

MUSIC TECHNOLOGY, BIKES, AND COFFEE. USUALLY IN THAT ORDER.



Human-Computer Interaction





User-Centered Design

human-centered and participatory design



Digital Lutherie digital musical instrument design



Rapid Prototyping computer-aided design, 3D printing, laser cutting Creative Coding audio and interactive media programming



Motion Capture

movement and performance gesture analysis





Improvising across Abilities Pauline Oliveros and the Adaptive Use Musical Instrument

John Sullivan | McGill University

Input Devices and Music Interaction Laboratory Center for Interdisciplinary Research in Music Media and Technology

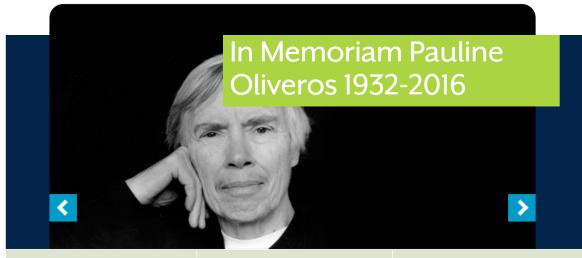
Sherrie Tucker I University of Kansas

Listen to everything all the time and remind yourself when you are not listening.



INTERNATIONAL INSTITUTE FOR CRITICAL STUDIES IN IMPROVISATION AboutNews &Workshops &IICSI -Events -Conferences -

Welcome from our Director, Ajay Heble.



Critical Studies in Improvisation

CSI-ECI is an open-access, peer-reviewed, electronic, academic journal. Search the Research Library

 and find a range of pieces including films, articles, think pieces, and interviews...

AUMI

Adaptive Use Musical Instrument (AUMI) software interface and iOS App are new musical instruments that enable...

SONIC MEDITATIONS

illin sult ossit okno ositi usic Members of the Group may achieve greater awareness and sensitivity to each other.

Music is a welcome by-product of this activity.

Pauline Oliveros, 1974

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But not everyone could participate!







Rensselaer Polytechnic Institute

This is true!

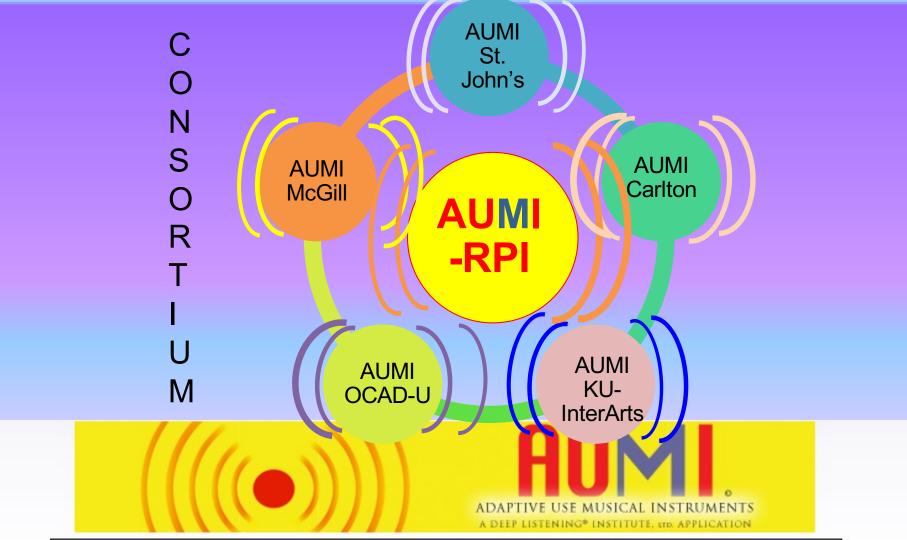
You've been on the cutting edge of music and technology for 60 years!

Rensselaer Polytechnic Institute

	ADAPTIVE USE ON&OFF IMUSICAL INSTRUMENTS MODE Keyboard Mode	
	SETTINGS AUDIO SET BRIGHTNESS VOLUME CONTRAST CONTRAST CONTRAST	
	KEYBOARD SETTING SOUND SOURCE: Piano 1 SCALE: Major Scale \$ KEY: GUIDE SIZE:	:

© 2009 Deep Listening Institute, Ltd.





AUMI (the instrument)



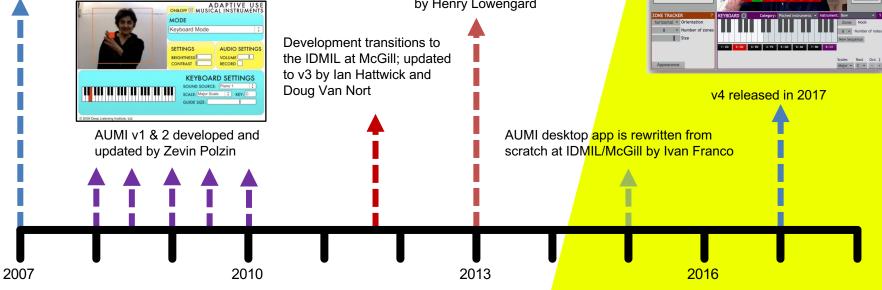


1st prototype developed at RPI by Zane Van Duzen



CONTROL PANEL AMERA: Dn Settings Fullscree TERACTION: zone tracker

AUMI for iOS released by Henry Lowengard



Musical

By Deep Listening

nstitute, LTI

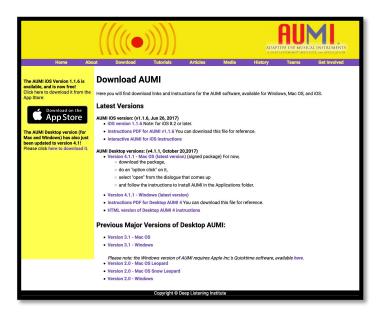
About Get Started



- Completely redesigned interface
- Simplified modules and controls
- Sound libraries
- User uploadable sounds
- Presets
- Sampler sound module
- Radial Tracker mode



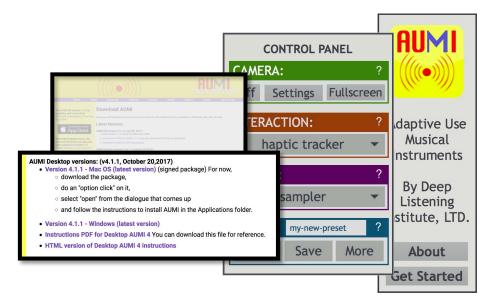
AUMI is free for everyone!



- MAC:
 - Version 4.1 Mac OS (latest version)
 - Double click downloaded .pkg file and app installs in /Applications directory
- Windows:
 - Version 4.1 Windows (latest version)
 - Expand downloaded .zip file and move AUMI folder into \Program Files directory
 - Launch app with enclosed AUMI.exe
- iOS:
 - Version 1.1.6
 - Install from iOS App Store

http://aumiapp.com/download.php

User Guide and Documentation



AUMI User Guide:

- PDF included in download
- Online at <u>aumiapp.com</u>

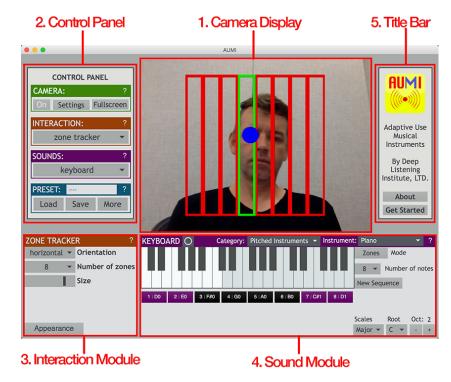
In-app help console:

- Look for the [?] icon on every module
- [About] and [Get Started] buttons

http://aumiapp.com/download.php

AUMI Desktop Application

- 1. Camera Display
- 2. Control Panel
- 3. Interaction Module
- 4. Sound Module
- 5. Title Bar





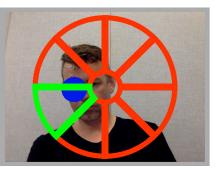
Zone Tracker

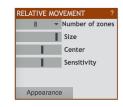




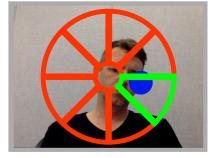
Radial Tracker





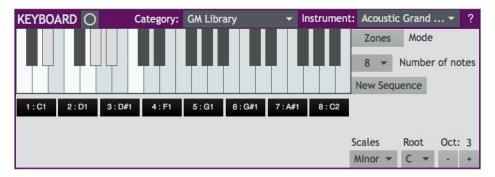


Relative Movement





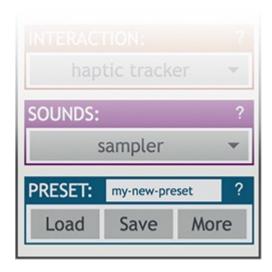
Keyboard Module







- Saves all user settings within the app
- Full preset management
 - Load and Save
 - Free mode
 - Import and Export
 - Delete



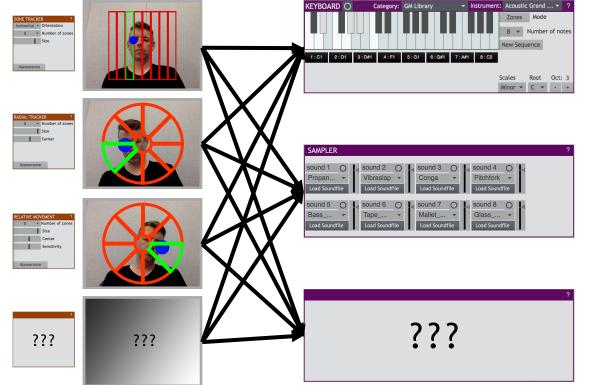


AUMI experiments

AUMI v4 key concept:

The *Interaction* and *Sound* modules are separate so they can be mixed and matched.

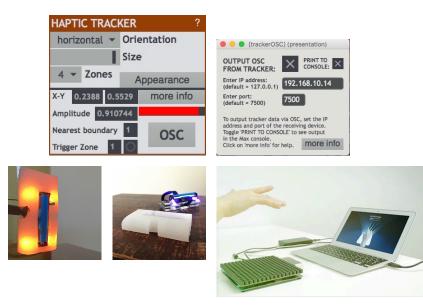
This opens the door to many creative possibilities for instrument development, designing for greater accessibility, and accommodating a wide range of unique user needs.





Haptic Tracker:

- Implementing tactile feedback for AUMI
- Conducting lab tests with VibroPixels¹ wearable, modular tactile displays
- Experiments with UltraHaptics mid-air tactile interface²



¹ Hattwick, Ian, Ivan Franco, and Marcelo M. Wanderley (2017). "The Vibropixels: A Scalable Wireless Tactile Display System". In Proceedings of the Human Computer International Conference. Vancouver, Canada.

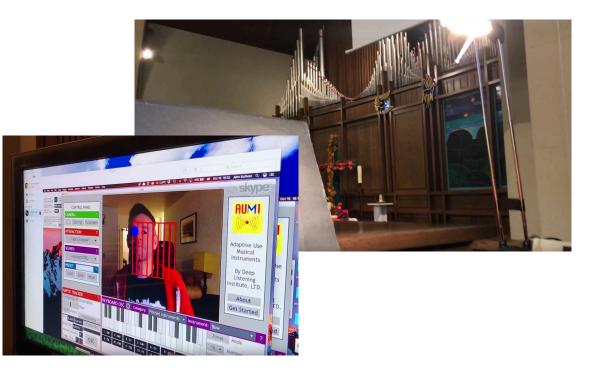
² Carter, Tom, et al. (2013). "UltraHaptics: multi-point mid-air haptic feedback for touch surfaces." In Proceedings of the 26th annual ACM symposium on User interface software and technology.



AUMI Organ:

- Live telematic performance
- Pipe organ in a Vancouver church played by AUMI in Montreal

https://youtu.be/23K4G X6kncM



- Web-based AUMI app
- AUMI for collaborative online performance (ZOO-AUMI?)
- Bespoke hardware interfaces
- Exploring AUMI installation in playgrounds
- Improving functionality based on feedback from use in the field



What's next?

AUMI. It's what people do with it!





AUMI-Carleton We Are All Musicians Jesse Stewart in residency with H'Art of Ottawa, 2014





AUMI Jam Sessions AUMI-KU, Independence Inc., and Lawrence Public Library 2015-Present



It's What People do with it

MacKay Centre School Pilot Project:

What are the uses of AUMI in achieving pedagogical goals for children with developmental disabilities?

- Weekly sessions with 2 facilitators, music teacher and students (some playing AUMI, and some with other instruments)
- Improve social engagement/participation
- Improve and explore communication among peers, with adults
- Complete multi-stepped tasks
- Foster creativity and leadership
- Promote positive self-perception and self-esteem.

OUT NOW!!!

AUMI-Sings!

Ellen Waterman, Gillian Siddall, Laurel Forshaw, Henry Lowengard, adults with vocal impairments and the St. Johns Vocal Exploration Choir



COMING IN 2021!!!

Collaborative, cocreative **book project**! Chapters of all shapes and sizes!

Improvising across Abiliites Pauline Oliveros and the Adaptive **Use Musical** Instrument

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The AUMI iOS Version 2.0.0 is available, and is free!

click here: for more information about AUMI 2.0.

Click below to download it from the App Store if you are reading this on an iOS device.



The AUMI Desktop version (for Mac and Windows) is currently version 4.1.2. Please click here to download it.

A related project is AUMI Sings, which is a more complicated version of AUMI intended to be able to provide a singing voice controlled the same way AUMI is.

Welcome!

Hello, and welcome to the online home of the Adaptive Use Musical Instruments (AUMI) project. Please use the links above to navigate the site.



AUMI Website aumiapp.com



Research in Augmented Harp Performance

From gestural control to the Bionic Harp

John Sullivan^{1,2,3} & Alexandra Tibbitts^{1,4}

¹ Centre for Interdisciplinary Research in Music Media and Technology ² Input Devices and Music Interaction Laboratory ³ McGill University ⁴ Université de Montréal









Part 1: a quick overview

Gestural Control of Augmented Instrumental Performance

A Case Study of the Concert Harp

John Sullivan^{1,2,3}, Alexandra Tibbitts^{1,4}, Olafur Bogason ^{1,2,3}, Brice Gatinet^{1,3}

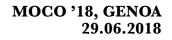
¹ Centre for Interdisciplinary Research in Music Media and Technology ² Input Devices and Music Interaction Laboratory ³ McGill University ⁴ Université de Montréal











Abstract

- Goal: A new gesture control system for augmentation of instrumental performance.
- Concert Harp: A case study
- Holistic Approach:
 - Analysis of gesture in harp performance
 - Participatory design of hardware and software tools
 - Practical application: New work and performances



Objectives

- System design:
 - Lightweight gestural control system to augment live instrumental performance.
 - Develop simple and reliable tools for <u>musicians</u> (who are not necessarily technologists) to use.
 - A flexible system that can be used with any instrument
 - Integrate easily into common live performance workflows.
- Augmenting instrumental performance with gestural control
 - Leverage natural performance gestures

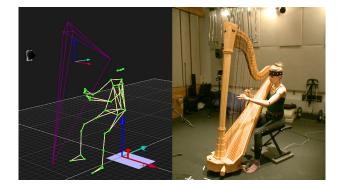
Why harp?

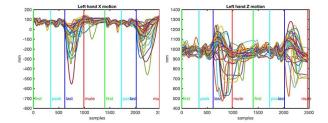


"Some players have spare bandwidth, some do not."

Cook, P. (2001). Principles for designing computer music controllers. Proceedings of the 2001 International Conference on New Interfaces for Musical Expression.

Phase 1 Motion Capture Study





Phase 2 Hardware/Software design



Phase 3 Rehearsal & Implementation





Phase 1: Motion Capture Study

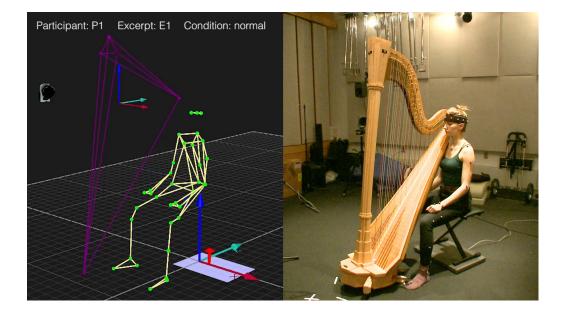


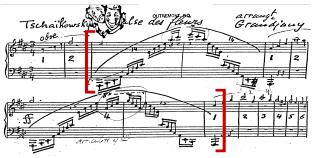
- Proceedure:
 - Updarstanding patural may ansists of harp performance as well as variance in individual style
 4 short excerpts from standard harp repertoire
 How can they be leveraged in a gesture control
 system:

 - - normal, deadpan, expressive, immobile ٠

- Hypothesis: map instrumental and ancillary gestures ٠
 - Instrumental alertor to plate haunally with outper & Bertec force plate altering technique
 - Ancillary: explicitly control other parameters without interfering with his month of the second control of the second con

Phase 1: Motion Capture Study

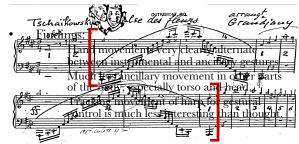


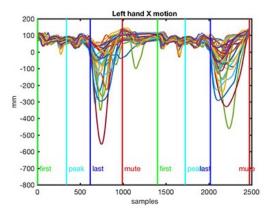


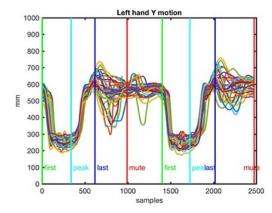
• Excerpt #1: Tchaikovsky – Nutcracker Suite, Waltz of the Flowers

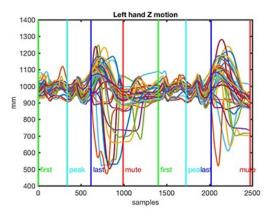
Phase 1: Motion Capture Study

- Marker reduction of Plug-In Gait marker placement to isolate hand, torso, head movements.
- Dynamic Time Warping (DTW) applied to compare movements across participants and expressive styles.
- Example: Excerpt 1 Left hand, all participants, all styles (n = 8 * 4)
 - (x = left/right; y = fore/back, x = up/down)
- Additional video analysis to understand basic shapes and motions.







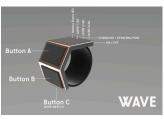


Phase 2: Technology

- Hardware prototypes
 - ESP8266 microprocessor/wireless communication
 - IMU-based (MPU-9250) motion acquisition sensor array
 - 2 LEDs (1 status, 1 programmable)
 - haptic motor
 - internal LiPo battery
 - motion data transmitted via OSC
- Device designed by Ólafur Bogason, Genki Instruments¹
 - Early prototype to the **Wave**

¹https://www.genkiinstruments.com/





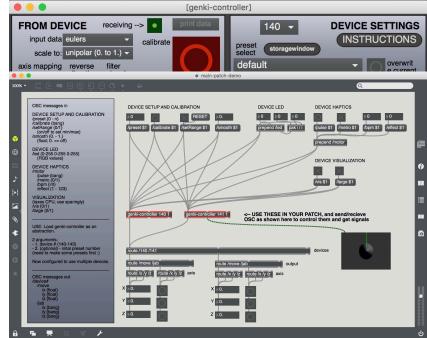


genki

Phase 2: Technology

- Software & User Interface
 - Designed in Max
 - Three modes of operation:
 - 1. Max abstraction for use in a larger patch
 - 2. Max for Live device
 - 3. Standalone application sending OSC messages via UDP

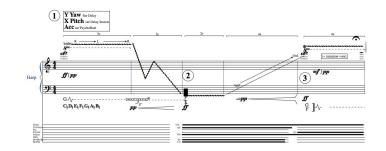




Phase 3: Implementation

- Composition:
 - Brice Gatinet, D-Mus candidate, McGill University
 - "...prends mois, chaos, dans tes bras..."
 - Based on three materials:
 - choreographed motions of a harpist's musical gestures
 - narration of a Sumerian creation poem
 - transcription of Hurrian Hymn no. 6, (circa 1400 B.C.E.)
 - For solo harp, voice and gesture-controlled electronics.

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1441日日147		医美国的 医子宫 医子宫
Beginning:	~ <u>~</u>	End of 1st phrase:
Last line:	P P P P P P P P P P P P P P P P P P P	reprint excerpts: Prof. Kilmer



Phase 3: Implementation

- Rehearsals:
 - Concurrent with hardware and software development
 - Also overlapping with mocap analysis
 - Each phase informing the others:
 - mocap -> mappings to try out in rehearsal
 - rehearsals -> provide feedback during tech. technical development
 - tech. development -> compositional tools



Phase 3: Implementation

- Performances:
 - Premiere:
 - Université de Montreal, Salle Claude-Champagne 2017
 - Additional performance:
 - live@CIRMMT, McGill University 2017
 - ICLI (International Conference on Live Interfaces) 2018, Porto, Portugal



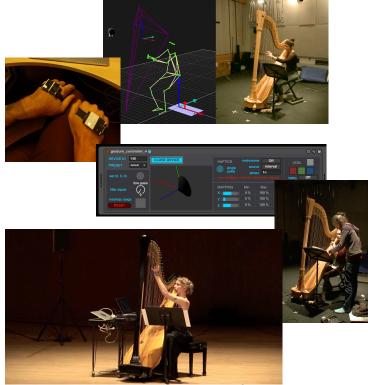
Continued Work

- New Hardware: Genki Wave
 - Bluetooth communication instead of ESP8266
 - MIDI messages instead of OSC
 - 3 modes: motion, tapping, note
 - Improved tracking accuracy
 - On-device calibration and scaling
- Performance: ICLI '18
 - Refined composition
 - Redesigned gesture mappings for new hardware
 - More time for performer to practice with controllers



Contributions & Future Work

- Contributions:
 - Methodology for holistic design of a gesture control system for augmenting instrumental performance.
 - Specific results and documentation for use of concert harp in experimental and electronic music
 - Genki Wave controller: Successfully crowd-funded and ship by summer of 2019
- Future Work:
 - Machine Learning: Intentionally avoided to preserve simplicity of use, but will implement in future iterations
 - Continued study and application of natural instrumental performance movements in a simple and flexible gesture control system.
 - New works for harp (and other instruments!)



...moving right along....

Research in Augmented Harp Performance: The Bionic Harp

John Sullivan^{1,2,3} & Alexandra Tibbitts^{1,4}

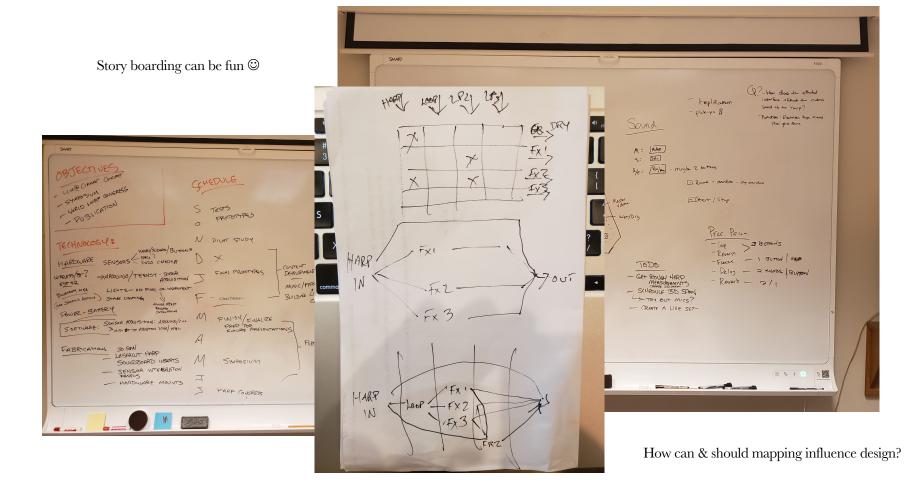
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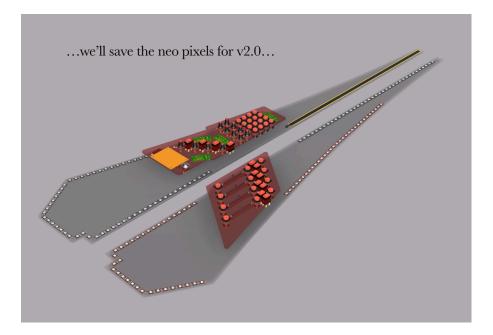


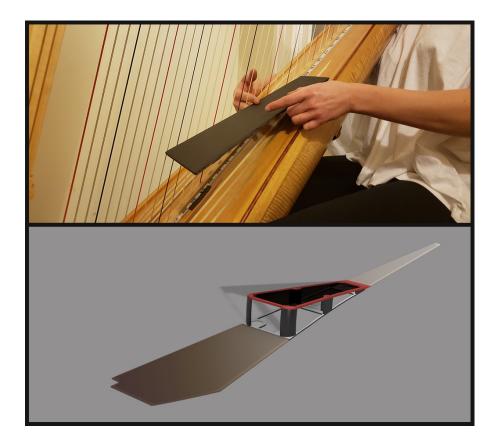




We had some fun making mock-ups







A more realistic layout



Magnets?!?!

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Customized circuit boards

Ordering parts

And some executive decisions

ASSEMBLE!















Festival + Forum **Edition 21** Montréal



Thank you!

contact: john.sullivan2@mail.mcgill.ca alexandra.tibbitts@gmail.com





🐯 McGill



