McMASTER INSTITUTE FOR MUSIC AND THE MIND
SUMMARY ACTIVITY REPORT
April 2021 – March 2024

Submitted by MIMM Director
Dr. Laurel Trainor
March 11, 2024

1.0 MANDATE AND VISION

The McMaster Institute for Music and the Mind (MIMM) was established in 2006 and brings together psychologists, neuroscientists, music theorists, musicians, dancers, media artists, mathematicians, kinesiologists, health scientists, engineers, and community and industry partners to study questions relating to the perception, performance, neural processing, and impact of music and other creative arts. Creative performance is a broad framework that helps researchers to understand not only specific questions related to the execution, aesthetics, and perception of artistic presentations, but also broader scientific questions about child development, aging, learning, pedagogy, cognition, brain function, mental health, human interaction, communication and communication disorders, and movement and movement disorders.

2.0 RESEARCH

2.1 Infrastructure History

After obtaining two CFI grants coupled with ORF and McMaster University support, in the fall of 2014, MIMM opened the LIVELab (Large Interactive Virtual Environment), a unique 106-seat Performance-Research Space. The LIVELab contains technology to measure behavioural responses (100 tablet system), movement (motion capture), brain responses (EEG) and physiology (e.g., heart rate, galvanic skin responses, breathing, muscle tension) in multiple performers and audience members simultaneously. The space contains a Disklavier piano, which can record and playback the exact velocity and timing of all key presses during a performance, a video wall, and studio-quality sound recording equipment. The Meyer Constellation sound system, consisting of 28 microphones and 75 speakers, can instantaneously recreate the size and reverberation characteristics of almost any space, and present sounds that move around the room in 3-D space. The high precision synchronization between equipment systems in the LIVELab enables cutting edge multi-faceted analysis of complex questions of human interaction related to music, hearing, vision, movement, and learning.

2.2 Overview of Research Activity in MIMM and the LIVELab

In the past 3 years, MIMM members published over 150 peer reviewed articles. It should be noted that the LIVELab was shut down during the pandemic, and it took time and effort to get the equipment back into a research-ready state. Despite this, many research studies have been conducted in the LIVELab since 2021.

Here are a some of the research projects in the LIVELab from the last three years to highlight the breadth of research enabled by the LIVELab:

Music Therapy & Proactive Wellness

Efficacy of online group music therapy (led by Rachael Finnerty, PhD Candidate). This study showed that online music therapy classes reduce stress and anxiety compared to control, measured both by questionnaires and hair cortisol measures.

Music therapy for proactive wellness (led by Rachael Finnerty, PhD candidate). This study showed that in-person music therapy for McMaster U. students who did not have a diagnosis, but wanted to improve their mental health, was effective at reducing stress and anxiety and lowering cortisol levels. The plan is now to advocate for this inexpensive and proactive therapy across university campuses.

Hearing Impairment

Enhancing sound during live music concerts for hearing-aid wearers (led by Dr. Ian Bruce, Electrical Engineering). Sounds recorded from a concert of the Hamilton Philharmonic at First Ontario Place were manipulated and fed directly into participants' hearing aids to augment the free field sound. Participants rated which feeds sounded best, with the goal of determining best individual feeds depending on degree and type of hearing loss.

Do hearing aid wearers have particular difficulty with vocal music? (led by Sean McWeeny, postdoc). This study is investigating specific enhancement of the vocal part of music with singers as hearing aid users appear to have particular difficulty with the vocal part.

Aging & Neurodegeneration

Role of motor imagery in effects of dance participation in Parkinson's patients (led by Joseph DeSouza, York U. in collaboration with the Hamilton City Ballet). This study tested whether motor imagery of dance steps during group participation improved motor movements of Parkinson's patients.

An upper-body music synchronization task affects postural stability in healthy elderly (led by Dr. Dobri Dotov, postdoc; currently Assistant Professor, U. Omaha, funded by MIRA). This study showed that fall risk is increased in the healthy elderly when engaging in a task involving the synchronization of arm movements to sound stimuli.

Social Synchrony

Mother-infant interaction (led by Erica Flaten, PhD candidate). Motion capture and heart rate were measured in mothers and infants simultaneously as mothers sang and talked to their infants. The signals from the mother and infant are being analyzed for synchrony and communication, indicating how mother and infant each affect the other when interacting. How these relationships relate to early cognitive, emotional and social development is also being analyzed.

Non-verbal communication during group drumming (led by Dr. Dan Cameron, postdoc). Motion capture and audio analyses measured synchrony and information flow between novice drummers to determine how they adjust to each other non-verbally to stay in sync.

Group music drumming positively increases social connectedness and cooperation (led by Dr. Sean McWeeny, postdoc). This study showed that the positive social effects of drumming

together are present whether or not people drummed in phase (i.e., some were drumming on the beat and some off the beat).

Charismatic Leadership (led by Dr. Berson Yair, Business). In a large SSHRC-funded study, how leaders (confederates of the experiment) gave the instructions to groups, who were to complete a task together, was found to affect the quality of the group task completion and related to physiological measure of heart rate and EEG. This has potentially wide-reaching implication for solving large societal problems.

Creative Practice

Cannabis and creativity (led by Emily Wood, PhD candidate). Many musicians claim they are more creative when high. High and sober performance of a funk band were compared. Auditory and movement analyses indicated that the musicians were less coordinated and made more mistakes while high. Measures of creativity are currently being analyzed.

How do judges make their decisions at Hip Hop competitions? (led by Chantal Carrillo, PhD candidate). Initial analyses indicate that movement synchrony between dancers (measured by motion capture) is a big factor in the decisions made by experienced judges.

What is the best way to teach partner dancing (led by Martin Miguel, postdoc). This study tests whether it is best for novices to learn with one dance partner or with multiple partners, using motion capture measures of dance skill acquisition.

Audience Research

Live opera for infants (led by Dr. Laura Cirelli, U. Toronto). Infants' attention and heart rate synchronization were better during live than recorded concert experiences, indicating how important live music is, even very early in development.

Audiences enjoy participating at concerts (led by Dana Swarbrick, PhD student, RITMO, Norway). Audience members felt greater enjoyment at a pop concert when asked to participate (e.g., clap along).

Physiological coordination between audience members during a classical concert (led by Rory Kirk, PhD candidate, U. Sheffield, UK). Data are under analysis, but preliminary indications are that heart rate synchronizes among audience members, indicating common elements of experience.

Sub-bass sounds entice people to move more (led by Dr. Dan Cameron, postdoc). During a live electronic music concert in the LIVELab, motion capture showed that participants' movements on the dance floor increased when undetectable sub-bass speakers were turned on. This study garnered a lot of media interest (see below) and a follow-up study is underway.

Does vibrotactile information contribute to our sense of the musical beat? (led by Dan Cameron, postdoc). Music is multisensory, not simply auditory, and this study investigates the contribution of vibrotactile information to our sense of groove – the pleasurable urge to move to music.

2.3 Grants Obtained

In addition to studies funded from various researchers' individual grants, a number of grants were obtained specifically for LIVELab, as follows.

2021

Incite Foundation for the Arts (led by Trainor) - $20,000
NSERC Promo Science (Stafford) - $63,500
NSERC Science Odyssey (Stafford) - $5,000
NSERC New Horizons (Trainor) – $99,063
SSHRC Arts Research Board (Sonnadara) - $5,950
Hamilton Community Foundation, Proactive Wellness - $25,000

2022

Incite Foundation for the Arts (Trainor) - $21,000
RITMO, Norway funding (Swarbrick, RITMO, Norway) - $5,453
Mitacs funding (Kirk, U. Sheffied, UK)- $3,000
SSHRC Arts Research Board (Cameron) – $4,787
SSRHC Arts Research Board (McWeeny) - $4,430

2023

Incite Foundation for the Arts (Trainor) - $25,000
Incite Foundation for the Arts, Carl Turkstra Memoriam - $10,000
Hamilton Community Foundation – Edith H Turner (Stafford) - $15,000
Hamilton Community Foundation – Arcelor Mittal Dofasco (Stafford) - $14,000
Lauren Fink Startup ($30,000 to the LIVELab)
John Iversen Startup ($30,000 to the LIVELab
SSRHC Arts Research Board (McWeeny) - $5,268
Age Well Grant (Bruce) - $37,000
SSRHC Arts Research Board (Cameron) - $4,300

2024 (so far, others under review)

Incite Foundation for the Arts (Trainor) - $25,000
FRQSC Grant, Quebec: Game in Action project (Ferrari, McGill)– $19,000
Hamilton Community Foundation, Proactive Wellness - $5,000

2.4 Annual NeuroMusic Conference

MIMM holds one of the foremost conferences on NeuroMusic. The 20th annual NeuroMusic will be held in October 2024. This conference features talks from top researchers around the world and a poster session where trainees and researchers can get feedback from international experts. Here is information on the last three conferences.

2021 17th Annual NeuroMusic V-Conference: *Rhythm And Interpersonal Coordination*
Virtual Attendees: 318
International Attendees: 60
Virtual Posters: 31

Speakers
- Dr. Stefanie Hoehl, University of Vienna
- Dr. Keith Doelling, Institut de l'Audition, Paris, France
- Dr. Peter Keller, Center for Music in the Brain, Aarhus University, Denmark, The MARCS Institute for Brain, Behaviour and Development, Western Sydney University, Australia

Keynote Concert/Lecture: *Enacting Entrainment: The Social Coordination of Music and Dance*
- Dr. Justin London, Carleton College, MN
- Dr. Henry Daniel, School for the Contemporary Arts | Goldcorp Centre for the Arts, Vancouver
- Featuring dance performed by Amanda Damaren and Seana Williams with music composed by Emily Wood

2022 18th Annual NeuroMusic Conference: *Developmental Disorders and Music*
Attendees: 115 (63 in person, 52 virtual)
International Attendees: 39 (6 in person, 33 virtual)
Posters: 38 (30 in person, 8 virtual)
Speakers
- Dr. Barbara Tillmann, Laboratory for Research on Learning and Development, LEAD – CNRS UMR5022, Université Bourgogne Franche-Comté, Dijon, France
- Dr. Reyna Gordon, Assistant Professor, Vanderbilt University Medical Center, Nashville, TN
- Dr. Devin McAuley, Director of the Interdisciplinary Cognitive Science Program, Michigan State University, MI
- Dr. Miriam Lense, Director of Music Cognition Lab, Vanderbilt University Medical Center, Nashville, TN

Keynote Concert/Lecture: Rhythm And Music In Early Social Interactions In Children With And Without Autism
- Dr. Miriam Lense, Director of Music Cognition Lab, Vanderbilt University Medical Center, Nashville, TN
- Featuring Hamilton All-Star Jazz Band

2023 19th Annual NeuroMusic Conference: *Rhythm, Expectation and Emotion*
Attendees: 162 (101 in person, 61 virtual)
International Attendees: 45 (13 in person, 32 virtual)
Posters: 58 (47 in person, 11 virtual)
Speakers
- Dr. Peter Vuust, Danish Royal Academy of Music and Dept of Clinical Medicine Aarhus University, Aarhus/Aalborg, Denmark
- Dr. Jonathan Cannon, Assistant Professor of Psychology, Neuroscience & Behaviour, McMaster University, ON
- Dr. Psyche Loui, Associate Professor of Creativity and Creative Practice in the Department of Music and director of the MIND (Music, Imaging, and Neural Dynamics) lab at Northeastern University, Boston, MA

Keynote Concert/Lecture: Groove on the Brain
- Dr. Peter Vuust, Danish Royal Academy of Music and Dept of Clinical Medicine Aarhus University, Aarhus/Aalborg, Denmark
- Featuring musical performance by the Jazz Trio: Peter Vuust (Bass), Mikkel Vuust (Drums) & Tommaso Perazzo (Piano)

3.0 MIMM MEMBERSHIP

The 21 McMaster researcher members of MIMM and the 15 external members can be found on the MIMM website https://livelab.mcmaster.ca/people/#tab-content-research-affiliates. These cover most of the Faculties at McMaster, highlighting the interdisciplinary nature of the institute.

The LIVELab got a big boost with the appointment of two new faculty members to PNB in the field of Neuroscience of Music, Dr. John Iversen (Associate level) and Dr. Lauren Fink (Assistant level). John brings expertise in mobile sensing and Lauren Fink in multi-person eye tracking. Both conduct cutting edge research at the intersection of music, neuroscience, and AI, and will help guide the LIVELab into its next 10 years.

4.0 STAFF

There are only 3.5 staff for everything in the LIVELab, so they each need to be skilled in a wide variety of areas, as follows.

Dr. Daniel Bosnyak, Technical Director (paid 25% through the Director's personal grants)
- Supervise technical personnel
- Oversee purchase and integration of new technology and systems
- Maintain and repair all data collection systems (EEG, motion capture, 76-speaker/28 microphone Meyer sound system, physiological measurement [heartrate, skin responses, breathing, EMG], 100 table response system, Disklavier)
- Modify, assemble, and create custom engineering solutions to meet research needs
- Conduct data analysis and signal processing for EEG, motion capture, and other data
- Train students, postdocs, and researchers on data collection procedures with equipment systems
- Collaborate with students and researchers to define optimal analysis processes for studies
- Oversee data analysis
- Backups of all data
- Maintain all IT infrastructure
- Help design experiments
- Oversee conduct of experiments
- Assist in preparation of publications and grants
- Oversee and provide technical support during concert performances
- Contribute to conducting outreach activities, e.g., workshops

Hany Tawfik, Research Engineer

- Give training on equipment systems (EEG, motion capture, 76-speaker/28 microphone Meyer sound system, physiological measurement [heartrate, skin responses, breathing, EMG], 100 table response system, Disklavier) to users
- Assist in the maintenance and upgrades of equipment systems
- Train students, postdocs, and researchers on data collection procedures with equipment systems
- Modify, assemble, and create custom engineering solutions to meet research needs
- Engage in data collection, organization, and storage of large datasets generated in experiments
- Conduct data analysis and signal processing for EEG, motion capture, and other data
- Collaborate with students and researchers to define optimal analysis processes for studies
- Write technical reports summarizing findings and methodologies
- Assist in defining scope and resource needs for new research projects or contracts
- Test human participants in research studies
- Provide technical support during concert performances
- Contribute to coordinating outreach activities, e.g., workshops

Sally Stafford, Lab Manager

- LIVELab Reception – main point of contact
- Financial – Budget, Book-keeping, Mosaic
- Grant Writing
- Reporting
- Lab Scheduling
- Front of House at concerts
- Purchase equipment and materials
- Coordinate outreach
- Coordinate social media
- Assist with science communications
- Coordinate research concert series
- Research Coordinator
- Recruit and supervise Work Study Students
- Recruit and supervise Volunteers
- Upkeep and maintenance of facility and equipment

Susan Marsh-Rollo, Research Coordinator & Stage Manager (50% time)

- Research Coordinator
- Clinical Studies Coordinator
- Stage Manager
- Ethics Applications
- Co-supervisor of project and thesis students
- Annual NeuroMusic Co-organizer
- Technician (assist during studies with mo-cap and physiological equipment)

- Assist with Outreach
- Assist with Social Media
- Coordinate Science Communication
- Liaise with performers for the Research Concert Series
- Recruit and supervise Work Study Students
- Recruit and supervise Volunteers
- Upkeep and maintenance of facility and equipment

5.0 EDUCATION AND EXPERIENTIAL TRAINING

Undergraduate, graduate and postdoctoral trainees gain rich hands-on experience in designing and conducting experiments, audio technology, physiological measurements (EEG, motion capture, etc.), and large data set analysis (including cutting edge signal processing and statistical modeling).

A large number of trainees have benefited from research experience in the LIVElab.

2021
McMaster Post-doctoral fellows: 3
McMaster Graduate students: 9
McMaster Undergraduate students: 24
Work Study Students: 2
Volunteers: 55

2022
McMaster Post-doctoral fellows: 3
McMaster Graduate students: 9
McMaster Undergraduate students: 24
Work Study Students: 5
Volunteers: 46

2023
McMaster Post-doctoral fellows: 4
McMaster Graduate students: 15
McMaster Undergraduate students: 56
Work Study Students: 5
Volunteers: 48

Spring 2024
McMaster Post-doctoral fellows: 5
McMaster Graduate students: 18
McMaster Undergraduate students: 71
Work Study Students: 2
Volunteers: 32

VPR Funded Summer Student: 2 part-time students, pending
OUR Funded Summer Students: 2 part-time
Mitacs Students: 2

6.0 OUTREACH AND COMMUNITY ENGAGEMENT

6.1 Research Concerts

The public are invited to attend our Concert Series, most of which involve research.

2021
Nov 20 – Music and Dance – Virtual research performance with Henry Daniel & Justin London
Dec 6 – Space Trio (First Hybrid Concert since Covid, LIVEStream in conjunction with Mohawk College Broadcast program students

2022
May 9-14 – Scored in Silence Production
June 18 – Aaron Davis, Circle of Friends
Sept 23 –Swarbrick, Alex Whorms Research Concert
Oct 21 –Kirk & Wood, Chopin Research Concert
Nov 22 – Neuro Music Keynote Concert in the LIVELab with Hamilton All Star Jazz Band

2023
Feb 1 – Iris Trio
Mar 24 - LV094 Nezqwik Research Concert
Sept 24 – Adi Braun Hearing Aid Research Concert
Oct 28 – NeuroMusic Keynote Eye-tracking Research Concert with Peter Vuust
Dec 8 – Laila Biali Wintersongs & Holiday Classics

2024 – In planning stages
April 2 and 4 – The Innocents Research Performance
April 20 - Orphx Research Concert (Very Low Bass Follow-Up Study)
Oct TBD– John Ellison in collaboration with Greening Media
Nov 15-17 – Double Pendulum: Synaptic Rodeo Research Multimedia show

2025 – In planning stages
Trevor Copp Research Performance
HPO Intimate and Immersive Research Concert around hearing aid research
Tom Wilson Research Concert

6.2 Tours

The LIVELab engages in extensive outreach and community engagement, giving tours and experiences to a wide range of groups, as follows.

2021

Youth (2 virtual tours, 120 students)

- Virtual Science RendezVous (100 students)
- Virtual Tour for "Take Your Kids to Work Day" (20 students)

Undergrad students (75 students)

- PNB Students Talks

Community & External Research (3 tours)

- Mohawk College The Agency
- Crow's Theatre
- Mohawk College Broadcasting Site Visit

McMaster Departments / Individuals (5 tours)

- EdCog Conference Virtual Tour
- Yana Stainova, McMaster Dept of Anthropology
- Yair Berson, McMaster Business
- Advancement, Maryella Leggatt

2022

Youth (11 tours, 552 students)

- Virtual Science RendezVous & "Meet a Music Scientist" Zoom Call (125 students)
- Fall Preview (100 attendees)
- Westmount High School (1st in-person tour since Covid) (30 students)
- L'Amoreaux Collegiate (50 students)
- SHAD McMaster (70 students)
- HPO Youth Orchestra (25 students)
- Assumption High School (40 students)
- Glendale High School (30 students)
- MacNab High School (25 students)
- St. Thomas More Physics Students (32 students)
- HPO Youth Orchestra (25 students)

Undergrad students (3 tours, 210 students)

- Mac Undergrad Tours (30 students)
- Ayesha Khan SciComm Class (80 students)
- MSU Group: VIE Division Dance Final Showcase (100 students)

Community & External Research (13 tours)

- Cara Eastcott, Producer Scored in Silence
- Canadian Association of Physicists (30 attendees)
- Dr. Annie Andrieux, University of Grenoble
- Megan Benjafield, HPO Youth Orchestra

- Richard Allen, Annette Paiment, Cotton Factory
- Eric Anderson, Indigenous Youth Outreach
- Melissa Brandon
- Katrina Deane
- Allan Gaumand, Hillfield Strathallan School, Jazz Band
- HWDSB Music Teachers
- CBC (Dan Cameron regarding the very low bass study)
- OnSemi (Ian Bruce regarding hearing aid research)
- Barbara Tillman (NeuroMusic Speaker)

McMaster Departments / Individuals (14 tours)

- Susanne D'Order, McMaster Student Accessibility Services
- Jenn Tretjack for VPR Event
- MSU Campus Events Director
- Pamela Edmonds, McMaster Museum of Art
- Alumni Karen McQuigge and Altaf Arain
- EdCog Conference (43 attendees)
- McMaster Advancement (15 attendees)
- PNB Grad Orientation
- Liz Hobson, PNB Speaker
- Avis Favaro, FOS Journalist in Residence
- Nicole Gervais, Ethics Office
- Zafar Syed, Sheridan College with Joe Kim
- Yair Berson group, McMaster Business
- MREB

2023

Youth (16 tours, 1233 students)

- Music Production Workshop Dundas Valley (8 students)
- HWDSB Tours, 5 tours (150 students)
- AIFEC Grade 1 tours, 4 tours (240 students)
- HWDSB Westdale Music Production Workshop (20 students)
- HMC Music Mastering Workshop (15 students)
- March Break 10am and 12pm (100 students)
- May@Mac (100 attendees)
- Fall Preview (100 attendees)
- Tour for Troy Hill's Class Six Nations (30 students)
- National Brain Bee Tours (50 students)
- Westmount HS (40 students)
- May@Mac, 6 tours (200 attendees)
- ELEVATE (30 students)
- SHAD McMaster 2 Tours (70 students)
- HPYO TuneUp Tour (30 students)

Undergrad students (9 events, 576 students)

- MSU Group: MacProd (4 meetings with 30 per meeting)
- MSU Group: Battle of the Bands MSU (150 students)
- MSU Group: VIE Division Dance Final Showcase (100 students)
- Joe Kim's Class (25 students)
- Tour Michelle Cadieux Class (30 students)
- Student Tours (20 students)
- Ayesha Khan's Class (80 students)
- Mohawk Intro Psych (50 students)

Community & External Research (16 tours)

- Marc Justin Brown
- HPO Music Director Short-List Tour (3 tours, 6 attendees/tour)
- Wayne Kelso
- Mike Jose
- Sebastian Himbert
- Angie Nikoleychuk
- Joe Kim's visiting researchers
- AMP & Film Doc Tour (6 attendees)
- Gerr Audio Demo (20 attendees)
- Sherry Maynard University of West Indies
- Public Tour (10 attendees)
- Jeff Pollack
- Doug Tewksbury
- Tristan Miller

McMaster Departments/Individuals (14 tours)

- Colloquium speaker Tours
- 50th Alumni Anniversary concert band (60 attendees)
- Central McMaster Marketing Team/ Jesse Dorey) (10 attendees)
- Two Library Tours (19 attendees)
- Alumni Tour for B.Music '77 (50 attendees)
- Two UTS Tours (50 attendees)
- EdCog Tour (50 attendees)
- McCall MacBain Tour (Joe Kim) (20 attendees)
- MIRA Older Adults on Campus Tours (15 attendees)
- Faculty Tour Jay Robb & Juliet Daniels (10 attendees)
- Brandon Kaiser – Health Sci Comms (2 attendees)
- Canada Wide Science Fair Organizers (6 attendees)
- Central University Advancement (23 attendees)

2024 (Winter/Spring)

Youth (8 tours, 922 students)

- Thomas A. Blakelock High School Science (30 students)

- Bayview Glen High School Music (32 students)
- Waterdown High School Music (30 students)
- March Break 10am and 12pm (100 students)
- Brain Bee Tour and Talk (Lauren Fink) (50 students)
- AIFEC Grade 1 Tours (480 students total)
- May@Mac (100 attendees)
- Fall Preview (100 attendees)

Undergrad (5 events, 255 students)
- MSU Group: Neuroscience Society (50 students)
- MSU Group: Music Cognition Society (50 students)
- MSU Group: MusicBox Charity (25 students)
- Two MSU Group: MacProd (30 students)
- MSU Group: VIE Division Dance Final Showcase (100 students)

Community & External Research (4 tours, 825 public)
- Public Tour (20 attendees)
- Three Music Director Candidates HPO (6 attendees/tour)
- Maria Campbell, Mohawk College Vocal Coach (x1)
- Doors Open Hamilton (x800)

McMaster Departments/Individuals (3 tours)
- PNB Admin Candidates (x4)
- Research Finance (x20)
- McMaster ATI Health Research Group (x30)

MSU Clubs using LIVELab
- Mac Producers
- VIE Division Dance
- Music Cognition Society
- Neuroscience Society
- MusicBox Charity
- Battle of the Bands
- Artists at McMaster
- MSU Sidewalk Sale

McMaster Groups and Depts Requesting Tours for 2024
- University Technology Services
- Libraries
- Central Advancement
- Central Communications
- MIRA
- Alumni
- Health Sciences Individual Labs

McMaster Organizations for Youth Requesting Tours 2024

- SHAD
- ELEVATE
- MacIStep

7.0 RELATIONSHIPS AND AFFILIATIONS

We work with many research, industry, and community partners, as illustrated in the following examples.

7.1 Affiliations With Other Research Institutions and Centres

- RITMO, University of Oslo
- Max Planck Institute for Empirical Aesthetics (Frankfort, Germany)
- University of British Columbia
- Bar-Ilan University
- University of Sussex
- ETH Zurich
- University of Toronto
- Carleton College
- Fitchburg State University
- Tokyo Institute of Technology
- University of California San Diego
- University of Connecticut
- University of Granada

7.2 Affiliations With Industry/Public Sector Partners

- VibraFusion Labs
- Gerr Audio
- OnSemi
- SoundsGood Lab
- Musicians Clinics of Canada
- Hamilton Philharmonic Orchestra
- Unitron Hearing Aids
- Sonova Hearing Aids
- Yamaha

7.3 Community Partners

- An Instrument For Every Child (AIFEC)
- Hamilton Music Collective
- Hamilton Youth Steel Orchestra (tours to be booked with John Ellison concert)
- Girls in Science/NFP
- Empowerment Squared/NFP
- Six Nations
- Hamilton Philharmonic Orchestra

- Hamilton Philharmonic Youth Orchestra
- Hamilton Wentworth District School Board
- Halton District School Board
- EdCog Conference
- McCall MacBain PDFs
- ComSciConCAN
- Greening Media
- Mohawk College Broadcasting
- Mohawk College The Agency
- Centre3
- Long & McQuade Musical Instruments
- Judy Marsales Real Estate
- McMaster Alumni

8.0 COMMUNICATIONS

Research from the LIVELab is of high public interest. Our website, twitter, and Instagram accounts serve to let the public know about what we are doing, as well as recruit participants to our studies. Here are the increases since May 2021:

Twitter followers: 2,662 (26% increase)
Facebook followers: 1,890 (13% increase)
Instagram followers: 963 (31% increase)

8.1 Media Coverage

Here follows selected links to media stories:

2021

- Auditory Cognitive Neuroscience Editors' Pick 2021
- If We Built It Today: Episode on Concert Halls on CTV
- Technology Unlocks the Mystery of our Musical Minds
- POV Hamilton Podcast
- Science Daily: The brain's 'prediction machine' anticipates the future when listening to music
- CHCH: Music and dating

2022

- Artist Chisato Minamimura brings 'Scored in Silence' and special vibratory technology to McMaster's LIVElab
- Ep. 137, Mindy Peterson, NCTM: Music Educator and Podcast Host: What makes a lullaby a lullaby, and what difference does it make? with Laurel Trainor, PhD
- Brighter World: Want to fire up the dance floor? Play low-frequency bass, Science Daily: Want to fire up the dance floor? Play low-frequency bass, Neuroscience News: Want to Fire up the Dance Floor? Play Low-Frequency Bass, The Naked Scientists: Low frequency bass boosts boogieing, New Scientist: All about that bass: Low-frequency sounds make

you dance more, Georgia Public Broadcasting: What makes us dance? It really is all about that bass, Science News Explores: When it comes to dance, it's all about the bass, NPR: What makes us dance? It really is all about that bass
- TVO Today: Can Music Bring Us Together? | The Agenda
- The Art of Science Episode 1: The Social Coordination of Music and Dance

2023
- 'An Itsy Bitsy Audience': Babies find live music more engaging
- The Art of Science Episode 2: Performer's Impact on Audience Interaction
- *Medical Express, Music therapy improves student mental health, study shows.* April 18 2023. https://medicalxpress.com/news/2023-04-music-therapy-student-mental-health.html

2024
- Sold on Hamilton Podcast-January 13, 2024
- The Art of Science Episode 3: Eye Tracking & The Innocents (in progress)

9.0 FINANCIALS

The LIVELab has balanced its books FY2023, and projections for FY 2024 are good. Detailed budgets are in *Appendix A* and *Appendix B*.

FY2024 (May 1, 2023 – April 30, 2024)
Income: $640,701
Labour expenses: $386,663
Expenses: $240,232
Net Income: $13,806

FY2025 (May 1, 2024 – April 30, 2025 projected)
Income: $626,365
Labour expenses: $441,855
Expenses: $184,050
Net Income: $460

10.0 STRENGTHS & WEAKNESSES

The pandemic was devastating for the LIVELab because we were unable to conduct any research as human testing was shut down. However, we did use this period to hone our live broadcasting skills, and we are now able to do very high-quality live concert broadcasts involving multiple camera angles (fixed and moving) and real-time camera-switching decisions, forging a new relationship with Mohawk College Broadcasting around this. Following the restrictions, we were able to get our systems up and running relatively quickly, and the last two years have seen a marked increase in our research.

The 2021 External Report of MIMM identified a number of strengths and weaknesses. The report was very positive overall, indeed stating that the LIVELab should be treated as a national treasure. We are building on our strengths and have made some progress on dealing with the weaknesses, but it is admittedly difficult during this time of fiscal restraint.

The following outlines how we are acting on major threats and suggestions outlined in the 2021 report.

1. **Succession planning.** The 2021 report identified that a plan needs to be put in place to obtain and nurture younger researchers who can eventually take over directing the institute. I'm happy to say that the Faculty of Science has understood and acted on this, and that we now have two additional faculty members in PNB, one at the junior and one at the mid-career level, who have already become very active in MIMM and the LIVELab.
2. **We suggest that a culture of distributed responsibility for supporting MMIM through grants be developed. Further, funding should be raised specifically to subsidize pilot testing and experiment development, as this will ease the barrier to using the LIVELab.** To a large extent we are on this path, with new grants from Yair Berson (Business), Ian Bruce (Electrical Engineering), Lauren Fink (PNB), and John Iversen (PNB), as well as from the director. In addition, staff member Sally Stafford has been successful in obtaining funding for outreach projects. Regarding grants for smaller pilot testing, we chose to use two small endowments that were created after the passing of two MIMM members (Drs. Larry Roberts & David Gerry) for competitions that allowed trainees to conduct small LIVELab studies. But there is no ongoing plan for funding for pilot studies.
3. **Apply for a new CFI to renew and update the infrastructure.** We are in the process now of applying for a new CFI.
4. **Create a digital library system for data and procedural archiving be established such that the rich data collected in LIVELab can serve more than the individual researcher or research group who collected it.** We plan to make this infrastructure part of the CFI proposal.
5. **Lack of sufficient staff and no redundancy, leaving the institute vulnerable if a key person leaves.** This is a difficult problem, especially as two key staff members are approaching retirement age. They have built up considerable technical and practical expertise over the years, and because we are a unique facility, it will require overlap between them and new staff to maintain the LIVELab in working order. The solution to this, as well as to the lack of redundancy (e.g., if a key person gets sick and needs to stay home for a few days it can threaten a research project worth tens of thousands of dollars that needs to occur on a particular date), is additional staff. This is a financial challenge that remains unsolved. One goal going forward to increase usability for a wider range of people by setting up user-friendly presets for some equipment systems for use in smaller studies that do not require custom settings.
6. **Lack of stability in the Faculty of Music.** This has been an ongoing issue. Over the last 15 years, tenured or tenure track music faculty have gone from a dozen to 2 remaining (one of whom is teaching faculty). And no new music students were accepted this year.

As Director of MIMM, I have tried over the years to advocate for a stronger music department at McMaster, as well as to increase our ties with SOTA, but at this juncture, I believe the prudent course of action is to strengthen our ties with music departments at other institutions. In particular, we have colleagues at Western University, which has a very strong music department. A goal over the next years will be to increase our affiliations and collaborations there.

7. **Lack of ongoing sustainable funding.** This is a difficult question with no easy solution. The 2021 external report recommended making the Technical Director a permanent salary line. Ideally, institutes in general should have staff salary lines associated with them, similar to departments, in order to remain competitive internationally, but the current financial situation makes this difficult. We have been able to remain financially responsible through a combination of grant writing, outreach programs, and donations, but it does mean that we spend most of our time on these concerns rather than on research and mentoring trainees, and it hampers our ability to maintain our international leadership.
8. **A rebalancing and extension of financial responsibility for MIMM, including the music/humanities dimension, could provide the stable foundation on which to ground the brilliant interdisciplinary potential that lies ahead.** We agree with this and have tried to engage in discussions with other faculties (e.g., Humanities, Engineering, Business) but I think this will require it to be a priority at the Dean/Provost/VP Research levels.

11.0 ALIGNMENT WITH STRATEGIC GOALS AND VISION FOR THE FUTURE

MIMM aligns with university strategic goals in contributing to (1) fundamental research (e.g., brain/body imaging to understand socio-emotional interactions between people), (2) health outcomes (e.g., hearing aid innovation; proactive group music therapy; neurodevelopmental disorders to neurodegenerative disease in aging; music in premature infant outcomes), and (3) new technology advancement (e.g., leading-edge multi-person measurement tech; real-time adaptation and AI-driven biofeedback).

In this time of fiscal constraint, we are examining creative ways to maintain our outreach, educational programs, infrastructure, and cutting-edge research. As we head into the 10th Anniversary of the LIVELab, we have planned a series of events, including exciting new research concerts, with the goals of celebrating our accomplishments *over the last 10 years* and envisioning directions *for the next 10 years*. We are also expanding our annual conference this year – our 20th annual NeuroMusic Conference. The theme this year is focused on forward-looking technology and the new questions it enables us to answer. These events and the conference will engage our stakeholder groups – researchers, students, health practitioners, artists, the community, funders, and the tech industry.

We are also seeking new funding sources. In particular, we plan to put in a new CFI proposal that will enable us to update our existing infrastructure and add exciting new capabilities, such

as mobile EEG and other physiological tracking (windows into brain and body); eye gaze and pupillometry (windows into attention and emotion); and real-time computations for interactive feedback powered by AI.

We have been increasing the number of national and international researchers who do research in the LIVELab, both within McMaster (e.g., Yair Berson, business, SSHRC grant; Ian Bruce, Engineering, MIRA grant) and beyond (e.g., Manuela Ferrari, McGill; Rory Kirk, U. Sheffield; Dana Swarbrick, RITMO, Norway). We plan to continue this trend.

While challenges remain, we are optimistic that the next 10 years will be even more exciting than the last 10 years.

Appendix A

MIMM (May 1, 2023 - April 30, 2024 Projected)			
Line Item	Amount	Totals	Notes (projected to end of April 2024)
A_420004 Concert Revenue	-$8,000		Ticket sales
A_420005 Conference Income	-$8,800		NeuroMusic Registration
A_420013 Fee for Service Revenue	-$8,500		Tours, event space rental
A_470000 Int Revenue	-$66,125		Research revenue (Trainor, Berson)
Internal Revenue (Fink, Iversen)	-$60,000		
Connection Grant (SSHRC)	-$10,000		Rest ($40,000) to be spent next fiscal year
PromoScience Grant ($0); Hamilton Community Foundation Edith H Turner Grar	-$15,000		Outreach for Underrepresented Youth
AcelorMittal Dofasco community outreach grant	-$17,000		Outreach for Underrepresented Youth
ARB (Dan C additional revenue from Groove in Dance)	-$4,000		
ARB (Dan C Indigenous Music)	-$4,300		
NSERC Discovery Horizons Grant	-$10,500		
Postdoc salary supplement (Age Well Grant)	-$14,316		
Ian's hearing aid grant (Age Well) for studies in LIVELab	-$15,000		5 days in LIVELab
URIOB	-$55,000		Sound board and Hearing Aid consultant
URIOB	-$101,160		Eye tracking
Faculty of Science match to URIOB	-$15,000		Rest of the matching funds from a donation from Bob Simpson
Faculty of Engineering match to URIOB	-$15,000		
Air Canada Headset Study	-$8,500		
A_450000 Donations Revenue	-$26,000		Long & McQuade ($1k) + INCITE ($25k) - Concert Series + Outreach
Donations for Hearing Aid consultant	-$30,000		
A_480001 Revenue Transfer-Donations	-$5,000		Alumni ($5k - Concert Series)
A_450020 Sponsorship Revenue	-$20,000		Misc donations
PNB contribution to NeuroMusic	-$1,000		
Science Advancement Leslie Choules, Kelsea Thompson	-$50,000		
A_480040 Int Rev Trnsfr-within ENVELOPE	-$51,000		RCI PDF ($50k) + Faculty of Science NeuroMusic ($1k)
A_480050 Int Rev Trnsfr-within FUND	-$14,000		VPR RCI Neuromusic Support ($8k) + VPR UG Summer Std ($6k)
WorkStudy (Faculty support)	-$5,000		
WorkStudy (Central rebate)	-$2,500		
TOTAL FUNDING		***-$640,701***	
A_5112 Academic Stipends	$7,440		Director stipend + benefits portion
-A_5100 Salary and Benefits	$271,407		Staffing (3.5 FTEs)
-A_5100 Salary and Benefits	$64,316		RCI PDF
-A_5100 Salary and Benefits	$13,500		Students
Consultant on Hearing Aid work Steve Armstrong	$30,000		
TOTAL LABOUR		***$386,663***	
A_610031 Computer Hardware-Under $10000	$1,000		Maintenance, repair, equipment, etc.
A_610045 Computer Software Fees	$5,372		Qualisys Software Service Contract
A_630010 Equipment Maintenance	$1,800		Maintenance, repair, equipment, etc.
A_610001 Equipment - Under $10,000	$250		Misc. repair
Equipment over $10,000	$161,160		Eye tracking and sound board
A_600001 Materials & Supplies	$1,500		Misc. repair
A_600008 Lab & Shop Supplies	$1,800		Consumables, misc.
Additional Equipment repairs and replacement	$20,000		
A_600102 Advertising Expense	$4,000		Event promotion (posters, pamphlets, etc.)
A_670005 Marketing Professional Service	$14,400		
A_655019 Workshop Expense	$12,000		NeuroMusic Conference
A_670020 Artist-Performer Fees	$12,000		Concert series
A_600200 Communication Expense	$900		Phones - Versature - $76/month
A_600208 Web Development	$600		MacSites
A_650050 Meals and Entertainment	$3,000		Event catering + Bar at Concerts
A_600013 Courier Expenses	$50		
A_600005 Office Supplies	$50		
A_420030 Parking Vouchers	$250		
A_640006 Computer Services	$100		
TOTAL OTHER EXPENSES		***$240,232***	
A_3000 Net Income		***-$13,806***	

Appendix B

MIMM (May 1, 2024 - April 30, 2025 Projected)			
Line Item	Amount	Totals	Notes
A_420004 Concert Revenue	-$8,000		Ticket sales
A_420005 Conference Income	-$9,000		NeuroMusic Registration
A_420013 Fee for Service Revenue	-$8,500		Tours, event space rental
A_470000 Int Revenue	-$70,000		Research revenue (Trainor, Berson)
Internal Revenue (Fink, Iversen)	-$60,000		Research revenue (Iversen, Fink)
Larry Roberts Legacy Fund	-$3,439		Call for Student Led Research in Sept 2024; Remaining of $10,577
David Gerry Research Fund	-$5,000		Call for Student Led Research in Sept 2024; 23,500.23 remaining (16,250.25 + 7,249.98 Faculty match)
Connection Grant (SSHRC)	-$40,000		$10,000 spent in last fiscal
PromoScience Grant	-$20,000		Pending Award: of FOS Combined Grant
ARB Grant - McWeeny Hearing Aid Users	-$5,268		Confirmed
NSERC Discovery Horizons Grant	-$10,500		
AgeWell grant postdoc salary supplement	-$32,158		
URIOB	-$80,000		Estimated (EEG)
External revenue research use	-$48,000		Ferrari Video Games ($19,570) others pending
A_450000 Donations Revenue	-$16,000		Long & McQuade ($1k) + INCITE ($15k)
A_480001 Revenue Transfer-Donations	-$10,000		Alumni ($10k - 10th Anniversary Celebration)
A_450020 Sponsorship Revenue	-$20,000		Misc donations (Director's contacts)
Science Advancement Leslie Choules, Kelsea Thompson	-$60,000		
INCITE Youth Outreach Grant	-$10,000		Pending Award: incite Foundation for the Arts
Hamilton Community Foundation Youth Outreach	-$15,000		Pending Award: Edith H Turner
Arcelor Mittal Dofasco Youth Outreach	-$17,000		Pending Award: Arcelor Mittal Dofasco
A_480040 Int Rev Trnsfr-within ENVELOPE	-$6,000		PNB Neuromusic Spt ($1k) + One Time Funding from FOS up to $5,000
A_480050 Int Rev Trnsfr-within FUND	-$34,000		VPR RCI Support ($8k) + VPR UG Summer Std ($6k) + 20K VPR promo video
WorkStudy (Faculty support)	-$5,000		
WorkStudy (Central rebate)	-$2,500		
WorkStudy (International Student Success Centre)	-$1,000		
Donation - Hearing Aid Research	-$30,000		
TOTAL FUNDING		***-$626,365***	
A_5112 Academic Stipends	$7,440		Director stipend + benefits portion
-A_5100 Salary and Benefits	$358,757		Staffing (3.5 FTEs)
-A_5100 Salary and Benefits	$32,158		PDF extention for 6 months
-A_5100 Salary and Benefits	$13,500		Students
Hearing Aid Research Consultant	$30,000		Steve Armstrong Hearing Aid Consultant
TOTAL LABOUR		***$441,855***	
A_610031 Computer Hardware-Under $10000	$11,000		Maintenance, repair, equipment, etc.
A_610045 Computer Software Fees	$7,000		Qualisys Software Service Contract + Other Software Upgrades and Renewals
A_630010 Equipment Maintenance	$5,000		Maintenance, repair, equipment, etc.
URIOB equipment	$80,000		(EEG)
A_610001 Equipment - Under $10,000	$2,500		Misc. repair
A_600001 Materials & Supplies	$1,500		Misc. repair
A_600008 Lab & Shop Supplies	$5,000		Consumables, misc.
A_600102 Advertising Expense	$4,000		Event promotion (posters, pamphlets, etc.)
A_670005 Marketing Professional Service	$12,000		Greening Art of Science $6,000; Social Media $6,000
10th anniversary promo video	$20,000		Through VP research office
A_655019 Workshop Expense	$20,000		NeuroMusic Conference (expanded)
A_670020 Artist-Performer Fees	$12,000		Concert series
A_600200 Communication Expense	$900		Phones Versature - $76/month
A_600208 Web Development	$600		MacSites
A_650050 Meals and Entertainment	$2,500		Bar at Concerts
A_600013 Courier Expenses	$50		
A_600005 Office Supplies	$0		Removed this line item - purchased under Materials and Supplies
A_420030 Parking Vouchers	$0		Removed this line item - purchased under Materials and Supplies
A_640006 Computer Services	$0		Removed this line item - purchased under Materials and Supplies
TOTAL OTHER EXPENSES		***$184,050***	
A_3000 NET INCOME		***-$460***	