

# Matthew Skarha

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mskarha

in /in/skarha

Creative and technology-fluent **graduate in audio and acoustics** with a passion for signal enhancement in augmented listening applications. Proven ability to combine effective communication with professionalism to convey sophisticated concepts. Excellent at preparing deliverables such as reports and presentations for project-based work. Always eager to build own skillsets in order to stay up to date with industry standards.

## Education

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### M.A. in Music Technology

McGill University, Montréal, QC

Sept 2019 – Aug 2021

GPA: 3.9/4

- Focus in computational acoustics and audio signal processing
- Center for Interdisciplinary Research in Music Media and Technology

### B.A. in Physics

Oberlin College, Oberlin, OH

Aug 2015 – May 2019

GPA: 3.4/4

- Minors in Computer Science, Mathematics
- Independent studies in jazz piano at Oberlin Conservatory

## Experience

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### Residency in Architectural Acoustics, Threshold Acoustics LLC

Oct 2021 – March 2022

- Programmed MATLAB application for visualizing 3D Ambisonic impulse response measurements as direction-dependent sound intensity vectors progressing in time
- Improved mechanical review workflows through automating HVAC calculations by pulling equipment, ductwork and air terminal metadata from Revit API

### Graduate Student Researcher, Computational Acoustics Modeling Lab

McGill University, PI: Dr. Gary Scavone, Music Technology

Oct 2020 – Present

### Associate Researcher, Input Devices & Music Interaction Laboratory

McGill University, PI: Dr. Marcelo M. Wanderley, Music Technology

June 2020 – June 2021

### Teaching Assistant, McGill University

Sept 2020 – April 2021

- MUMT 501: Digital Audio Signal Processing, Winter 2021
- MUMT 306: Music & Audio Computing I, Fall 2020

### Research Assistant, Illinois Augmented Listening Laboratory

University of Illinois at Urbana-Champaign, PI: Dr. Andrew Singer, Electrical & Computer Engineering

June 2018 – Aug 2019

- Built large dataset of multichannel acoustic impulse responses and speech recordings using large (150+) distributed and wearable microphone arrays
- Evaluated performance tradeoffs of overdetermined microphone arrays with beamforming, source separation, and localization algorithms for applications in spatial audio capture and human/machine audition

### Teaching Assistant, Oberlin College

Jan 2017 – May 2018

- PHYS 104: Elementary Physics II, Spring 2018, Spring 2017
- PHYS 068: Energy, Science, and Technology, Spring 2018
- PHYS 103: Elementary Physics I, Fall 2017

### Tutor, Physics, Mathematics

Various

- Oberlin College Department of Physics & Astronomy, Tutor Doctor, private in-home, Mathnasium

## Technical Skills

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**Acoustics:** Room Acoustics Measurement, Ray Tracing, Structural Isolation, Architectural Enclosures, MEP Review, Auralization, RT Calculation, LEED Credit, Vibration/Impact Testing, Musical Instrument Analysis and Design, Numerical Methods.

**Electrical Engineering:** Digital Signal Processing, Physical Modeling, Electronics/Circuit Design, Soldering, Oscilloscopes, Microprocessors, Data Analysis/Statistics.

**Programming Languages:** MATLAB, C++, Python, Java, Faust, HTML, CSS, LabVIEW, R, LaTeX.

**Architecture:** Revit, Odeon, AutoCAD, Bluebeam Revu, Rhino, Grasshopper, SketchUp, EASERA, REW, Price All-In-One, Insul

**Computer Music:** Max/MSP, Pd, JUCE, VCV Rack, Processing.

**Fabrication:** Arduino, Fusion 360, OpenSCAD, 3D-printing, Laser cutting.

**Audio Production:** Studio recording, Logic Pro, Pro Tools, Audition, Reaper.

**Music:** Piano (jazz), Voice (choral), Aural skills, Music theory, Rudimentary guitar, bass, drums.

**Languages:** English, French (intermediate).

## Selected Coursework

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**Graduate:** Computational Modeling of Musical Acoustics, Digital Audio Signal Processing, Time-Frequency Representations & Parametric Modeling of Sound Signals, Digital Sound Synthesis & Audio Processing, Music Perception & Cognition.

**Undergraduate:** Classical Mechanics, Seminar in Mathematical Modeling, Sound Recording, Electricity & Magnetism, Quantum Mechanics, Artificial Intelligence, Algorithms, Data Structures, Linear Optimization, Jazz Theory, Jazz Aural Skills.

## Publications

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Skarha, M. (2022). *Performance Tradeoffs in HRTF Interpolation Algorithms for Object-Based Binaural Audio* [Preprint] (Master's thesis, McGill University, Montréal, Canada). Available: [http://mattskarha.com/assets/docs/Skarha\\_M\\_A\\_thesis\\_preprint.pdf](http://mattskarha.com/assets/docs/Skarha_M_A_thesis_preprint.pdf)

Skarha, M., Cusson, V., Frisson, C., Wanderley, M. M. (2021). *Le Bâton: A Digital Musical Instrument Based on the Chaotic Triple Pendulum*. In *Proceedings of the International Conference on New Interfaces for Musical Expression*. New York University Shanghai.

R. M. Corey, M. D. Skarha, A. C. Singer, "Cooperative Audio Source Separation and Enhancement Using Distributed Microphone Arrays and Wearable Devices", *2019 IEEE 8th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*, Guadeloupe, 2019

R. M. Corey, M. D. Skarha, A. C. Singer. (2019): "Massive Distributed Microphone Array Dataset.", University of Illinois at Urbana-Champaign. [https://doi.org/10.13012/B2IDB-6216881\\_V1](https://doi.org/10.13012/B2IDB-6216881_V1)

## Selected Projects

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### M.A. Thesis: Performance Tradeoffs in HRTF Interpolation Algorithms for Object-Based Binaural Audio

Feb 2021 – Dec 2021

Computational Acoustic Modeling Lab, McGill University

- Evaluated reconstruction quality vs. computational costs in algorithms for constructing continuous representations of Head-Related Transfer Functions
- Implemented  $N$ -th order spherical harmonic (Ambisonic) decomposition and bilinear interpolation with FFT-based overlap-save convolution and frequency-domain crossfading in both MATLAB and C++ to determine optimal algorithm for audio rendering in virtual acoustic environments

### Le Bâton: A Digital Musical Instrument Based on the Chaotic Triple Pendulum

June 2020 – June 2021

Center for Interdisciplinary Research in Music Media and Technology, Montréal, QC

- Received \$3500 Student Award from CIRMMT to research application of chaos to digital musical instruments by inventing **immersive audiovisual experience** based on the chaotic triple pendulum
- Designed, implemented embedded electronics system and electromechanical control mechanism
- **3D-modeled**, 3D-printed custom electronics enclosures using **Autodesk Fusion 360**
- **Managed team of researchers** in producing conference submission by delegating tasks to meet deadline

### eggDJ: A Portable Real-Time Music Augmentation System

Nov 2019 – Dec 2019

McGill University

- Built embedded pocket device based on the Raspberry Pi 4 for interacting with everyday music consumption by layering samples and applying audio effects in real-time

### Laser Interferometry for Loudspeaker Characterization

Oct 2017 – Dec 2017

Department of Physics & Astronomy, Oberlin College

- Designed a method for measuring **frequency response** of a **loudspeaker** using Michelson-type laser interferometry
- Fixed mirror to cone of JBL studio monitor and measured interference pattern with photoelectric detector, oscilloscope

## Community Involvement

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### Athlete, men's ultimate frisbee

2015 – 2020

McGill University, Oberlin College, various club teams

- As captain at Oberlin, planned/led practices, scheduled tournaments, fostered positive team atmosphere
- Played in two national championship tournaments

### Student Conduct Officer & Liaison, Club Sports Executive Council

2017 – 2019

Oberlin College

- Instituted and coordinated bystander intervention and trans allyship trainings for all club sport athletes at Oberlin College
- Oversaw budgeting process for allocating money to teams

### Head Cook, Pyle Inn Co-op

2017 – 2019

Oberlin Student Cooperative Association

- Planned, prepared, and supervised a staff in cooking weekly co-op meals for 60-80 people

## Other Interests

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Chess

Ultimate Frisbee

Espresso

French

Chicago sports