example as a function of training, age, or neuro-motor degenerative disease progression.

Modelling the Dynamic Network Connectivity of Music Listening

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T-I2-2

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Music listening is a sophisticated behaviour that blends layers of information into a singular experience. Because music remains enjoyable later in life, it is often used in clinical settings with those with neurodegeneration. However, numerous methodological hurdles remain in the analysis of music listening data, and in combining multiple modes of information across varying temporal scales (most notably, brain and behaviour measures). As well, much is still unknown about how music listening adapts to reconfigurations in brain network dynamics related to healthy aging. This talk will present a series of studies examining dynamic brain network activity during music listening in healthy younger and older adults with the aim of presenting a workflow for analyzing and interpreting multi-modal music listening data with a primary focus on these methods' applicability to the study of aging and neurodegeneration. Network measures, including network occupancy and between-network transitional probabilities, were extracted using hidden Markov modelling and modelled together with behavioural ratings and music feature data using partial least squares analysis. This workflow was applied to fMRI and EEG data, as well as features extracted from musical stimuli using the music information retrieval toolbox. We found age-, stimulus-, and task-related differences in network activity. In a mixed-age fMRI study, we found younger adults were more likely to employ an auditory reward network during listening to well-liked music while older adults were more likely to employ this network across all types of music. In an follow-up study with the older adult participants, this network was more active still following eight weeks of music-based intervention. In a separate younger adult study using EEG, we show different patterns of between-network activity related to attentional focus and behavioural reporting in perceptual versus emotional music listening. We discuss the implications of modelling music listening at different spatiotemporal scales with a particular focus on applicability for phenomenological investigation of music-based interventions in clinical settings.

Modeling Continuous Emotion Ratings with Surface-Level, Structural, and Information-Theoretic Predictors

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T-I2-3

Expectation and prediction play a key role in shaping the emotional experience of listening to music (Huron, 2006), which is frequently measured using the two-dimensional emotion model of valence and arousal (Russell, 1980). Modeling expectation is complex, since music consists of many simultaneous features that each afford several possible cognitive representations. While expectancies have broadly been shown to influence emotions, this research has been limited by the availability of concurrent emotional and feature-rich musical data. In this paper, we examine a recent corpus of 100 popular songs featuring continuous ratings of valence and arousal (V&A) alongside symbolic representations of melody and harmony, and the root mean square energy (RMS) of the audio. Several exploratory analyses assess the predictive value of various musical features (and their optimal representations) on the V&A ratings. We compare different models, including various configurations of IDyOM (Pearce, 2009), to examine the impact of different representation schemes on their ability to predict the V&A ratings. Preliminary results with linear mixed-effects modeling suggest that 'surface level' features appear to have a greater effect on arousal and valence than structural features overall, with pitch height and loudness most impacting both ratings. However, harmonic surprise—as estimated by PPM-Decay (Harrison et al., 2020) such that each unique chord symbol is a possible outcome—also significantly predicted valence ratings, whereby increased surprise resulted in decreased valence. We continue to test more complex representations (e.g. separating out chord roots and qualities) in our modeling approaches to explore whether different derived features of melody and harmony make separable contributions to valence and arousal.

Perceptual Influences on Large-Scale Repetition Structure: A Corpus Study

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T-I3-1

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In musical form, certain patterns of large-scale repetition are more prevalent than others, but it is not well understood why. The habituation-fluency (HF) and uniform information density (UID) theories suggest that listeners' perceptual constraints influence how composers structure repetition. HF posits that composers use extensive immediate repetition to build listeners' fluency with relevant musical material, but guard against habituation by balancing this with moments of sudden contrast and decreasing the level of immediate repetition as a piece progresses. Conversely, UID posits that composers structure repetition to create a consistent rate of musical information, with few moments of extreme surprise or extreme predictability. Which of these conceptually differing theories provides a better account of the repetition structures observed in a corpus? I developed modelling approaches to test how well the key predictions of HF – (1) high immediate repetition, (2) progressively decreasing immediate repetition – and UID – (3) relatively consistent rate of information – apply to a stylistically diverse corpus of 1,300 works. To test (1) and (3), I generated 1,000 reordered versions of each piece, calculated the proportion of reorderings with reduced immediate repetition (1) or more variable information profiles than the original (3), and measured whether the distributions of these proportions were closer to 1 than 0 using a Wilcoxon test. To test (2), I calculated a "repetition center-of-mass" metric for each piece (expressed as a proportion of its length) and measured whether the distribution of repetition centers-of-mass tended to be closer to the beginning of the piece than the end using a Wilcoxon test. Only the UID test (3) produced a significant result: most pieces had less variable information profiles than their reorderings under multiple models of information. In other words, pieces tended to feature smooth trajectories of information, with gradual changes in complexity rather than sudden spikes in surprise or predictability. This is consistent with wider evidence for UID across music and language, supporting a domain-general account of the information-theoretic structure of auditory communication.

The Effect of Pitch and Timing on Musical Expectancy

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T-I3-2

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Musical expectancy is a theoretical framework focused on how we generate predictions in music. It is well known that both pitch and rhythm can be used to generate predictions, but little is known about how pitch and timing information interact. To address this, participants were presented with unfamiliar four-second monophonic melodies at 120 BPM and were asked to rate the final note in terms of its melodic and temporal fit with the melody. Across multiple conditions, the final note could be shifted time, pitch or both. The expected note occurred at a quarter-note interval from the last note, and was a good (expected) resolution to the melody (i.e., tonic, dominant, subdominant). Timing variations ranged from +.25 seconds to -.25 seconds, with variations on note timings falling on musical intervals (i.e., eighth note, 16th note, three 64th notes…) or at non-musical intervals (i.e., 50 ms). Pitch variations spanned five note categories including, chord tones, diatonic tones, chromatic tones, and half and quarter semitones to account for mistuned notes outside the chromatic scale. Ratings for all pitch variations were consistent with goodness-of-fit ratings from a tonal hierarchy task only when direction is controlled for.. Interestingly, final notes that occurred the closest to the “On Time” condition (±.05 seconds), were rated worse than those that occurred farther away but in a musical timing construct (±.09375 seconds) . Moreover, timing did not affect the goodness-of-fit ratings for diatonic notes, timing did impact the ratings of notes outside the diatonic scale. Specifically, it became a more salient predictor of note ratings than the notes themselves. These results suggest a nuanced relationship between pitch and timing when making goodness-of-fit ratings.

Contrastive Stress in Music

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T-I3-3

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Contrastive stress is a stress given to a word or syllable as a way of contrasting it with something else. The stressed word is generally new to the conversation, or unexpected in some way: "Sue is chairing the committee, right?" "No, BILL is the chair." In some cases the same speaker mentions both the expected item and the unexpected one, stressing both (e.g. "It's not WHAT you know, it's WHO you know"); in such cases, the unexpected item is usually second, following the usual conversational principle of placing "given" before "new" information. Contrastive stress is generally indicated by an increase in pitch on the stressed element (or elements). I will argue that there is a close analogy to contrastive stress in music. I will begin by presenting some relevant corpus data. In classical music, when an intervallic pattern is immediately repeated with a single interval changed, the interval is usually larger in the second instance of the pattern than in the first; this is analogous to the "given-before-new" pattern in contrastive stress, since larger intervals are less expected. (The fact that the interval deviates from the expected exact repetition of the pattern also contributes to its unexpectedness.) This strategy is used more often with ascending intervals than descending ones, mirroring the intonational accent associated with contrastive stress. In music, then, a single musical feature— an unexpectedly high pitch—represents both the semantic aspect of contrastive stress (the unexpected element) and the prosodic aspect (the means by which it is emphasized). I will also show that a number of the most well-loved themes in classical music use exactly this strategy of altered repetition. I will suggest that the use of this strategy contributes to the appeal of these melodies, and that its speech-like, conversational character may explain its positive effect.

Children's Agency and Engagement During Parent-Child Singing Activities in Autistic and Non-Autistic Preschoolers

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T-I4-1

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When children are offered agency and autonomy, they can see themselves as active participants in their environment. Therefore, supporting child agency is important for children's development. Parent-child singing is a common musical activity in many young children's home environments. However, it is unclear how parents structure joint musical interactions with regard to offering their children agency (i.e., opportunities to direct the activity). Here we take a mixed-methods, process-oriented approach to understand if and how parents foster their children's agency through song. Forty-four parent-child dyads (23 autistic, 21 non-autistic; children's mean age 38.6 months [SD 9.1]) were filmed while singing verses from common children's songs (e.g., *Old MacDonald Had a Farm*). Videos were behavior coded for i) whether the parent offered their child agency in choosing the next verse, ii) if so, what strategy they used to offer agency, and iii) whether children sang during the verses. Parents of autistic children were significantly less likely to offer their children agency than parents of non-autistic children ($\chi^2 = 4.38, p = .036$). As well, autistic children were less likely to act on opportunities for agency (48.7% of opportunities) than non-autistic children (75% of opportunities). Across the sample, when parents did offer their child agency, elongating lyrics (e.g., "and on that farm he had aaaa…") and directly asking their child what verse should be next (e.g., "which animal should we sing about next?") most effectively resulted in the child acting upon their agency (>64%).Children sang for 22 of 35 opportunities (62.9%) when offered agency but only for 9 of 24 opportunities (37.5%) when they were not. Complementary behavior coding and case examples suggest parents adaptively respond to and promote their child's engagement when offering agency during song sharing. This may reflect in-the-moment parent-child attentional dynamics and their history with the song. Singing activities, which are common and accessible activities for parents to engage in with their children, may be used to support children's agency and parent-child engagement.

Virtual Mindfulness-Based Music and Songwriting to Support Well-Being of Parents/Caregivers of Children with Intellectual and Developmental Differences

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T-I4-2

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Parents/caregivers of children with intellectual or developmental differences (I/DD), which impact 1 in 6 children in the USA, experience increased levels of stress and mental health difficulties and reduced well-being. Mindfulness-based interventions can support the mental health and well-being of this caregiving population; however, there is a significant need to expand program accessibility and receipt of mindfulness-based skills. Music-based interventions can positively impact emotion regulation and well-being and integration of music with mindfulness techniques may increase uptake of mindfulness skills. Here we share findings from an initial feasibility study ($n = 12$) and a randomized trial ($n = 33$) of the virtual Mindfulness-Based Music and Songwriting (MBMS) program. During MBMS's 8 weekly sessions, conducted individually over telehealth, parents/caregivers of children with I/DD (e.g., autism, ADHD) learned and practiced mindfulness strategies through music-based meditations and writing of two original songs focused on mindful awareness of their child and loving kindness toward themselves. Across both the feasibility and randomized trial stages, there was high program receipt by participants. Using an experience sampling approach, MBMS sessions were associated with immediate affective and social connection changes in participants ($ds >= 0.67$). In the randomized trial, participants in MBMS reported decreases on well-validated surveys of stress and depression and increases in well-being and mindfulness from baseline to program end compared to a business-as-usual control group, with effects maintained at a one-month follow-up ($ds >= 0.62$). Qualitative feedback from semi-structured interviews, coded via thematic analysis, indicated that participants learned and applied mindfulness skills through MBMS and that songwriting was considered fun, confidence-building, and a vehicle for social connection. Songwriting provided a vehicle for participants to process and reappraise their experiences through the lens of mindfulness and was feasible over a virtual platform. Overall, data suggest that MBMS is well-aligned with models of well-being (e.g., PERMA), as well as with adult learning principles to support engagement and learning during therapy. MBMS may be a novel and accessible program for supporting caregiver well-being.

The Child Musicality Screening: A New Short Questionnaire to Assess Musicality in 3–10-Year-Olds

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T-I4-3

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Musicality in childhood is often measured using perception tests that cannot fully capture the complex nature of musicality. Research indicates that musicality encompasses various facets, including not only perception but also production and motivational components (Buren et al., 2021). However, there is a notable lack of assessment methods that can efficiently capture musicality while aligning with a more comprehensive definition of child musicality. **Aim**: The aim of this study is to develop a standardized brief screening instrument for the assessment of musicality in children aged 3 to 10 years, that is based on a comprehensive understanding of musicality, meets common psychometric criteria, and is suitable for mapping individual developmental trajectories. **Methods**: We created an online questionnaire in German and English with 57 statements on child musical behavior. The participants rated these statements in relation to a child they know well on a 5-point Likert scale. The sample comprised 808 adults (293 English-speaking, 400 female) aged 18 to 81 years ($M = 32.90, SD = 10.43$). In order to explore the structure and select items for the final version, an iterative methodology was chosen in which the factors to be extracted were determined using parallel analysis and then extracted using an exploratory factor analysis. Confirmatory factor analyses with invariance tests were carried out for German vs. English language and younger vs. older children. **Results**: The final model consists of 9 items on 3 factors (motivation & enthusiasm, music perception, music production), which explain 61% of the cumulative variance. The relative and absolute fit indices for this model are in a good range (RMSAE = .048, SRMR = .033, CFI =.985, TLI = .977). Factor loadings range between .54 and .86 with $p <= .001$. Cronbach's α for the total scale is .86, with scale values of .82, .82 and .73. It achieves strict invariance across German and English and different age groups. Convergent validity was established by correlation with the Music@Home scale (Politimou et al., 2018; $r = .40, p < .001$) and the KOMPIK Musical interest and competencies scale (Mayr et al. 2012; $r = .71, p < .001$). **Discussion and Conclusion**: The resulting short questionnaire is based on a broad understanding of musicality, is time-efficient, and can be used by both parents and teachers. To our knowledge, this is the first questionnaire that enables rapid assessment of children's general musicality across a broad age range in English and German. The inclusion of this scale could benefit studies of basic perceptual and cognitive skills, as well as research on general music classes, music training, social and solo musicking, and potentially even neural approaches.

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Gaze Behavior in Online and In-Person Concert and Film Viewing: A Large-Scale Naturalistic Eye-Tracking Study

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T-J2-1

Gaze behaviour, as observed through eye-tracking, serves as a powerful indicator of viewer attention, cognitive processing, and emotional engagement. However, a notable gap exists in utilizing existing eye-tracking technologies for comprehensive real-world investigations. Here, we investigate gaze behaviour across online and offline mediums of film and concert viewing. Our objectives are twofold: first, to introduce the methodology and framework for conducting a large-scale eye-tracking study with simultaneous online and in-person audiences, and second, to compare gaze measures between viewing conditions and media. Across two days of events in April 2024 at the LIVELab at McMaster University, for the first time in a concert setting, we simultaneously recorded eye measures from 60 in-person audience members (30 on each event day) using portable eye-tracking glasses and custom-developed software. Both days of events were live-streamed to an online audience for whom we recorded eye data using standard webcam-enabled laptops and a custom-developed web experiment that deploys our previously published webcam-based eye-tracking methodology (Saxena et al., 2023). Data from 21 online participants was screened for analysis. Both audiences watched a music performance and an associated documentary film; the order of media was counterbalanced across event days. We present preliminary findings from our online and in-person data collection including a comparison of gaze measures such as fixation/blink/saccade rates, gaze entropy, and gaze time at faces, instruments, etc. between the conditions. Gaze synchrony in different conditions is also calculated using inter-subject correlation on participants' gaze positions. Further, novel, custom metrics, unique to the social eye-tracking situation, are introduced, such as joint gaze distance across participants. The extensive software tools developed for this project and the rich, multi-modal dataset collected will be released under open-science principles for accessibility and future collaborations. Overall, our research contributes important insights to the fields of computer science, cognitive neuroscience, and media/music psychology. Our work democratizes access to advanced methods, empowering researchers, and boosting the external validity of music/eye-tracking studies.

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Investigating the Influence of Contextual Information on Cardiac Activity in Response to Musical Performance

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T-J2-2

Previous research investigating emotional responses to music through physiological measures, such as heart rate, are often performed in controlled laboratory conditions using short musical stimuli. However, typical musical experiences often occur in social contexts and over longer timescales, which presumably allow for deeper immersion and emotional engagement. The present study aimed to bridge the gap between laboratory and real-world situations by analyzing cardiac activity of individuals attending a documentary film screening and social advocacy themed musical performance. Both media were shown on two days (2/4 April 2024) in McMaster's LIVELab. Sixty participants attended either the film-then-performance ($n = 29$) or the performance-then-film ($n = 31$). Bangle.js 2 smart watches recorded participants' photoplethysmogram (PPG), which were used to calculate cardiac indices (e.g., heart rate, heart rate variability, etc.) to gauge relative emotional arousal to the film and performance over time. Additionally, we used a fine-grained time-series analysis technique called the matrix profile to identify motifs (similar response patterns) and discords (dissimilar response patterns) in cardiac activity. We primarily aimed to address: 1) whether cardiac activity changed consistently across participants over the span of the performance; and 2) whether patterns of cardiac activity differed depending on the contextual information provided by the film. The strength and consistency of effects across participants were hypothesized to depend on the order of film and performance. Our ongoing analyses consider two contrasting predictions: the film could provide a prior context that 1) increases similarity in participants' responses during the performance; or 2) diminishes the performance's impact and weakens corresponding responses. By situating our study in a live-concert setting, using non-invasive recording techniques, and applying state of the art analyses, our results offer a nuanced and ecological perspective on the emotional processes of music listeners.

Costs and Benefits of High-Stakes, Single-Shot, Multi-Person Data Collection Events

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T-J2-3

[1] Department of Psychology, Neuroscience & Behaviour, McMaster University, Canada

In recent years, there has been a push within music perception/cognition research towards "naturalistic" stimuli and experimental paradigms. Adopting this shift can be as simple as using "real" music in the lab, or as extreme as collecting data during a live music concert. This latter example acknowledges music's inherent sociality and the fact that immersive musical experiences tend to occur over longer timescales, in social contexts. However, such an approach, though promising, is not without its costs, literally and figuratively. From paying professional musicians and renting a venue, to the emotional toll of knowing that a year or more of planning and research will culminate in a one-time event during which everything must go relatively perfectly for usable data to result, single-shot, multi-person, data collection events are incredibly high-stakes. The present contribution will outline these, and more, potential costs and benefits via discussion of a large-scale event held at McMaster University's LIVELab in April 2024. Focus will be given to discussing how such events can foster 1) DEVELOPMENT OF TRAINEES' skills, scientific identity, and collaborative capabilities. For example, the current project involved 3 graduate and 10+ undergraduate students working collaboratively, across disciplinary boundaries, with the Principal Investigator. 2) COMMUNITY OUTREACH and engagement. Beyond the necessity to communicate the event and research goals clearly to the public to generate an audience, the current project centered around the notion of social justice advocacy through music. Via music performance, documentary film, and direct engagement with community stakeholders and non-profit organizations, we used our public platform to raise awareness about pressing social justice issues. 3) OPEN SCIENCE best practices. From pre-registration to development of extensive open-source code and multi-modal datasets, it is critical that such costly and time-consuming events are beneficial beyond their immediate research context and questions. Given the potential transformative value, but also the prohibitive costs of such events, how can our field collaborate to make them most beneficial to all of us?

A Longitudinal Investigation of the Development of Error Detection Skills

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T-J3-1

[1] Rhode Island College/Georgia Southern University, USA
[2] The Pennsylvania State University, USA

Researchers have used cross-sectional designs to investigate task attributes, participant attributes, score study strategies, and contextual variables impacting error detection skill. Here, we employ a longitudinal design examining the development of pitch and rhythm skills, and pitch and rhythm error detection. The research questions were: (1) To what degree does error detection skill improve after two years of musicianship coursework and formal musical training? (2) What are the relationships among beat perception, beat production, and rhythm error detection? (3) What is the role of working memory in pitch error detection, rhythm error detection, and combined error detection? We tested first year music majors ($N = 66$) and from that pool again two years later ($N = 26$). The measurement tools have all been used in previous research. with college music majors. Participants completed Forward Digit Span, a synchronization-continuation task, the Beat Finding and Interval Test from the Harvard Beat Assessment Test, an interval identification test, a rhythmic error detection test, and a melodic error detection test. Results indicated a significant improvement between Year 1 ($M = 15.15, SD = 3.63$) and Year 3 ($M = 16.67, SD = 3.90$) in tests of interval identification ($p = .008$), between Year 1 ($M = 9.88, SD = 4.27$) and Year 3 ($M = 11.62, SD = 3.29$) in test of melodic error detection ($p = .025$), but not between Year 1 ($M = 13.85, SD = 3.56$) and Year 3 ($M = 14.65, SD = 2.87$) in rhythmic error detection ($p = .071$). Small-to-medium effect sizes were indicated for both interval identification and melodic error detection. Performance on beat perception, beat production, and rhythmic error detection were not significantly interrelated ($p > .05$). Working memory in Year 1 was significantly related to Year 3 rhythmic error detection ($r = .442, p = .021$), but not to Year 3 melodic error detection ($p > .05$). We will prepare a regression model explaining the development of these skills in light of background variables, memory, and component variables. A unique contribution of this research is exploring musicians' skills in pitch and timing at the beginning of their collegiate studies and two years later.

The Systematic Impact of Cognitive Load on Involuntary Musical Imagery

Matthew G. Evans[1], ***Nicolas Davidenko***[1]

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T-J3-2

Phenomenological studies suggest that Involuntary Musical Imagery (INMI) occurrence is associated with mind-wandering and may be expected to correlate negatively with cognitive load. However, previous research has found conflicting results: one study found comparable INMI occurrence with low and high cognitive load (Hymen et al., 2013), while another study found higher INMI durations during a baseline task but no significant differences between low, medium, and high cognitive load tasks (Floridou et al., 2017). This conflict may be due to the nature of the tasks in the two studies: in the first, neither condition required sustained attention; in the second, each difficulty level used different tasks, each engaging different aspects of working memory. In two within-subjects experiments, we used an n-back task to manipulate cognitive load across easy ($n = 1$), medium ($n = 2$), and hard ($n = 3$) blocks (fully counterbalanced). In Experiment 1, 55 participants were primed with a tune before each block of trials, and after each block, they were asked to estimate the percentage of the block spent with music playing in their heads. We found a significant main effect of cognitive load on reported INMI duration, with post-hoc tests revealing significantly more INMI reported during the easy block (Mean Duration = 31.9% of the block) compared to the medium (MD = 19.4%) and hard (MD = 20.0%) blocks ($F(2, 164) = 5.1, p < .01$). In Experiment 2, 136 participants completed a similar experiment that also included a baseline do-nothing block where participants sat with their eyes closed for five minutes. Again, there was a significant main effect of cognitive load on reported INMI duration ($F(3, 543) = 21.3, p < 0.001$), with post-hoc tests revealing significantly more INMI during the easy block (MD = 20.6%) compared to the medium (MD = 14.1%) and hard (MD = 11.7%) blocks and even more INMI during the baseline block (MD = 30.3%). Our results provide systematic evidence that INMI decreases as cognitive load increases.

Participatory Music Learning Online: Investigating Older Adult Amateur Musicians' Selection and Use of Self-Regulated Learning Strategies

Ann M. Harrington[1], ***John O. Egger***[2], ***Crystal N. Berner***[1]

T-J3-3

[1] Florida State University, USA
[2] Purdue University Fort Wayne, USA

Self-regulated learning (SRL) strategies encompass any learning in which individuals incorporate meta-cognition, motivation, and behavioral processes to attain specific goals (Zimmerman, 2008). These processes are important in lifelong learning (Taranto & Buchanan, 2020), independent music practice (Miksa, 2015), and online learning settings (Schunk & Zimmerman, 1998), which have expanded to include more opportunities for participatory music learning (MacRitchie, et al., 2023). Adult learners may be more likely to retain self-generated strategies (Derwinger et al., 2005) rather than strategies provided by instructors (Bugos & High, 2009), which suggests that instructional efforts may be aided by increased awareness of self-selected strategies. As such, the purpose of this study was to explore older adult amateur musicians' self-reported (OAAM) selection and use of SRL strategies while learning a new instrument in an online setting. After a 6-week online beginning ukulele course, a purposive sample of survey respondents ($N = 28$) rated the difficulty of performance skills, their ability to perceive and improve aspects of their playing, and their use of SRL strategies (Zimmerman & Martinez-Pons, 1988; Sabesta & Seth; 2017). We used those results to write relevant learning scenarios. In follow-up interviews, participants ($n = 12$) described their preparations, practice habits, in-class behaviors, and outlined strategies for scenario challenges. After three rounds of coding, we mapped codes onto an operational model diagram structured around SRL processes (Saldaña, 2016). Participants' accounts suggested self-efficacy beliefs (motivation) notably influenced planning, goal setting, and strategy selection (metacognitive), and that self-evaluation (metacognitive) was indispensable in this online setting. Participants valued environmental structuring (behavioral) and emphatically expressed their beliefs concerning the efficacy of repetition (behavioral), often at the exclusion of other learning strategies, although some participants demonstrated task analysis strategies through their suggestions to reduce the difficulty of certain playing tasks (behavioral). Most participants could not offer strategies for improving the more complex bimanual coordination tasks. Implications of these results will be discussed in conjunction with existing literature along with potential directions for future research.

The "Foreign Music Effect": Listening Experience Influences Perception of Musical Tempo

Jared Leslie[1], ***Jessica Nave-Blodgett***[1], ***Shantala Hegde***[2], ***Olayinka Ogunlade***[3], ***Gaye Soley***[4], ***Joel Snyder***[1], ***Erin Hannon***[1]

T-J4-1

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Listeners often perceive foreign speech as faster than their native language, even when there are no differences in speech rate. This "Foreign Language Effect" could arise because more experienced listeners are able to track native speech at both faster (syllables) and slower (sentences) levels of structure, making it seem slower. Given that music also has hierarchical temporal structure, we ask whether a similar “Foreign Music Effect” might lead culturally unfamiliar music to sound slower than familiar music. We assessed listeners’ familiarity with cultural musical genres from the United States, India, Latin America, Turkey, and West Africa. Our sample included 118 participants from locations across the globe who took part in the cross-cultural study administered through Qualtrics. We also asked participants to make relative tempo judgments of song pairs that could differ in beats per minute, familiarity, or both. Using multilevel modeling, we found that unfamiliar music is rated as faster than familiar music, even after controlling for beats per minute and other correlates of tempo perception such as event density. Our results demonstrate that cultural exposure and accumulated listening experience may influence how listeners experience musical tempo.

A Cross-Cultural Comparison of Individual Differences in Musical Reward

Jinyu Wang[1], ***Nicholas Kathios***[1], ***Yongtian Ou***[2], ***Daxing Wu***[3], ***Psyche Loui***[1]

T-J4-2

[1] Northeastern University, USA
[2] University of Minnesota, USA
[3] Central South University, China

Music is an important source of pleasure for people, yet sensitivity to musical reward varies greatly across individuals. To assess individuals' sensitivity to musical reward, the Barcelona Music Reward Questionnaire (BMRQ) is a frequently used scale that has been translated into seven languages to date, but its five-factor structure has not been validated consistently across all languages. Here we assessed musical reward sensitivity in 1333 Chinese participants and 1433 US participants with the BMRQ, using multidimensional scaling and network analysis to explore culture-specific patterns of musical reward sensitivity in two countries. We hypothesized that there would be differences in network structure between the two groups, and that musical training would influence musical reward sensitivity. Results showed higher overall musical reward sensitivity in the US group than in the Chinese group, $F(1, 2749) = 194.65, p < .001, \eta_p^2 = 0.04$. However, multidimensional scaling analyses showed a greater distance between participants with high and low musical training in the US than in China, suggesting a tighter link between musical reward sensitivity and musical training in the US compared to the Chinese group, $M_{cn} = 0.53, M_{us} = 3.43, t(25) = -16.46, p < .001, d = 5.16$. Network analysis also revealed distinct structures of musical reward sensitivity between the groups: the US group showed a single cluster of Sensory-Motor items related to dancing, singing, and music-induced movement, whereas the Chinese group showed two distinct cluster, one for music-induced movement and vocalization, and another for dance. These results underscore the importance of culture and music experience in contributing to individual differences in musical reward sensitivity and highlight the need for further development of comprehensive tools to measure musical reward sensitivity across different cultures.

A Cross-Cultural Study of Pentatonic Scale Systems in Japanese and Western Musical Traditions

Cheng-Yun Mia Wang[1], ***Taichi Ishimoto***[2], ***Rie Matsunaga***[2], ***David R.W. Sears***[1]

T-J4-3

[1] Performing Arts Research Lab (PeARL), Texas Tech University, USA
[2] Matsunaga Lab, Kanagawa University, Japan

In a recent study, Matsunaga et al. (2020) demonstrated that listeners in bi-tonal environments (like present-day Japan) possess differential sensitivity to in-key vs. out-of-key notes in music employing Japanese scales compared to heptatonic western scales. However, no cross-cultural perceptual study has yet compared knowledge of pentatonic scale systems across musical traditions. To address this issue, this study conducted a cross-cultural behavioral experiment that examines knowledge of pitch structures reflecting pentatonic scale systems from western and non-western musical traditions. Eighty participants from the Lubbock, TX community and the Yokohama, Japan community (40 each) listened to monophonic melodies from each of four pentatonic scale systems (Japanese – Miyakobushi: scale-degrees 1 b2 4 5 b6; Ryukyu: 1 3 4 5 7; western – major: 1 2 3 5 6; minor: 1 b3 4 5 b7) presented in two instrumental timbres (shamisen and acoustic guitar). Participants then indicated how well each of the twelve members of the 12-tone-equal-tempered chromatic collection (in the matching instrumental timbre) fit with the preceding melodic context using a 7-point Likert scale (see Krumhansl & Kessler, 1982). The results have shown that the different instrumental timbres (shamisen and acoustic guitar) did not affect both groups' probe-tone ratings. However, each scale produced characteristic tonal hierarchies for both groups. American participants rated the Western and Japanese melodies using the step sizes found in the most relevant heptatonic superset scale, but Japanese participants appeared to be slightly less predisposed toward the heptatonic superset over its pentatonic subset. What is more, the western pentatonic scales elicited significantly higher intersubject correlations than the Japanese pentatonic scales for both participant groups, suggesting both participant groups were more familiar with western pentatonic scales. Finally, a follow-up regression analysis exploring the effects of several stimulus predictors on the participant ratings will be reported.

SMPC Research Grants Pilot Retrospective

***Presenters*:**

Alex Rossi (University of California Davis), Simbarashe Nyatsanga (University of California Davis), Jay Marchand Knight (Concordia University)

***Panelists*:**

Adena Schachner (University of California San Diego), Robert Slevc (University of Maryland), Dominique Vuvan (Skidmore College)

S-A2

Overview:

At the 2022 SMPC Conference in Portland, a pilot research grants program was announced. This pilot research grants program funded two-year, trainee-led research projects with the explicit goals of supporting studies that (1) Address understudied topics in the field, especially studies that have the potential to challenge extant views on music and cognition by considering musical cultures other than Western art music, and (2) Are led by one or more trainees, with preference given to trainees from communities underrepresented in SMPC. This symposium highlights the funded projects of this pilot research grants symposium. It will conclude with a panel discussion about the pilot research grants program.

Talks:

- Using Motion Capture to Create Animated 3D Models of Capoeira Practice (*Alex Rossi*, *Simbarashe Nyatsanga*)
- How pitch, timbre, and visual bias influence voice Fach categorization by cis and gender-expansive listeners (*Jay Marchand Knight*, *Mickael Deroche*)

The SingWell Project: An Update on Insights From Studies on Benefits of Group Singing for Communication and Wellbeing*

***Speakers*:**

Frank A. Russo (Toronto Metropolitan University), Arla Good (Toronto Metropolitan University), Alexander Pachete (Toronto Metropolitan University), Catherine des Rosiers (Université de Montréal), Gemma Perry (Bond University), William Forde Thompson (Bond University), Tara Raessi (Toronto Metropolitan University), Dawn Merrett (Université de Montréal), Chi Yhun Lo (Toronto Metropolitan University), Benjamin Zendel (Memorial University of Newfoundland),

S-A3

Overview:

Background: Increasingly, adults are discovering group singing as a meaningful social activity that has the power to generate community, improve mood, and decrease stress. But what about group singing in adults who suffer from communication challenges? A communication challenge affecting speech production might be considered an anti-requisite to participation in group singing. The SingWell Project (singwell.org) challenges this stigma by encouraging group singing for all, focusing on the potential of singing for the development and improvement of communication skills, in addition to benefits for psychosocial wellbeing. In this symposium, speakers will focus on their progress thus far in understanding the benefits of singing in Aphasia, Stuttering, Breathing Disorders and Parkinson's Disease. **Goals**: To introduce audience members to the aims and methods of the SingWell project, and to share new findings pertaining to Aphasia, Stuttering, Breathing Disorders, Hearing Loss and Parkinson's Disease. We also consider methods of delivery and potential underlying mechanisms. **Relevance, Value and Applicability**: We hope to inspire other researchers to join our project or to take up similar research initiatives.

Note: The SingWell Symposium occupies a double block of time, beginning one hour earlier than the other Thursday Symposia. It begins at 13:15 and ends at 15:15.

Talks:

- Unpacking the underlying mechanisms by which group singing impacts wellbeing (*Dawn Merrett*, *Isabelle Peretz*)
- Psychosocial Benefits of Using Low-Latency Technology for Virtual Group Singing (*Arla Good*, *Alexander Pachete*, *Frank A. Russo*)
- ChantWell: Assessing the benefits of chanting for individuals with breathing disorders (*Gemma Perry*, *Jack Sunjo*, *Farida Abass*, *William Forde Thompson*)
- Understanding the influence of Group Singing on Pain and Cortisol in Persons living with Parkinson's Disease (*Tara Raessi*, *Arla Good*, *Sean Gilmore*, *Frank A. Russo*)
- Group singing and stuttering (*Catherine des Rosiers*, *Simone Falk*)
- Understanding the Psychosocial Impact of Group Singing in Individuals with Aphasia (*Alexander Pachete*, *Christina Wynans*, *Arla Good*, *Frank A. Russo*)
- A multisite study investigating benefits of choir singing for older adults with untreated hearing loss (*Chi Yhun Lo*, *Benjamin Zendel*, *Arla Good*, *Frank A. Russo*)

The Musicultural Brain: A Multidisciplinary Approach to Understanding the Nature of Music and Musicality

***Speakers*:**

Massimo Lumaca (Aarhus University), Andrea Ravignani (Universita di Roma La Sapienza), Tudor Popescu (University of Padova), Julia Hyland Bruno (New Jersey Institute of Technology)

S-A4

Overview:

Why is music the way it is? What makes humans uniquely musical? These questions have sparked distinct lines of inquiry: ethnomusicologists and comparative musicologists explored the cultural evolution of music, while cognitive neuroscientists and biologists examined its neural basis and evolutionary origins. We advocate for an alternative and more recent hypothesis that bridges these two strands: music is a socio-cultural artifact that is deeply shaped by our neurobiology. This symposium integrates insights from cognitive science, neuroscience, evolutionary theory, and animal research to elucidate the neurocognitive, predictive, and sensorimotor processes underlying musical capabilities, the acquisition and transmission of music, and the genesis of music diversity. We begin by investigating the brain's role in organizing rhythm and melody. Experiments combining behavioural and neural data reveal how universal neurocognitive biases shape musical patterns during intergenerational transmission, giving rise to both shared structures and rich cultural variations. Next, we explore the evolutionary roots of rhythm, a fundamental dimension of music, dance and speech. Drawing on ethology, psychology, neuroscience, and anthropology, we map rhythm production across its myriad forms, from the vocalizations of songbirds and marine mammals to rhythmic abilities across the animal kingdom. Additionally, predictive dynamics provide a powerful framework for understanding the music-language connection. This framework emphasizes how prediction drives social interaction and the emergence of song and speech as distinct yet overlapping communicative modes. Finally, we adopt a comparative perspective on vocal learning. Studying the complex interplay of learning, innovation, and social interaction in songbirds offers insights into the sensorimotor mechanisms mirroring human speech and music acquisition. This challenges traditional views and highlights the crucial role of vocal interactivity in cultural transmission. In summary, we present a paradigm that bridges biological determinism and cultural constructionism to illuminate the biocultural evolution of music and potentially analogous forms of animal vocal communication.

Talks:

- (Neuro)biology matters: How Human Neurocognitive Biases Shape the Building Blocks of Musical Structure (*Massimo Lumaca*)
- The origins of isochrony and rhythmic categories between biology and culture (*Andrea Ravignani*)
- Dynamic predictive frameworks: Towards understanding the music-language family resemblance (*Tudor Popescu*)
- A comparative-species perspective on vocal interactivity and culture (*Julia Hyland Bruno*)

Dynamical Systems in Music Research: Current Debates and Future Perspectives

***Speakers*:**

Ji Chul Kim (University of Connecticut), Edward Large (University of Connecticut), Caroline Palmer (McGill University), Jonathan Cannon (McMaster University)

S-B1

Overview:

Dynamical systems approaches to music investigate the perception and performance of music as complex patterns emerging from coupled interaction between body, brain and environment. Often contrasted with the mainstream cognitive, information-processing views based on the idea of computation on mental representations and internal models, the dynamical approaches are concerned with the formation of, and transitions between, stable behavioral and neural patterns under intrinsic and environmental constraints. Recently, there is a growing interest in dynamical systems within music research. Dynamical systems theory is being employed as theoretical and conceptual frameworks for new related approaches such as embodied music cognition. Coupled oscillator models and nonlinear analysis methods are increasingly adopted to explain experimental data. At the same time, despite differences in underlying assumptions, recent theoretical work has attempted to incorporate nonlinear oscillatory dynamics into the cognitivist computational framework. This symposium aims to review recent developments and current debates on dynamical systems in music research and provide future perspectives by highlighting the unique strengths of dynamical systems theory and methods. Individual talks will engage one or more of the following topics: (1) recent developments and new applications of dynamical systems in music research, (2) comparison and relationship of dynamical approaches with other, more mainstream approaches in music cognition, (3) current debates regarding the nature of the dynamical processes in music perception and action, and (4) future directions in music dynamics research. With critical examinations of current issues, the symposium will inform ongoing development of dynamical systems approaches and promote their broader application.

Talks:

- Neurodynamics of Music (*Edward Large*, *Ji Chul Kim*)
- Delay-Coupled Models of Musical Synchrony (*Caroline Palmer*, *Alexander Demos*, *Bavo Van Kerrebroeck*)
- Dynamics of Beat Perception Through a Bayesian Lens (*Jonathan Cannon*)
- Music as Coordinated Movement: A Dynamical and Radical Embodied Approach (*Ji Chul Kim*)

Teaching Music Perception and Cognition: Workshop on Classroom Activities, Learning Outcomes, and Authentic Assessments

Contributors:

William Forde Thompson (Bond University), Siu-Lan Tan (Kalamazoo College), Peter Q. Pfordresher (University at Buffalo), Elizabeth H. Margulis (Princeton University), Frank A. Russo (Toronto Metropolitan University), Aniruddh Patel (Tufts University)

S-B2

Overview:

This workshop explores a range of approaches taken to teach music perception and cognition, with a focus on how we can convey existing research and theory along with the practical aspects of the field. Effective classroom activities, weekly topics, learning outcomes, and creative and authentic assessments will be discussed. The panel members, comprising authors of leading textbooks or other pedagogical resources, will share their insights for enhancing student understanding through engaging activities and assessments. This segment of the workshop will be followed by a flipped session in which suggestions related to the stated goals of the workshop are solicited from all workshop participants. Comments, insights, challenges, and prospects will be recorded and summarized in the final section of the workshop.

Goals:

The workshop aims to promote:

- **Meaningful learning**: share effective teaching methods for conveying core concepts in music perception and cognition.
- **Engaging activities**: identify activities that enhance student engagement and achieve personalized learning outcomes.
- **Authentic assessment**: summarize examples of creative, arts-based, and authentic assessments that connect concepts to lived experience and real-world settings.
- **Best practices**: summarize a range of effective strategies for developing new courses or refining existing ones.

Relevance, Value, and Applicability:

This workshop recognizes the high value of sharing pedagogical approaches in music perception and cognition. By emphasizing active learning, critical thinking, classroom activities, and creative and authentic assessments, educators can encourage student learning in meaningful ways. The workshop will offer practical insights and actionable strategies for educators and researchers seeking to promote rich learning experiences in the field.

Behavioral Data-Gathering With Special Populations Inside and Outside of Clinical Settings

***Panelists*:**

Peter Martens (Texas Tech University), Amy Belfi (Missouri University of Science and Technology), Jennifer Bugos (University of South Florida), Psyche Loui (Northeastern University)

S-B3

Overview:

A panel presentation and discussion on practical, ethical, and methodological aspects of data-gathering with special populations. Our four diverse panelists, one of whom will function as moderator, come from a wide range of disciplinary backgrounds including music therapy, music pedagogy, psychology, and neuroscience, and represent multiple perspectives across music perception and cognition.

Goals:

This session will introduce and provide real-world examples of the processes involved when music cognition researchers undertake studies with special populations in clinical settings (e.g. extended care facilities) or associated with and accessed via a resource institution (e.g. university-housed autism centers). The overarching goal is to give SMPC members confidence that they could undertake this type of work, either by themselves or with clinical collaborators.

Relevance, Value, and Applicability:

The presence of the creative arts and creative arts therapies in healthcare settings is on the ascent. And for good reason – basic research increasingly demonstrates the efficacy of especially music-based interventions. At the same time, new organizations such as the National Organization for Arts in Health are providing a framework for understanding, professionalizing, and regulating a broader spectrum of arts activity in healthcare settings. This activity includes both well-established treatment protocols such as those falling under Music Therapy and Music Education, but also less formal arts activity without specific therapeutic goals. Institutions that fund, encourage, or even allow arts-in-health activity depend on published experimental evidence to do so, hence the need for a greater quantity and quality of basic research in these settings.

Sound Health Network: Building a Music and Health Research Ecosystem

***Speakers*:**

Julene K. Johnson (University of California San Francisco)

S-B3

Overview:

The Sound Health Network (SHN) is an initiative of the National Endowment for the Arts (NEA), in partnership with the University of California, San Francisco (UCSF), and in collaboration with the National Institutes of Health (NIH), the John F. Kennedy Center for the Performing Arts, and soprano Renée Fleming. The SHN is led by a five-person leadership team (Julene Johnson, PI) with decades-long experience in music and health research and science communication. The mission of the SHN is to increase awareness about the impact of music on health and wellness across the lifespan. We accomplish our mission by engaging a broad range of multidisciplinary stakeholders. Through our coordinating role, we facilitate collaborative efforts at the intersection of music and health, advancing the potential of music to improve all our lives. Since its inception in 2020, we developed (i) key content related to music and health, (ii) networking tools, and (iii) strategic communications and outreach.

Goals:

- To increase awareness about the SHN for SMPC members
- To disseminate information about how to identify music and health funding opportunities
- To share tips about how to apply for music and health research grants
- To share ways for SMPC members to find collaborators related to music and health research

Relevance, Value, and Applicability:

The goal of the SMPC is to further the scientific and scholarly understanding of music from a broad range of disciplines. The Sound Health Network offers resources to music and health researchers and engages a broad range of multidisciplinary stakeholders.

Rhythmic and Metric Pathways into Language and Reading Development

***Speakers*:**

Jennifer Zuk (Boston University) Anna Fiveash (Western Sydney University) Mara Breen (Mount Holyoke College) Katerina Drakoulaki (Mount Holyoke College)

S-C1

Overview:

A rapidly growing body of evidence links rhythmic capacities with language and reading-related skills. Yet, it remains unclear which specific competencies involved in rhythm and meter perception may be associated with language and reading-related constructs, and to what extent these competencies may be attributed to separable underlying cognitive mechanisms and/or certain environmental influences. This symposium will consider newly emerging evidence from multimodal, cross-sectional, and intergenerational studies that span the developmental trajectory from early childhood to adulthood to examine links between rhythm and meter, and language and readingrelated constructs. First, this symposium will explore the relative importance and contributions of timing and content predictions to music and speech/language processing, with a focus on parallels and differences across the two domains, and potential differences emerging from musical training. Thereafter, building on established evidence that implicit metrical structure is associated with a larger neural attentional effect (larger N1) on metrically strong tones in adults, new findings reveal how the strength of this effect in children predicts their reading comprehension accuracy. Incorporating perspectives from early childhood development, this symposium will also include novel findings from an investigation in preschool-aged children revealing how beat perception and rhythm discrimination skills are associated with distinct language constructs. Lastly, intergenerational links will be considered through investigation of parents' musicality in relation to their oral language and reading skills, and whether and how this may be associated with the musical, language, and literacy environmental experiences parents provide their children. Overall, this symposium seeks to provide a multifaceted perspective on the intricate links between rhythm and meter processing and language and reading-related skills, with implications for potential avenues of leveraging rhythmic and metric cues to support language and reading development.

Talks:

- Exploring temporal predictions in speech and music perception (*Anna Fiveash*, *Luiza Lucuţa*, *Uğur Mustafa Kaya*, *Peter Keller*)
- Examining neural markers of metric stress processing in early reading development (*Mara Breen*, *Madeline Rose*, *Katerina Drakoulaki*, *Ahren Fitzroy*)
- Investigating different linguistic and cognitive predictors in beat perception and rhythm discrimination tasks in typically developing preschoolers (*Katerina Drakoulaki*, *Christina Anagnostopoulou*, *Maria Teresa Guasti*, *George Mikros*, *Barbara Tillmann*, *Spyridoula Varlokosta*)
- Intergenerational links between music and language: Examining parental musicality and language skills in relation to children's home music and language environments (*Jennifer Zuk*, *Helen Gray-Bauer*, *Talia Liu*, *Kelsey Davison*)

Computational Tools for Music Corpus Studies

Contributors:

Johanna Devaney (Brooklyn College), Nathaniel Condit-Schultz (Georgia Institute of Technology), David Sears (Texas Tech University), Elizabeth A. M. Acosta (Texas Tech University), Ngan Nguyen (University of Science, Ho Chi Minh City; Vietnam National University), Tommy Dang (Texas Tech University), Daniel McKemie (Brooklyn College), Alexander Morgan (Independent)

S-C1

Overview:

Computational studies of large musical corpora have become an important part of scientific music research over the last few decades. This work has often informed, and been informed by, music psychology via the general theory of statistical learning. Unfortunately, much computational music research has used custom data formats and analysis/processing pipelines, making it difficult to replicate analyses or compare data. There has also been much reduplication of efforts as we fail to capitalize on each others' work or on existing data processing pipelines available in programming environments like MATLAB, R, or Python. This special session consists of papers on three open-source musical-corpus analysis tools, which facilitate large-scale statistical analysis of audio data, symbolic data, and metadata. This special session will present three currently in-development computational tools for music corpus studies and their specific utility in music cognition research: humdrumR, MIRAGE, and pyAMPACT. HumdrumR is an R-based expansion of the humdrum toolkit (Huron, 1995) for symbolic computation musicology, facilitating easy but sophisticated analyses of the numerous published datasets encoded in the humdrum syntax. MIRAGE (Music Informatics for Radio Across the GlobE) is a web-based tool for exploring an extensive corpus of millions of songs streaming on internet radio stations across the globe. It facilitates the collection and analysis of a range of metadata and audio features. pyAMPACT (Automatic Music Performance Analysis and Comparison Toolkit) is a Python package that facilitates the estimation and analysis of music performance parameters through the alignment of symbolic and audio music representations. It is a re-implementation and expansion of an older MATLAB-based toolkit (AMPACT). The presentations will include both an overview of toolkits and available resources as well as live demonstrations of how to use them in music cognition research.

Talks:

- humdumR: An R library for music computation
- MIRAGE: Music Informatics for Radio Across the GlobE
- pyAMPACT: Automatic Music Performance Analysis and Comparison Toolkit in Python

Music and Neuroplasticity in Aging: Sensory Connections to Cognition

***Chair*:**

Jennifer Bugos (University of South Florida)

***Contributors*:**

Jennifer Bugos (University of South Florida), Veronica Vuong (University of Toronto), Maxime Perron (University of Toronto), Ricky Chow (York University), Claude Alain (University of Toronto), Michael Thaut (University of Toronto), Pascale Tremblay (University of Laval), Shayna Rosenbaum (York University), Shimin Mo (University of Toronto), Lei Zhang (Baycrest Hospital/Research Institute) Yi Du (Chinese Academy of Sciences)

S-C3

Overview:

Over the last 20 years, neuroscience research has shown that musical training enhances central auditory processing, which can compensate for age-related decreases in perception, motor control, and cognitive abilities. Music training in older adults necessitates effortful practice marked by increased auditory attention and visual cues thought to mitigate cognitive deficits. Research suggests that engagement in musical tasks – singing, music performance, and music listening may mitigate cognitive deficits associated with normal aging. We are just beginning to uncover how music participation can shape the brain of older adults. With the expansion of new analyses techniques, complex algorithms, and recent developmental data, a more comprehensive view of how music listening, and music performance affect behavioral performance and neuroplasticity is emerging. The **goals** of this symposium are: (1) to present research assessing neuroplastic changes associated with musical experiences in aging, and (2) to discuss pathways to rehabilitation based upon research findings. We will discuss the role of music training in maintaining and developing compensatory strategies. We will feature three projects in healthy older adults that examine music listening, lifelong singing, and lifelong instrumental performance on cognition and neurophysiological function. Collectively, our results suggest sustained musical engagement benefits perceptual and cognitive processing in healthy older adults.

Talks:

- Beyond Familiarity: Neuroelectric Correlates of Autobiographically Salient Music (*Veronica Vuong*, *Michael Thaut*, *Claude Alain*)
- Singing Across Ages: The Lifelong Cognitive and Neural Benefits of Choral Singing (*Maxime Perron*, *Pascale Tremblay*)
- Music Training Mitigates Age-Related Changes in Mismatch Negativity and Precision in Auditory Memory (*Ricky Chow*, *Jennifer Bugos*, *Shimin Mo*, *R. Shayna Rosenbaum*, *Claude Alain*)
- Auditory Dorsal Stream Connectivity Supports the Older Musicians' Preserved Audiovisual SIN Perception and Visual Benefit (*Lei Zhang*, *Yi Du*, *Claude Alain*)

Trainee Town Hall

Trainee Town Hall: Needs Assessment Preliminary Results and Discussion

***Organizer*:**

Natalie Miller (Princeton University)

TTH

Overview:

This Town Hall will report on preliminary findings from The Trainee Needs Assessment, fostering discussion around trainee needs and preferred support systems. Supported by the SMPC board, advised by the Mentorship Committee, and conducted by current SMPC trainee members, the Needs Assessment employs a mixed-method approach to identify the needs of SMPC trainees with regards to their academic, emotional, and social wellbeing, using our findings to determine appropriate interventions to address these needs.

List of Posters

Friday, July 26th

P1-01
Give Me a Break: Contributions of Active Practice and Breaks in Motor Learning
Suzanne E. Charney[1], Amy L. Simmons[1]
[1]*Center for Music Learning, The University of Texas at Austin, USA*

P1-02
Musicians and Non-Musicians' Neural Responses During Music Listening, Imitation, and Improvisation Tasks
Manal Lamouine[1,2], Adrianna Garcia[1], Steven Nguyen[1], Jennifer A. Bugos[1]
[1]*School of Music, University of South Florida, USA* [2]*Department of Psychology, University of Sidi Mohamed Ben Abdellah, Morocco*

P1-03
Movement Qualia Communicated via Laban-Coached Conducting Gestures
Peter A. Martens[1,2], Guilherme Feitosa de Almeida[1,3]
[1]*Texas Tech University, Dept. of Interdisciplinary Arts, USA* [2]*Texas Tech University, School of Music, USA* [3]*Baylor University, Dept. of Theatre Arts, USA*

P1-04
Effects of Athletic and Musical Training on Synchronization in Javanese Gamelan Musical Performance
Stefanie Acevedo[1], Spencer Davis[1], Steven Harrison[1],
[1]*University of Connecticut, USA*

P1-05
Focus of Attention on Music or Body Movement During Treadmill Running Affects Emotional Responses
Yixue Quan[1], Kirk N. Olsen[2], William Forde Thompson[3]
[1]*School of Psychological Sciences, Macquarie University, Australia* [2]*Australian Institute of Health Innovation, Macquarie University, Australia* [3]*Faculty of Society and Design, Bond University, Australia*

P1-06
The Rhythm of Words: The Effect of Rhythmic Entrainment on Statistical Learning
Ana Miranda Guimaraes[1], Stephen C. Van Hedger[1], Christine D. Tsang[1]
[1]*Department of Psychology, Huron University College at Western, Canada*

P1-07
Studying the Effect of Physical Balance on Motor Entrainment
Chenhui Xu[1], Derrick Nguyen[1], Grace Burnett[1], Connor Pailas[1], Dominique Vuvan[1]
[1]*Skidmore College, USA*

P1-08

Polyrhythm Classification Using the Composite Tool

Ève Poudrier[1]

[1]*University of British Columbia, School of Music, Canada*

P1-09

A Model of Tempo Maintenance in the Basal Ganglia During Rhythm Synchronization and Continuation

Jacob Duda[1,2], Jonathan Cannon[1]

[1]*Department of Psychology Neuroscience & Behaviour, McMaster University, Canada* [2]*Department of Physiology, University of Toronto, Canada*

P1-10

Contributions of an Audible Metronome to Musicians' Isochronous Tapping Accuracy and Evenness

Laura Bock[1], Robert A. Duke[1]

[1]*Center for Music Learning, The University of Texas at Austin, USA*

P1-12

Anticipatory to Synchronous Eye Movements to Audio-Visual Rhythms Until the Sound Is Contingent Then Divergent Strategies Arise: Using Gamification Theory to Explain Divergent Behavior

Jevaughn Barnett[1], Jason Burke[1], Sophia Miranda[1], Mary O'Hanley[1], Steven Talbot[1], Melissa Brandon[1]

[1]*Bridgewater State University, Department of Psychology, USA*

P1-14

Duet Synchronization Interventions Affect Social Interactions

Valentin Bégel[1,3], Alexander P. Demos[2], Caroline Palmer[3],

[1]*Institut des Sciences du Sport-Santé de Paris (I3SP), Paris Cité University, France* [2]*Department of Psychology, University of Illinois at Chicago, USA* [3]*Department of Psychology, McGill University, Canada*

P1-15

Expert Evaluations of Mode Across Musical Eras: Rethinking the Dichotomy

Aditi Shukla[1], Cameron J. Anderson[1], Michael Schutz[1,2],

[1]*Department of Psychology, Neuroscience & Behaviour, McMaster University, Canada* [2]*School of the Arts, McMaster University, Canada*

P1-17

Musical Training Modulates Cortical Effects of Attention in Processing of Musical Triads

Jessica MacLean[1,2], Elizabeth Drobny[1], Rose Rizzi[1,2], Gavin Bidelman[1,2,3]

[1]*Department of Speech, Language, and Hearing Sciences, Indiana University, USA* [2]*Program in Neuroscience, Indiana University, USA* [3]*Cognitive Science Program, Indiana University, USA*

P1-18

Enhanced Auditory Discrimination in Musicians: A Longitudinal ERP Study

Jed Villanueva[1], Assal Habibi[1]
[1]*University of Southern California, Brain and Creativity Institute, USA*

P1-19

The Effects of Perceptual Discrimination and Categorization of Pitch on Vocal Imitation

Chihiro Honda[1], Peter Q. Pfordresher[1]
[1]*University at Buffalo, The State University of New York, USA*

P1-20

Pitch Perception in Chords With Auditory Model-Based Stimuli

Jackson E. Graves[1], Daniel R. Guest[2], Anahita H. Mehta[1]
[1]*Kresge Hearing Research Institute, Department of Otolaryngology, University of Michigan, USA*
[2]*Department of Biomedical Engineering, University of Rochester, USA*

P1-21

Understanding Musical Abilities of Absolute Pitch and Tempo Among Western and Carnatic Musicians

Keerthana Vishwanath[1], Kelly Jakubowski[1]
[1]*Durham University, UK*

P1-22

Exploring the Phenomenon of the Missing Fundamental: Regression Insights into Stimulus Parameters

Lauren H. Vomberg[1], Mark A. Schmuckler[1]
[1]*Department of Psychology, University of Toronto Scarborough, Canada*

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Short-Term Pitch Memory Explains Variance in Both Incidental and Explicit Absolute Pitch Representations

Stephen C. Van Hedger[1], Sum Yee Hoh[1], Katarina Jovanovic[1]
[1]*Department of Psychology, Huron University College at Western, Canada*

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Lab vs. Nature: A Comparison of Sounds Encountered in Everyday and Experiential Environments

Andres Elizondo Lopez[1], Michael Schutz[1]
[1]*McMaster University, Canada*

P1-25

Quantifying the Influence of Acoustic and Emotional Features on Perceived Similarity of Popular Songs

Riesa Cassano-Coleman[1], Carmela Lozano[1], Vahni Tagirisa[1], Kelly Jakubowski[2], Elise A. Piazza[1,3]
[1]*Department of Brain and Cognitive Sciences, University of Rochester, USA* [2]*Department of Music, Durham University, UK* [3]*Department of Neuroscience, University of Rochester Medical Center, USA*

P1-26

Developing a User Interface to Evaluate Associations Between Instrument Timbre and Geographic Region

Cheng-Yun Mia Wang[1], Geethika Sanjeev[1,2], David R. W. Sears[1]
[1]*Performing Arts Research Lab (PeARL), Texas Tech University, USA* [2]*Interactive Data Visualization Lab (iDVL), Texas Tech University, USA*

P1-27

Identifying Voices Across Song and Speech

Matthew Eitel[1], Angela Cooper[2], Natalie Fetcher[2], Elizabeth Johnson[2], Laura K. Cirelli[1]
[1]*Psychology Department, University of Toronto Scarborough, Canada* [2]*Psychology Department, University of Toronto Mississauga, Canada*

P1-28

Perception of Legato Expressivity in Percussion Performance

Ben Duinker[1], Tristan Loria[2], Timothy Roth[3], Stephen McAdams[1]
[1] *Schulich School of Music, McGill University, Canada* [2]*Department of Kinesiology and Educational Psychology, Washington State University, USA* [3]*Faculty of Music, University of Toronto, Canada*

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Real-Time Audio-Visual Perception of a Piece for Karlax and Ensemble

Linglan Zhu[1], Benjamin Lavastre[1], Mael Oudin[1], Stephen McAdams[1]
[1] *Schulich School of Music, McGill University, Canada*

P1-30

How “Vocal” is Instrumental Music?

Jason Noble[1], Jay Marchand Knight[2], Louis Goldford[3], Gabriel Couturier[4], Theodora Nestorova[5], Caroline Traube[4]
[1]*Université de Moncton, Canada* [2]*Concordia University, Canada* [3]*Columbia University, USA* [4]*Université de Montréal, Canada* [5]*McGill University, Canada*

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The Influence of Genre, Mode, and Tempo on Narrative Generation

Alex Arnold[1], Richard Ashley[1]
[1]*Northwestern University, USA*

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Types of Restructuring in Music and the Analogies of Musical Sincerity, Authenticity, and Immediacy

Alpaslan Ertüngealp[1]
[1]*University of Pécs, Hungary*

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Quantifying the Human Aspect of Music Using Benford’s Law

Eli Oesterheld[1], Daniel Shanahan[1]
[1]*Northwestern University, USA*

P1-34
Do Listeners Prefer Human-Mastered Music to Machine-Mastered Version?
Song Hui Chon[1]
[1]*Belmont University, USA*

P1-35
Familiarity and Spontaneous Motor Tempo (SMT) Predict Music Preference Judgments
Ting Ting Goh[1], Elizabeth Acosta[1], David R. W. Sears[1]
[1]*Texas Tech University, USA*

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Relationships Between Familiarity, Personality, Musical Preferences, and Age on Listeners' Continuous Enjoyment Ratings During Live Performances of Contemporary Classical Music
Amanda L. Schlegel[1], Bruno Alcalde[2]
[1]*University of South Carolina, School of Music, USA* [2]*University of Richmond, Department of Music, USA*

P1-37
The Valence of Chords Within Progressions
Andrew Blake[1], David Temperley[1]
[1]*University of Rochester, Eastman School of Music, USA*

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Determinants and Norms of Musical Absorption
Harley Glassman[1], Tara Raessi[1], Sean Gilmore[1], Frank A. Russo[1]
[1]*Toronto Metropolitan University, Canada*

P1-39
The Role of Music in Emotion Perception Elicited by Dance Movements
Maercio Maia Alves[1], Abrahão Baptista[1], Patrícia Vanzella[1], Pedro Montoya[1,2]
[1]*Universidade Federal do ABC, Brazil* [2]*University of Balearic Islands, Spain*

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Factors Affecting the Judging of a Hip Hop Dance Competition
Chantal Carrillo[1], Susan Marsh-Rollo[1], Laurel Trainor[1]
[1]*McMaster University, Canada*

P1-41
Exploring the Role of Lyrics in Shaping Emotional Responses to Music
Michael Ishak[1], Assal Habibi[1], Sarah Hennessy[1]
[1]*University of Southern California, USA*

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Self-Selected Music Versus Researcher-Selected Music: A Comparative Analysis on Stress-Reducing Effects

Risa Murakami[1], Leigh VanHandel[1]
[1]*University of British Columbia, Faculty of Music, Canada*

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Music, Mood and Motion: Exploring Perception and Cognition in Film Music

Ruby Olivia Nagano Crocker[1], Gyorgy Fazekas[1]
[1]*Center for Digital Music, Queen Mary University of London, UK*

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The Effect of Aural and Visual Presentation Formats on Categorical and Dimensional Ratings of Emotion for Sung and Spoken Expressive Performances

Peter Miksza[1], Daphne Tan[2], Robert F. Potter[3], McCall Booth[3]
[1]*Indiana University Jacobs School of Music, Music and Mind Lab, USA* [2]*University of Toronto Faculty of Music, Canada* [3]*Indiana University The Media School, USA*

P1-45

Perceptual Tempo Differences in Latin Dance Music: The Role of Dance Experience

Jared Leslie[1], Erin Hannon[1]
[1]*University of Nevada, Las Vegas, USA*

P1-46

Cultural Classification and Emotion Perception of Western and Chinese Music by Western Listeners

Marjorie G. Li[1], Kirk N. Olsen[1], William Forde Thompson[1,2]
[1]*Faculty of Medicine, Health, and Human Sciences, Macquarie University, Australia* [2]*Faculty of Society and Design, Bond University, Australia*

P1-47

Infants Zooming with Grandparents: Intergenerational Musical Connections Via Video Chat

L. Rashmi C. de Silva Wijeyeratne[1], Catherine Tan[1], Brett Q. Ford[1], Laura K. Cirelli[1],
[1]*Psychology Department, University of Toronto, Canada*

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Social Justice Advocacy Through Music Performance: How Does Music Influence Prosocial Attitudes and Behavior?

Joshua L. Schlichting[1], Shreshth Saxena[1], Maya B. Flannery[1], Lauren K. Fink[1],
[1]*Dept. of Psychology, Neuroscience & Behaviour, McMaster University, Canada*

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Developing Written Music Literacy: The Relationship Between Working Memory and Melodic Dictation Ability

Erica R. Knowles[1], Leslie Anne Harrison[1], Ethan Bessette[1], Mi-Lan Hoang[1], Rose Koo[1], Bethanie Liu[1], Ella Shalev[1]
[1]*Berklee College of Music, USA*

P1-50

Exploring Teacher and Student Thinking in Studio Music Voice Lessons

Jennifer Blackwell[1]

[1]*Northwestern University Bienen School of Music, USA*

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The Global Orchestra: Testing Persistence of Instrument Gender Associations Among Pre-adolescent Students

Victoria L. Smith[1], Steven J. Morrison[1]

[1]*Center for the Study of Education and the Musical Experience, Henry & Leigh Bienen School of Music, Northwestern University, USA*

Saturday, July 27th

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Investigating Musical Strategies and Perceived Engagement in Non-experts During Joint Drum Improvisation

Alex Han[1], Takako Fujioka[1]

[1]*Department of Music, Center for Computer Research in Music and Acoustics, Stanford University, USA*

P2-02

Solo Versus Social Jazz Improvisations

Megan Kibler[1], Andrew Goldman[1,2]

[1]*Cognitive Science Program, College of Arts and Sciences, Indiana University, USA* [1]*Department of Music Theory, Jacobs School of Music, Indiana University, USA*

P2-03

Neural Correlates of Auditory Feedback in Pitch and Room Acoustics During Solo Piano Performance

Takako Fujioka[1], Marise van Zyl[1], Raymond Gifford[1], Angela Lee[1], Matthew Wright[1]

[1]*Department of Music, Center for Computer Research in Music and Acoustics, Stanford University, USA*

P2-05

The Effect of Cannabis on Live Improvised Performances

Emily A. Wood[1], Lucas Klein[1], Konrad Swierczek[1], Laurel Trainor[1],

[1]*McMaster University, Canada*

P2-06

Enriching Performance of Musique Concrète Instrumentale for Novice Listeners: Insights From Research in Embodiment, Gesture, and Ecological Psychoacoustics

Hubert Ho[1]

[1]*Northeastern University, USA*

P2-07

Exploring the Effect of Score Type on Auditory Attention and Coordination in Ensemble Singing

Madeline Kushan[1], Elizabeth H. Margulis[1]

[1]*Princeton University, USA*

P2-08

Role of Short-Term Practice on Cardiac Dynamics in Auditory-Motor Synchronization

Shannon E. Wright[1,2], Caroline Palmer[1]

[1]*McGill University, Department of Psychology, Canada* [2]*University of the Fraser Valley, Department of Psychology, Canada*

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The Role of Musical Training in the Perception of Popular-Music Harmonic Schemata

Samuel Gardner[1], Abby Fiedler[1]
[1]*Oberlin College & Conservatory, USA*

P2-10

Music Expertise Differentially Influences Hemispheric Lateralization of Music Reading

Sara Tze Kwan LI[1]
[1]*Department of Social Sciences, School of Arts and Social Sciences, Hong Kong Metropolitan University, China*

P2-11

Analyses of Musicians' Gaze Reveal Observers' Experience and Expertise

Suzanne E. Charney[1], Robert A. Duke[1]
[1]*Center for Music Learning, The University of Texas at Austin, USA*

P2-13

Balanced Pitch Set Spacing in Elliott Carter's Fifth String Quartet

Jeffrey Martin[1]
[1]*University of Iowa, USA*

P2-14

Post-Tonal Corpus Study and Statistical Learning in Morton Feldman's String Quartet No. 2

Noah Kahrs[1,2]
[1]*Eastman School of Music, USA* [2]*Northern Arizona University, USA*

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Ragtimes and Riches: A Comparison of Syncopation, Harmony, and Form in Golden Age Ragtime, Scott Joplin, and 1970s Revival Ragtime

Tylar Meister[1], Joshua Albrecht[1]
[1]*The University of Iowa, USA*

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GRuMPy: A Flexible Program for Rhythm Generation and Quantitative Analysis

Anika Jahagirdar[1], Leigh VanHandel[1]
[1]*University of British Columbia, Canada*

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Striking a New Chord: Neural Networks' Ascendancy in Music Information Dynamics

Farshad Jafari[1], Claire Arthur[1]
[1]*Georgia Institute of Technology, USA*

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Continuous Measures of Musical Mode: Integrating Human Perception and Computational Models

Jackie ZhiQi Zhou[1], Michael Schutz[1,2]

[1]*Department of Psychology, Neuroscience & Behaviour, McMaster University, Canada* [2]*School of the Arts, McMaster University, Canada*

P2-20

Assessing Music Content Analysis with Procedurally Manipulated Music

Konrad Swierczek[1], Michael Schutz[1,2]

[1]*Department of Psychology, Neuroscience & Behaviour, McMaster University, Canada* [2]*School of the Arts, McMaster University, Canada*

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Modelling Musical Coherence in the Repetition Structure of Novel Compositions

Aditya Chander[1], Richard Aslin[2]

[1]*Department of Music, Yale University, USA* [2]*Child Study Center & Department of Psychology, Yale University, USA*

P2-22

Perceptual and Neural Correlates of Sensory and Cognitive Priming in Chord Sequences

Anjelica J. Ferguson[1], Jackson E. Graves[1], Barbara Tillmann[2], Anahita H. Mehta[1]

[1]*University of Michigan, USA* [2]*Lyon Neuroscience Research Cente, France*

P2-24

Musical Gorillas: Inattentional Deafness Across Undergraduate Music Majors

Amanda L. Schlegel[1], Matthew L. Williams[2]

[1]*University of South Carolina, School of Music, USA* [2]*University of Arizona, School of Music, USA*

P2-25

Vocal Imitation of Speech and Song from Around the World

Adwoa Ampiah-Bonney[1], Patrick E. Savage[2,3], Yuto Ozaki[2], Peter Q. Pfordresher[1]

[1]*University at Buffalo, State University of New York, USA* [2]*Keio University, Japan* [3]*University of Auckland, New Zealand*

P2-26

Does Song Aid Learning? EEG Correlates of Comprehension, Listening Effort, and Engagement During Speech and Song

Anna M. Czepiel[1], Christina M. Vanden Bosch der Nederlanden[1]

[1]*Department of Psychology, University of Toronto Mississauga, Canada*

P2-27

Identifying Voices Across Song and Speech

Matthew Eitel[1], Angela Cooper[2], Natalie Fetcher[2], Elizabeth Johnson[2], Laura K. Cirelli[1]

[1]*Psychology Department, University of Toronto Scarborough, Canada* [2]*Psychology Department, University of Toronto Mississauga, Canada*

P2-28

Do Rewarding Effects of Background Music Compensate for Distraction When Learning From Concurrent Speech?

Mine Muezzinoglu[1,2,3], Rochelle S. Newman[1,2], L. Robert Slevc[1,3]

[1]*Neuroscience and Cognitive Science Program at University of Maryland, College Park, USA*
[2]*Department of Hearing and Speech Sciences at University of Maryland, College Park, USA*
[3]*Department of Psychology at University of Maryland, College Park, USA*

P2-29

Auditory-Motor Entrainment and Music Training Shape the Perceptual Learning of Concurrent Speech

Jessica MacLean[1,2], Jack Stirn[1], Gavin Bidelman[1,2,3]

[1]*Department of Speech, Language, and Hearing Sciences, Indiana University, USA* [2]*Program in Neuroscience, Indiana University, USA* [3]*Cognitive Science Program, Indiana University, USA*

P2-30

Early Auditory Stream Formation of Simultaneous Sound: Comparing Music and Speech

Shu Sakamoto[1], Emily Wood[1], Laurel Trainor[1]

[1]*McMaster University, Canada*

P2-31

The Effect of Altered Popular Music on Music-Evoked Autobiographical Memories

Elisabeth C. Roberts[1]

[1]*University of Western Ontario, Canada*

P2-32

Associative Memory Effects of Gamma-Augmented Music-Based Intervention for Mild Cognitive Impairment

Hannah Weibley[1], Nicholas Kathios[1], Eva Wu[1], Alexander Belden[1], Ben Kubit[1], Edward Large[2], Psyche Loui[1]

[1]*Northeastern University, USA* [2]*University of Connecticut, USA*

P2-34

Reactivation and Reconsolidation in Music Learning

Justin Lader[1], Amy L. Simmons[1]

[1]*The University of Texas at Austin, USA*

P2-35

Varied Vulnerability in Musical Messaging: From Distraction and Deception to Earnest Signals of Both Contest and Craft

David Schruth[1]

[1]*University of Washington, USA*

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Effect of Musical Culture on Metric Perception

Christopher White[1], Lisa Sanders[2]

[1]*University of Massachusetts Amherst, USA*

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Does Foreign Music Sound Scary? Perceptual Bias for Culturally Familiar and Unfamiliar Music by Western Listeners

Marjorie G. Li[1], Kirk N. Olsen[1], William Forde Thompson[1,2]

[1]*Faculty of Medicine, Health, and Human Sciences, Macquarie University, Australia* [2]*Faculty of Society and Design, Bond University, Australia*

P2-39

Examining the Effects of Vocal Numerosity on Social Affiliation and Group Cohesion

Emily Warkentin[1], Daniel Shanahan[1]

[1]*Northwestern University, USA*

P2-40

Testing the Effect of Short-Term Entrainment With Binaural Beats on Stroop Interference

George A. Seror III[1]

[1]*Dickinson State University, USA*

P2-41

Caregiver-Infant Interplay and Connectedness Across Freeform Musical Sessions

Angela Dou[1], Laura K. Cirelli[1]

[1]*Department of Psychology, University of Toronto Scarborough, Canada*

P2-42

Repeat After Me: Investigating Children's Speech and Song for Insights Into Domain-Specific Knowledge

Anne Cabildo[1], Christina Vanden Bosch der Nederlanden[1]

[1]*Department of Psychology, University of Toronto Mississauga, Canada*

P2-44

Beliefs About Musical Attributes

Zachary B. Wasserman[1], Haley E. Kragness[1]

[1]*Department of Psychology, Bucknell University, USA*

P2-45

Examining Preschoolers' Home Music Exposure in Relation to Their Executive Function Skills

Helen Gray-Bauer[1], Kelsey E. Davison[1], Kimberly Crespo[1], Jennifer Zuk[1]

[1]*Boston University, USA*

P2-46

Musical Training and Decision Making Ability: A Resting-State Amplitude of Low Frequency Fluctuations (ALFF) Study

Jiancheng Hou[1]

[1]*Indiana University, USA*

P2-47

Examining Relationships Between the Home Music Environment and Caregiver Oral Reading Expressiveness in Families of Preschool-Age Children

Kelsey E. Davison[1], Helen Gray-Bauer[1], Jennifer Zuk[1]

[1]*Boston University Department of Speech, Language, and Hearing Sciences, USA*

P2-48

Infant Long-Term Memory Formation of Briefly Presented Melodies

Laura K. Cirelli[1], Catherine Tan[1], Haley E. Kragness[2]

[1]*Psychology Department, University of Toronto, Canada* [2]*Psychology Department, Bucknell University, USA*

P2-49

Do Children Experience the Speech-to-Song Illusion?

Rodica Constantine[1], Christina Vanden Bosch der Nederlanden[2], Brooke Booth[1], Erin Hannon[1]

[1]*University of Nevada, Las Vegas, USA* [2]*University of Toronto Mississuaga, Canada*

P2-50

Goal Accomplishment During Music Practice Is Associated With Positive Feelings About Musicianship and Satisfaction With Life

Sarah E. Allen[1], Lani M. Hamilton[2], Amy L. Simmons[3], Robert A. Duke[3]

[1]*Southern Methodist University, USA* [2]*University of Missouri-Kansas City, USA* [3]*The University of Texas at Austin, USA*

P2-51

The Potential of Folk Songs as a Health Education Tool in Nigeria

Florence Ewomazino Nweke[1]

[1]*Department of Creative Arts, University of Lagos, Nigeria*

Mentorship Events

The SMPC Mentorship Committee has several exciting events planned throughout the conference. These events will take place during lunch. Please see below for event details.

Thursday, July 25th
SMPC Welcome Tables
11:45-13:15
Vistas Dining Room

The Banff Vistas Dining Room is open to all! If you're new to SMPC (and especially if you're a trainee member), please feel free to join us for lunch to meet other SMPC members.

Friday, July 26th
SMPC Mentor-Mentee Luncheon
11:45-13:15
Vistas Dining Room

Continuing the tradition from previous years, SMPC is pleased to offer the mentor-mentee luncheon. This program has been running for the past few conferences, and trainees have found it to be very beneficial. Non-trainee SMPC members are paired with a small group of SMPC trainees over lunch. The goal is to give trainees an opportunity to meet more senior members of the community in an informal context. In the past, trainees have used these meetings to grow their professional network, scope out new labs, or seek out career advice. If you have signed up for this event, either as a mentor or a mentee, you will receive further details about this event via email.

Saturday, July 27th
SMPC Lunchtime Mentorship Panels
11:55-12:45

SMPC is pleased to offer two lunchtime panels on Saturday, July 27th. These panels are geared toward both trainee members and junior faculty members.

Navigating Life on the Tenure Track: A Forum for Junior Faculty
KC 201

Navigating the Grad Student Experience (and Beyond): A Forum for Trainees
KC 205

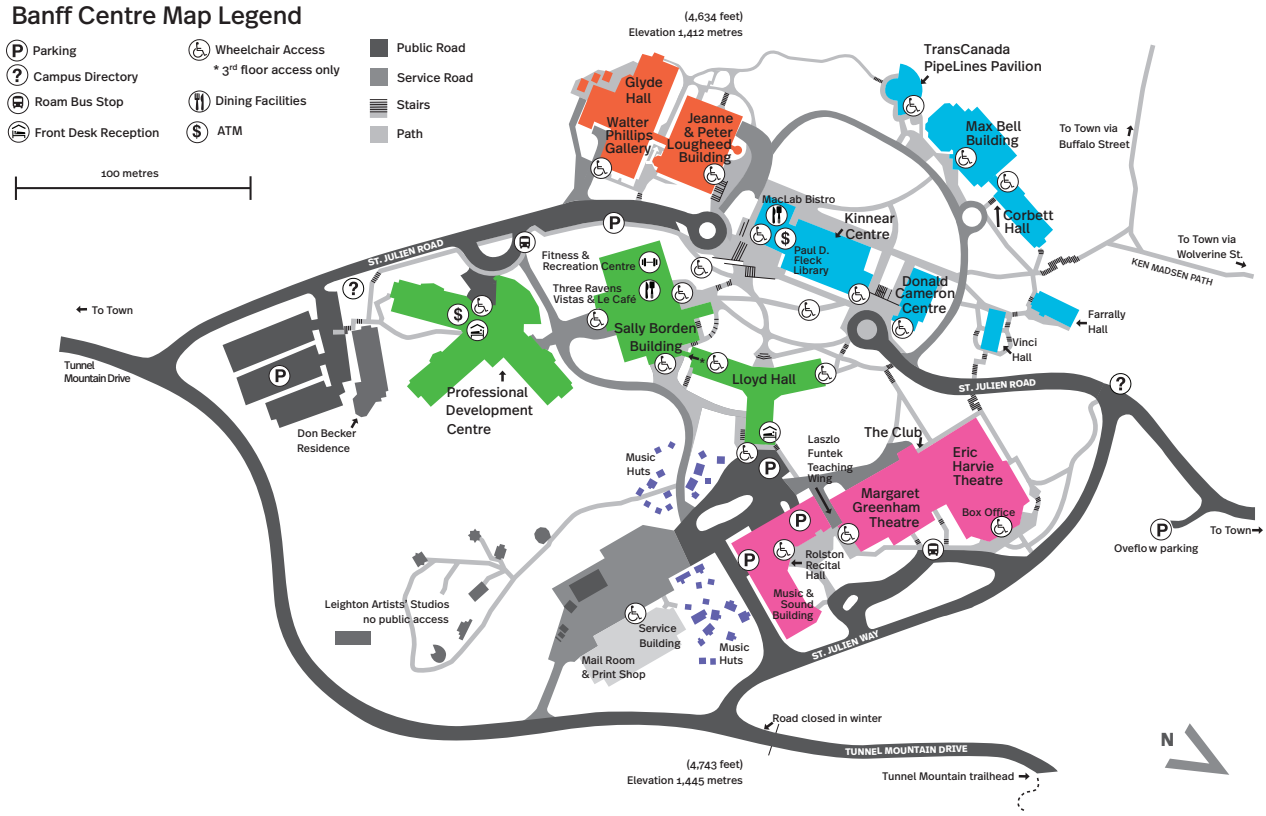
Useful Information

Location of Events

Talks, **Poster Sessions**, **Symposia**, **Welcome Reception**, and **Banquet** will be held at the **Kinnear Centre for Creativity and Innovation** on the campus of the Banff Centre for Arts and Creativity. This is also where breakfast, lunch, and the coffee breaks (all-inclusive with conference registration) will be located.

The **Keynote Lecture**, **Special Session on Inclusiveness and Equity**, and **Awards/Business Meeting** will be held in the Auditorium of the Max Bell Building, which is also on the campus of the Banff Centre for Arts and Creativity. The conference schedule provides a 15-minute time buffer to travel between the Kinnear Centre and the Max Bell Building.

A campus map of the Banff Centre for Arts and Creativity is provided below for convenience.



Wi-Fi

Wireless internet is available free of charge and the coverage is campus-wide. Look for banffcentre.ca from your computer. A password is not required.

How to Get to the Banff Centre for Arts and Creativity

Banff Centre is located in the town of Banff, a 90 minute drive west of Calgary. There are several transfer options available from the Calgary International Airport to Banff including airport shuttle service, bus transportation, and rental cars.

Banff Airporter is the official airport shuttle provider of Banff Centre and the best way to get to and from the Calgary Airport. Banff Airporter offers multiple departures daily between Calgary Airport and Banff Centre. Sit back, relax, and enjoy the scenery as you travel to Banff.

Brewster Transportation coaches offer several daily departures from Calgary International Airport to Banff hotels, and return daily from Banff to the airport. Please contact Brewster Transportation at 1.800.760.6934 or 1.403.762.6700 to confirm times and rates.

If you are driving to Banff/Lake Louise, the Trans Canada Highway 1 leads directly to the Rockies. The Trans Canada is a four-lane divided highway from Calgary to Lake Louise. The highway gains very little elevation from Calgary to Banff/Lake Louise and is a safe and scenic drive.

Note: This information is also on the Banff Centre's Website

Bringing Family and Friends to the Banff Centre

Family members or friends not registered for your conference are welcome to accompany you. Up to one additional person may stay with you in your room at no additional charge. Children under 13 years of age stay free in parent's room. Additional persons 13 years and over are charged at $20 plus applicable taxes per day. When booking your reservation, please be sure to indicate the number of adults and children in your party so that the most suitable room type can be assigned for you. Should the size of your party require a larger, upgraded room, you will be quoted a higher room rate than the price quoted for your conference package.

As a delegate, you will have been offered a special conference rate that includes some variation of a meal plan for you alone. Meals are not included for spouses/companions unless they are a registered delegate of the conference. Spouses/companions can purchase individual meals at Vistas Dining Room or at any of the food outlets on campus. If your spouse is also attending the conference as a delegate, the quoted "double" conference rate outlined on your registration form will apply to each of you. Meals will be included for both people if that has been pre-arranged with the conference. *Note: This information is also on the Banff Centre's Website*

List of Participants