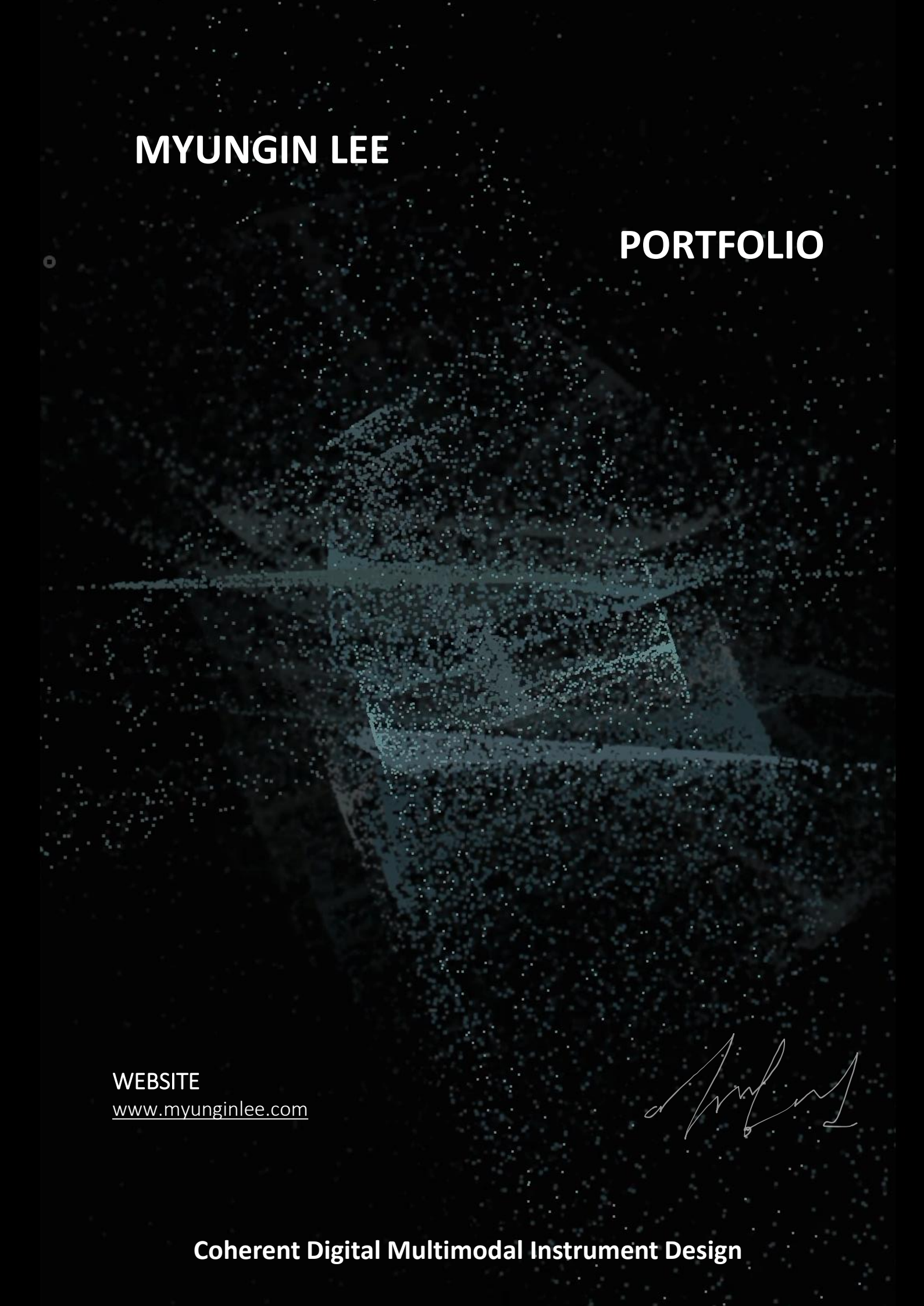
MYUNGIN LEE

PORTFOLIO



WEBSITE
www.myunginlee.com

Coherent Digital Multimodal Instrument Design

Myungin Lee [이명인 : Myeong–in Lee]

"A researcher designing multi-modal instrument based on scientific theory, composition, signal processing & machine learning, and gestural interface"

LISTS

SELECTED PROJECTS (https://www.myunginlee.com/projects)

Sensorium (2022-2024)
The Voice of the World Ocean

Coexistence with the SARS-CoV-2 Virus (2022-2023)
Interactive Audiovisual Installation

AlloThresher (2022-2023)
Multimodal Granulator

AlloSphere, AlloLib & Selected Series (2018-2023+)
Interactive Audiovisual Development Platform

Entangled (2021)
Multi-user interactive system in virtual 3D spaces
using the machine learning-based gestural recognition of smartphones

Inspiration (2018)
Deep neural network-based music source conducting system

Blind Reverberation Time Estimation (2015-2017)
Machine learning-based room acoustic information from sound sources received by microphones

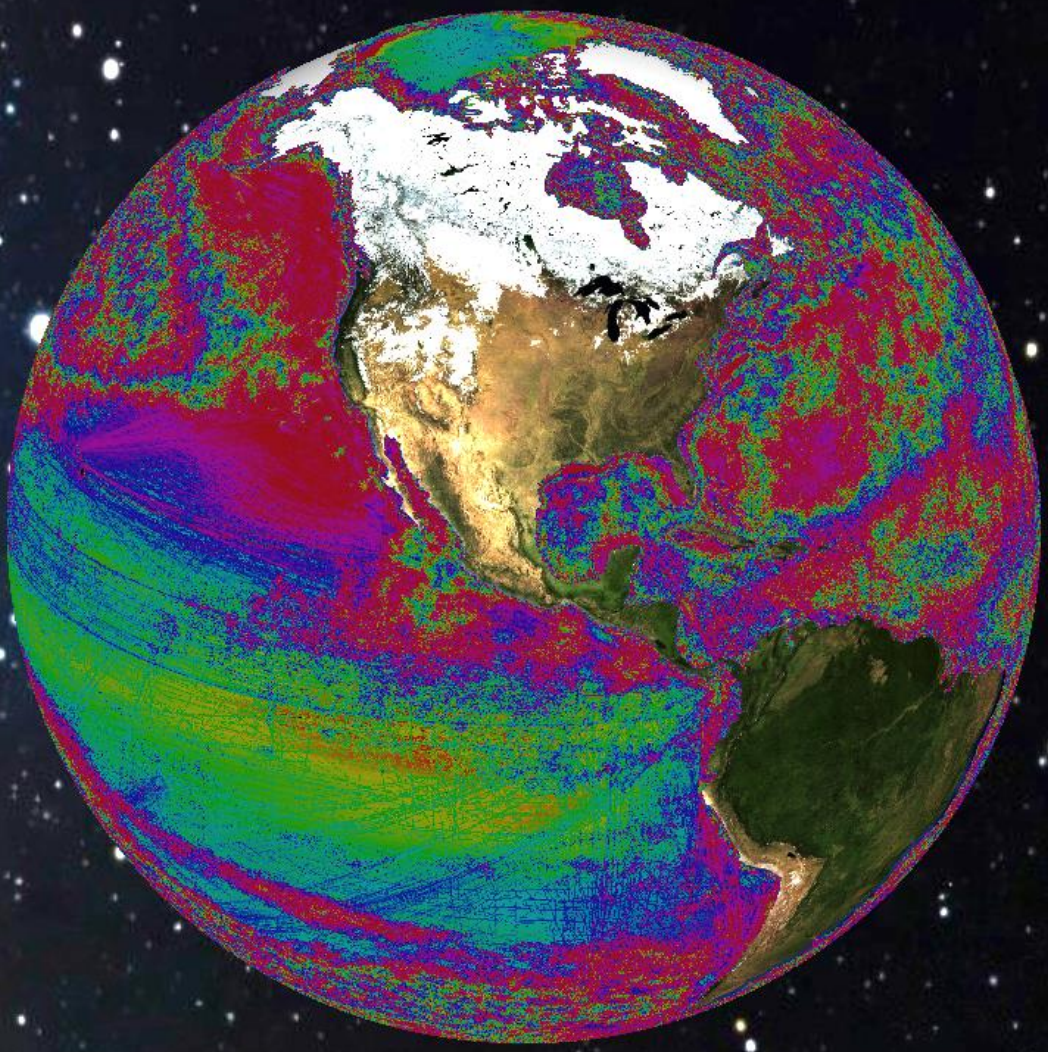
SELECTED STUDENTS PROJECTS

AlloLib Audiovisual Concerts (2022)
MAT 276IA, MUS 109IA, MUS 209IA

Sensorium (2022-2024)

| Pacific Standard Time (PST) 2024 - Getty Foundation

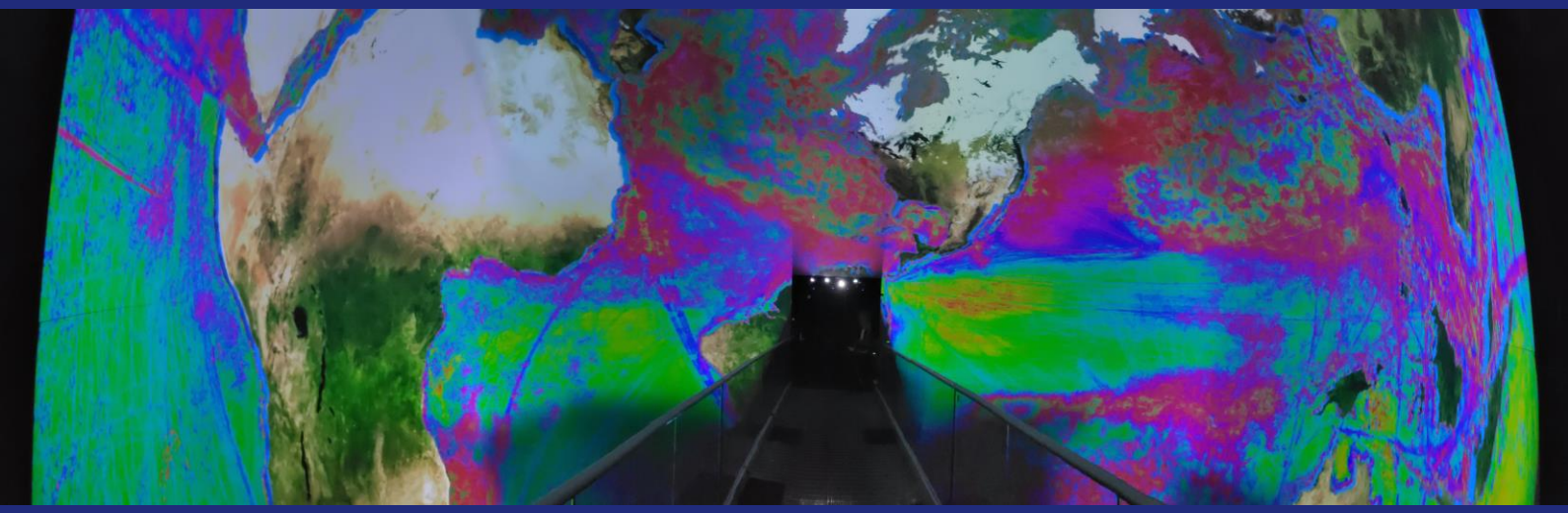
The Voice of the World Ocean



Sensorium (2022-2024)

| Pacific Standard Time (PST) 2024 - Getty Foundation

The Voice of the World Ocean



Role in the Project:

Collaboration with groups of ocean scientists and artists.
Core development of the large data processing, visualization, sonification, interaction, and installation.

A work by the Center for the Study of the Force Majeure Inspired by its late founder, the great artist and creative thinker Newton Harrison

Sensorium is both a work of art and science that sets out to synthesize the survival problems that the world ocean faces in our emerging heat shocked future. We believe that new and creative answers to questions regarding the ocean's ability to regenerate and return to ecological well-being will emerge from integrating core artistic concepts and creative strategies with current scientific resources and modeling, generating a new synthesis that builds on the strengths of the underlying science and the perspective of the artistic experience. These thoughts underpin the design and the work of Sensorium.

Sensorium is not a computer game nor an entertainment medium. Sensorium will start as an educational tool and continually develop to become a communication laboratory, one that challenges its visitors to investigate phenomena by asking questions to listen and heighten their awareness. In so doing we hope to exercise a new way of thinking and acting in response to the requests from the Life Web that is in crisis.

»Everything is interrelated«, as Alexander von Humboldt phrased it, and this interrelation includes ecosystems, humankind as well as the arts and sciences – natural sciences, ethnology, information technology and architecture.

Sensorium follows this holistic approach as a matter of principle providing the means for new thinking, insight and action: Sensorium takes a generalist approach scanning the whole in all cases, becoming a specialist as circumstances require.

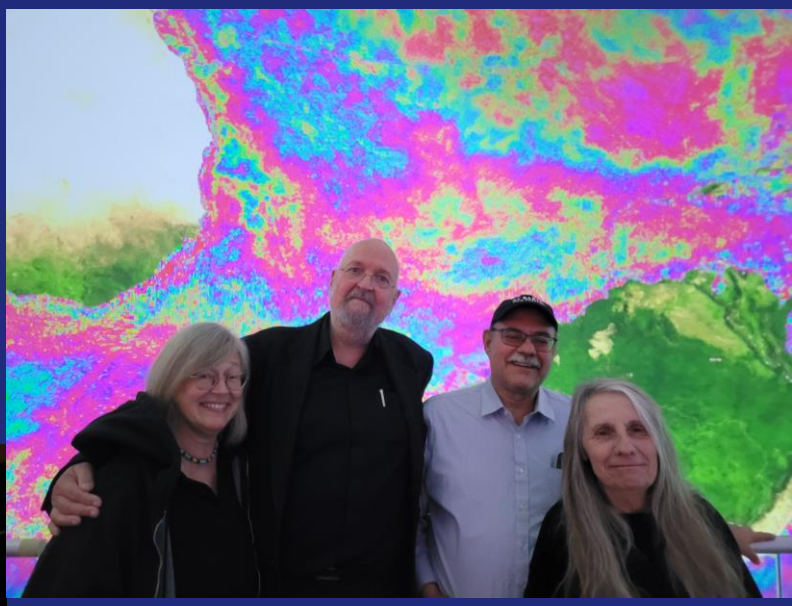
This work is inspired by the late Eco-Art Pioneer, Emeritus Professor Newton Harrison (UCSD) & Research Professor (UCSC) and conceived by the Center for the Study of the Force Majeure, based at the University of California, Santa Cruz.

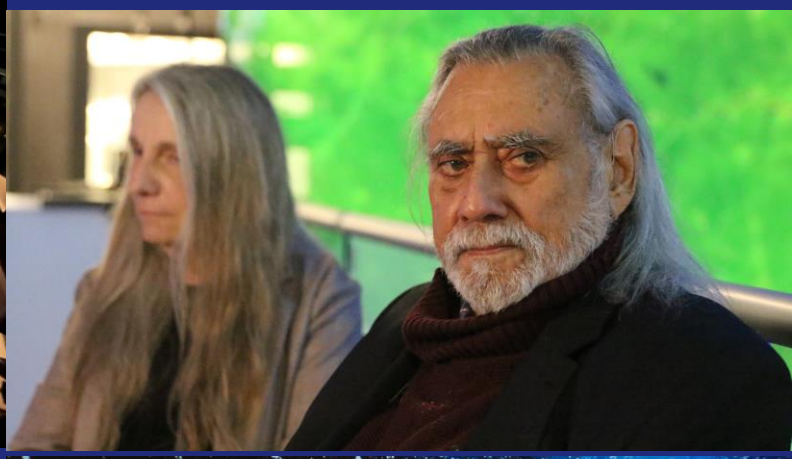
The team implementing and developing the project includes Distinguished Professor JoAnn Kuchera-Morin Ph.D., Director, The AlloSphere @ UCSB, Juliano Calil Ph.D., Virtual Planet Technologies, Center for Force Majeure Director Joshua Harrison, Co-Director Kai Reschke and Petra Kruse Ph.D. (both also Directors of the European Center for the Force Majeure).

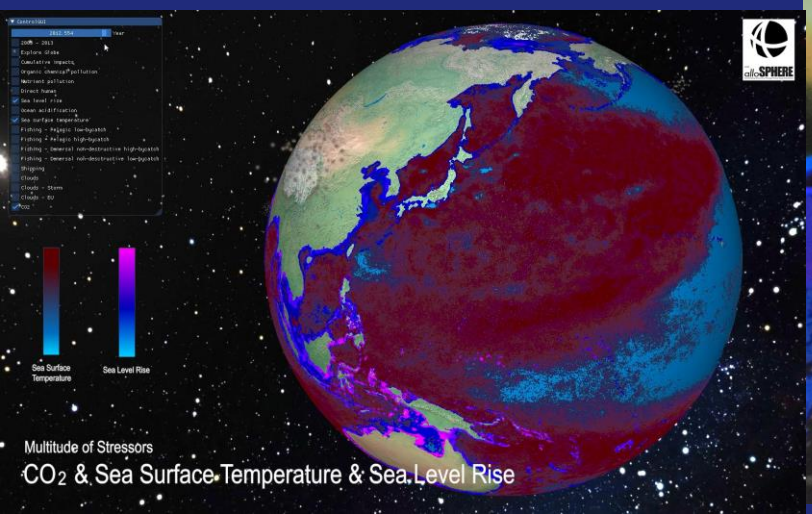
On development

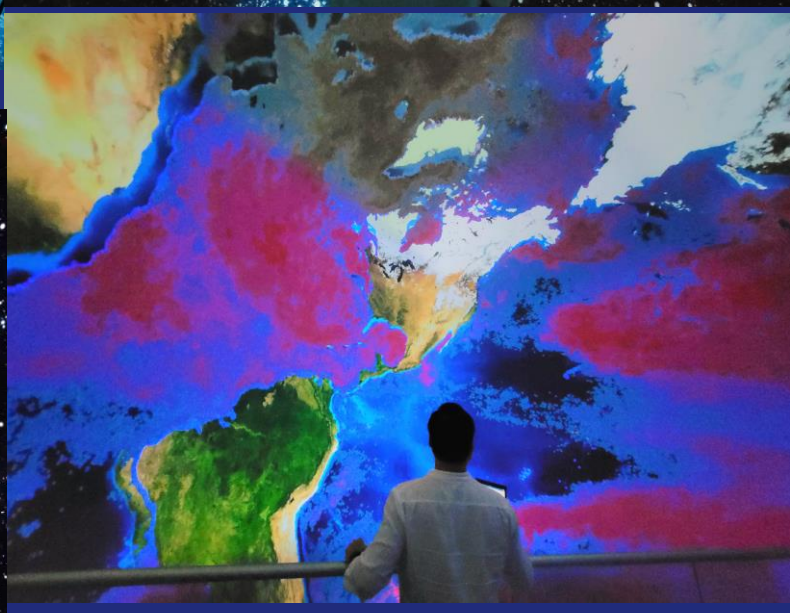
Video demo:
https://www.myunginlee.com/sensorium

News article:
https://news.ucsc.edu/2023/01/sensorium-experience.html



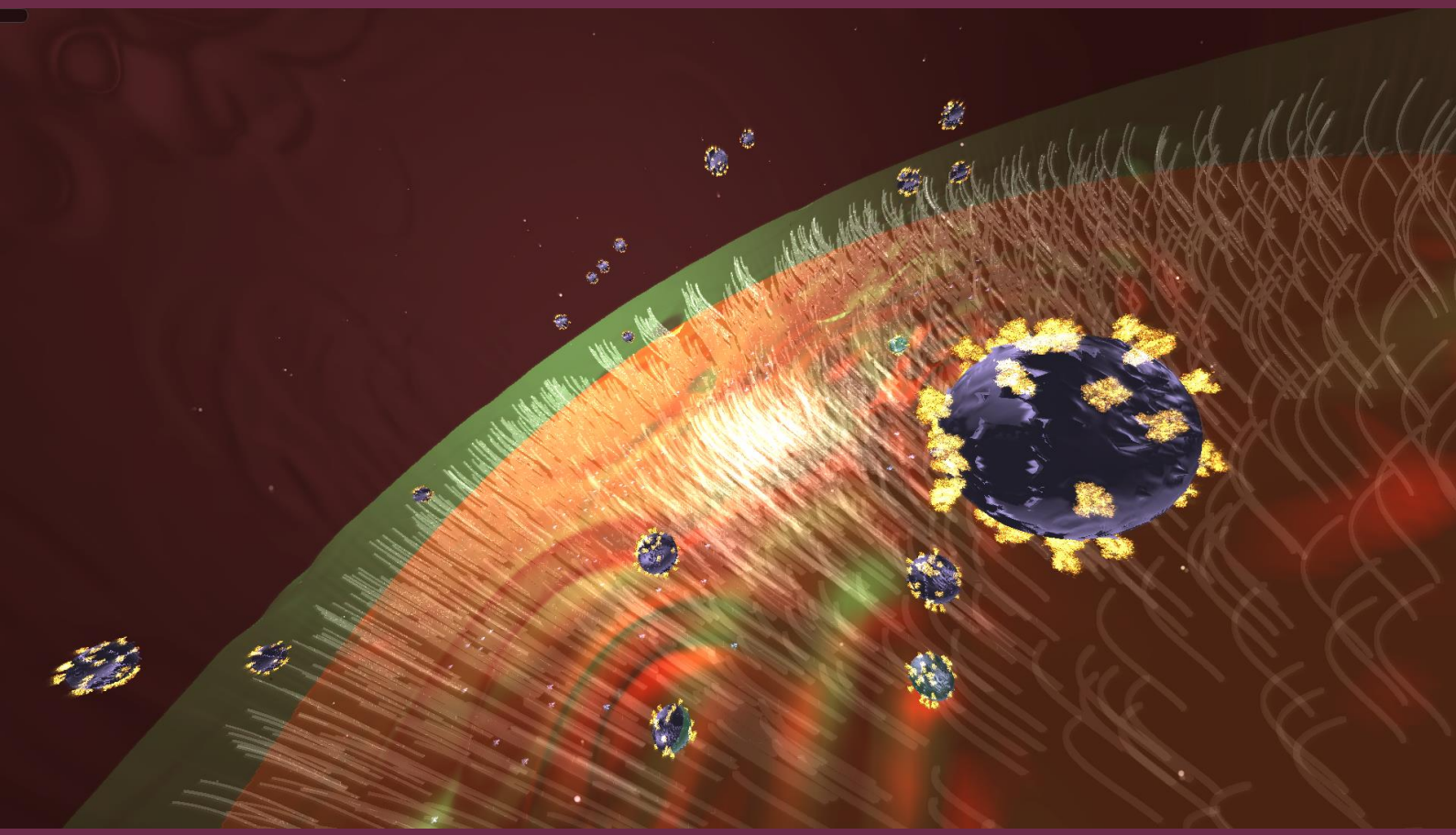






Coexistence with the SARS-CoV-2 virus

(2022-2023)



Role in the Project:

Collaboration with bio scientists and artists.

Core development of the simulation model, data processing, visualization, sonification, interaction, installation, and performance

Yoojin Oh, Sabina Hyoju Ahn, Myungin Lee

This project aims to transform the nano-scale of a striking biological phenomenon, the relationship between SARS-CoV-2 coronavirus and human molecules, into an interactive audiovisual simulation.

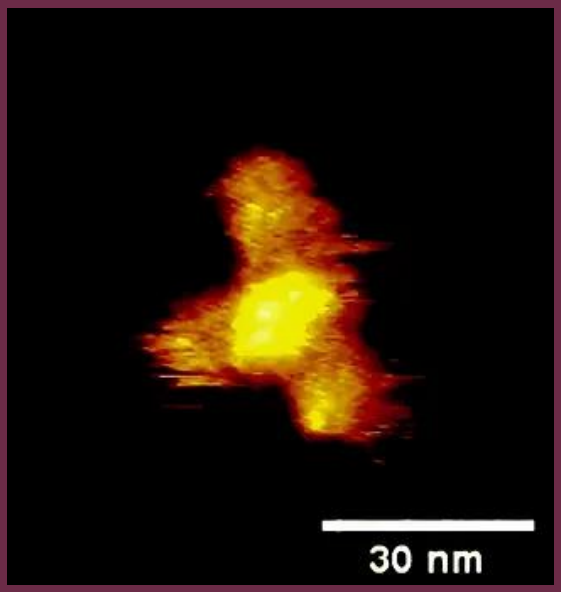
In this work, the interaction data between the spike protein of SARS-CoV-2 and human cellular proteins is measured by Atomic Force Microscopy, which can touch and image a single molecule.

We are creating an interactive audiovisual installation and performance from a set of interaction data. The audience is invited to an immersive space where they can control the biomolecules' behavior so that they can intuitively recognize the biological characteristics.

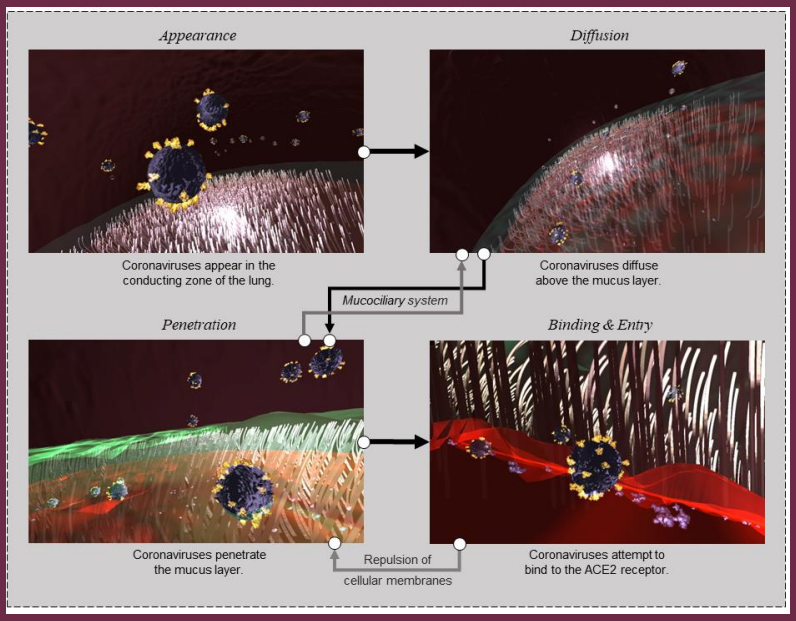
This project is not only a demonstration of scientific data but also tries to look at the interspecies relationship in parasitism. This project particularly deals with our current and future life with coronavirus and demonstrates how we might control our coexistence in virtual space.

Audiovisual Demo:
https://www.myunginlee.com/covid

Collaborative work with bio scientist to model and simulate the interaction between the human and the coronavirus



Atomic Force Microscope Data
(Left: Covid spike, Right: Surface of the human cell)



Four stages of SARS-CoV-2 infection toward the lung along the airway: Appearance, Diffusion, Penetration, and Binding for Entry


Article

THE EMBO JOURNAL

Identification of lectin receptors for conserved SARS-CoV-2 glycosylation sites

David Hoffmann[1,†], Stefan Mereiter[1,†], Yoo Jin Oh[2], Vanessa Monteil[3], Elizabeth Elder[4], Rong Zhu[2], Daniel Canena[2], Lisa Hain[2], Elisabeth Laurent[5], Clemens Grünwald-Gruber[6], Miriam Klausberger[7], Gustav Jonsson[1], Max J Kellner[1], Maria Novatchkova[1], Melita Ticevic[1], Antoine Chabloz[8], Gerald Wirnsberger[9], Astrid Hagelkruys[1], Friedrich Altmann[6], Lukas Mach[10], Johannes Stadlmann[1,6], Chris Oostenbrink[11], Ali Mirazimi[3,12], Peter Hinterdorfer[2] & Josef M Penninger[1,8,*]


HEALTH NEWS

Austrian scientists find coronavirus's Achilles' heel

Two sugar-binding proteins prevent SARS-CoV-2 variants from penetrating cells.

12 August 2021

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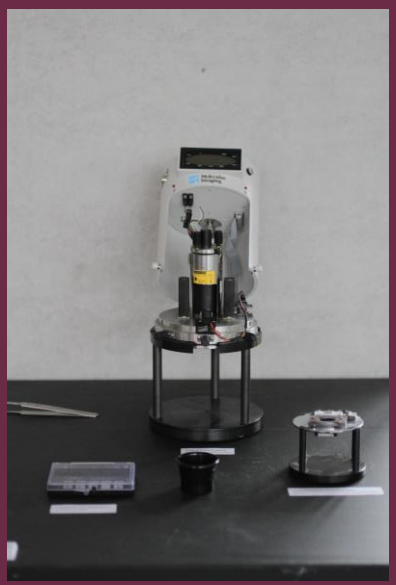
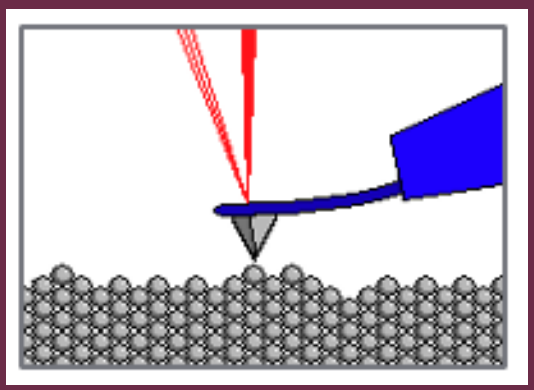
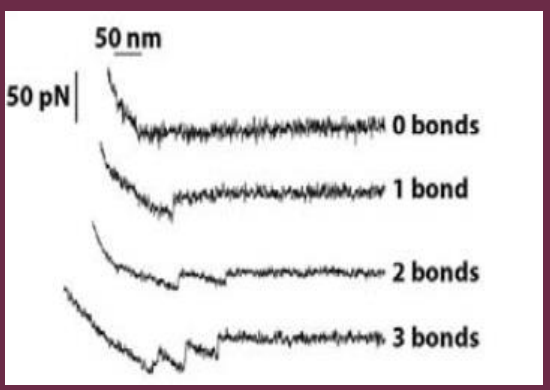
Publication on the discovery





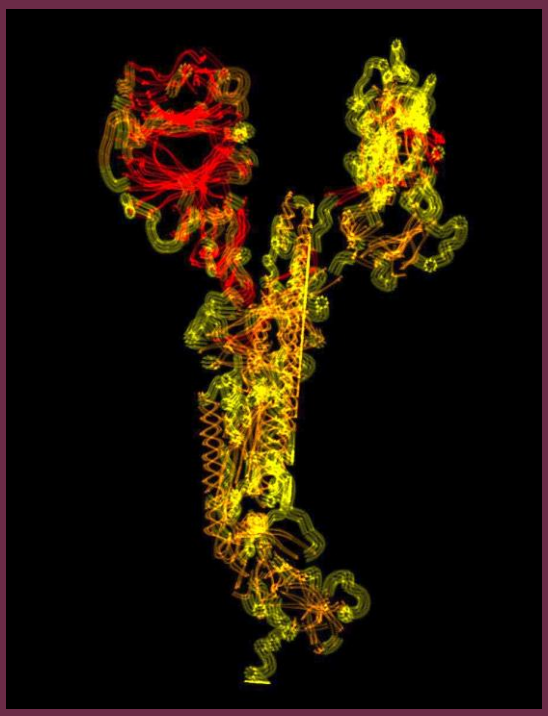


Atomic Force Microscope and its data describing the atomic force interaction between the virus and human

Credits
We acknowledge support from LIT-ARS-2022-005.
We appreciate data from H.Seferovic, R.Zhu, L.Hain (Institute of Biophysics, JKU), G.Kada(10-9), C.Rankl(RECENDT), and advice from J.Kuchera-Morin, A.Cabrera (UCSB), H.S.Lee(HS Clinic).

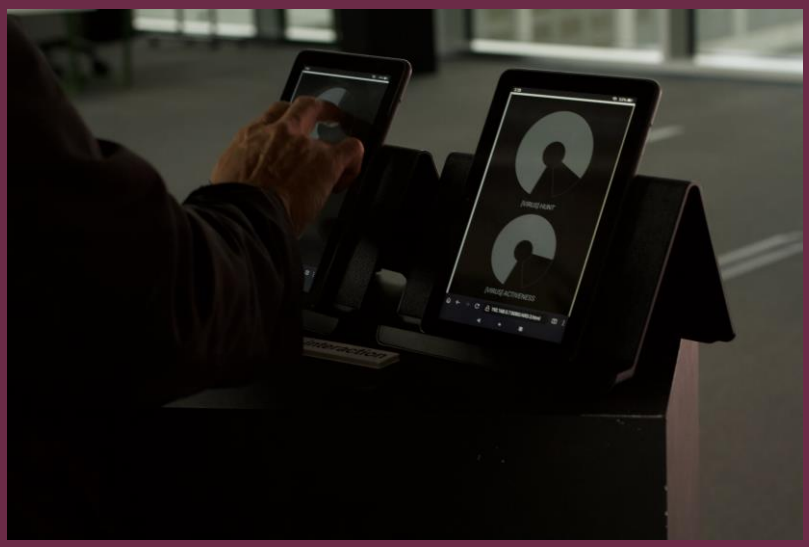
Development & Interactive Installation

Audiovisual Demo:
https://www.myunginlee.com/covid



Virus spike model implementation
- 3D Model of a protein trimer

Dynamic 3D model and behavior implementation
- Diffusion of the virus, movement of spikes (protein trimer), defensive system of the cell (mucus layer and cilia hairs)

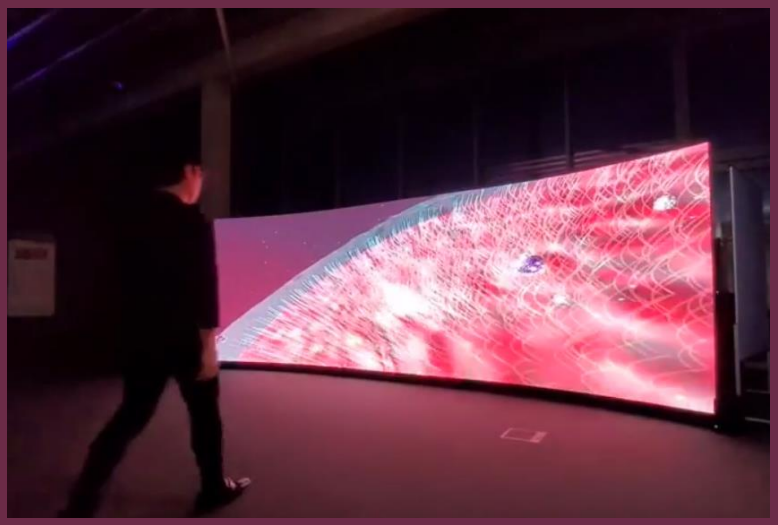


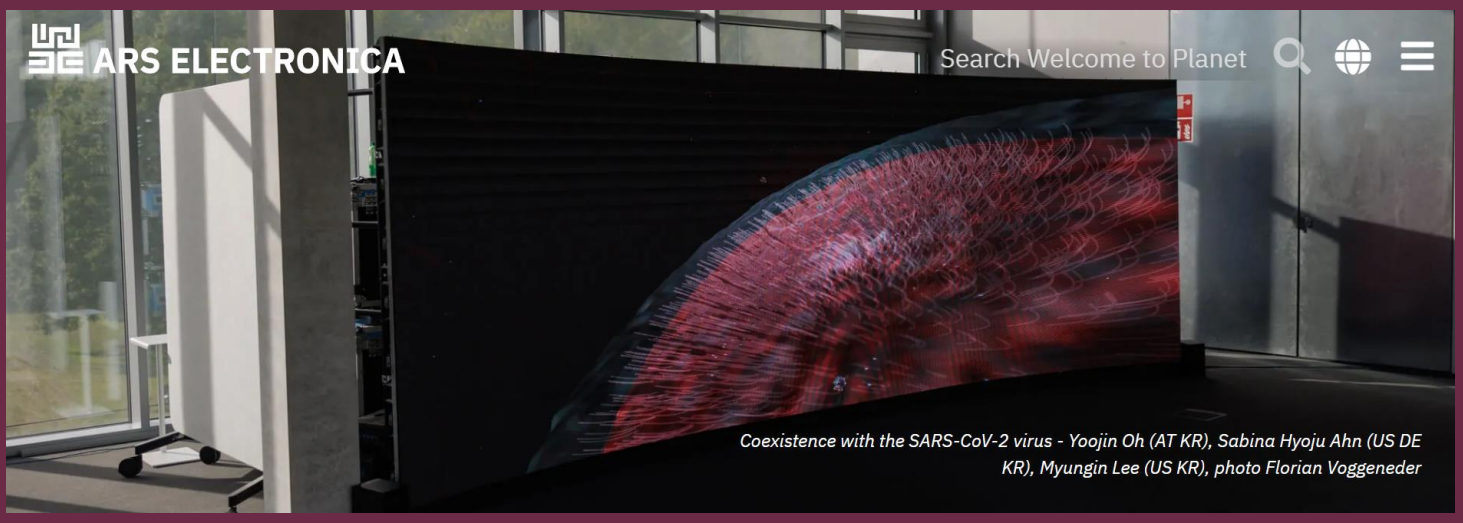
Interactive interface. Microphone & Touch-based interface representing human activity

Interaction in the Exhibition

Exhibitions

| Ars Electronica Festival 2022, Linz, Austria
| AlloSphere Open House (2022-2023), AlloPortal, Santa Barbara, USA
| Santa Barbara Center for Art, Science and Technology, USA





Coexistence with the SARS-CoV-2 virus - Yoojin Oh (AT KR), Sabina Hyoju Ahn (US DE KR), Myungin Lee (US KR), photo Florian Voggeneder

Press release:

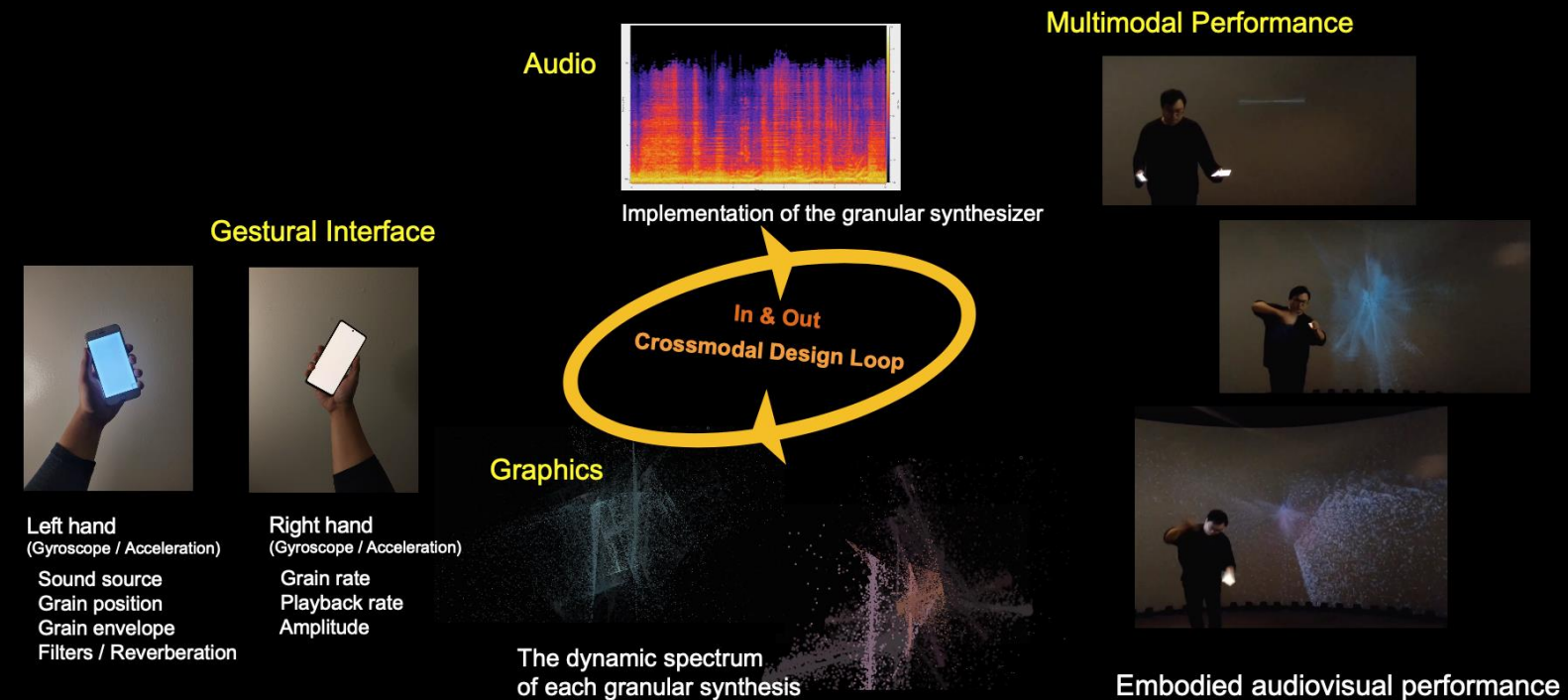
https://volksblatt.at/kultur-medien/hier-stellt-sich-eine-generation-vor-718090/
https://www.extradienst.at/ars-electronica-verwandelt-jku-campus-in-planet-b/

AlloThresher (2022-2023)

| ACM SIGGRAPH SPARKS, December 2022.

Multimodal Interactive Granular Synthesis

Part of coherent multimodal instrument design research



AlloThresher is a multimodal instrument with audiovisual granular synthesis using the gestural interface.
Granular synthesis is a sound synthesis method that creates complex tones by combining and mixing the simple micro-sonic elements called grains.

With two smartphones in both hands, the gestural interface interpreted from the sensors enables you to precisely and intuitively decide and play the parameter of the granular synthesis in real-time. Graphically, the corresponding visuals are generated simultaneously for each granule based on the spectrogram of the sound that morphs and blends dynamically with the gesture.

By breaking conventional interfaces like knobs and sliders, this seamless connection between modalities utilizes the profound advantage of the gestural interface. Moreover, the presence and gesture become part of the space and the performance so that the audience can observe and cohesively connect the audio, visual, and interface simultaneously.

While some modern digital media arts focus on the novelty of a specific technology in a single domain, this presentation and instrument suggest there are unique and creative opportunities when the multimodal digital instruments are designed cohesively over the different modalities.

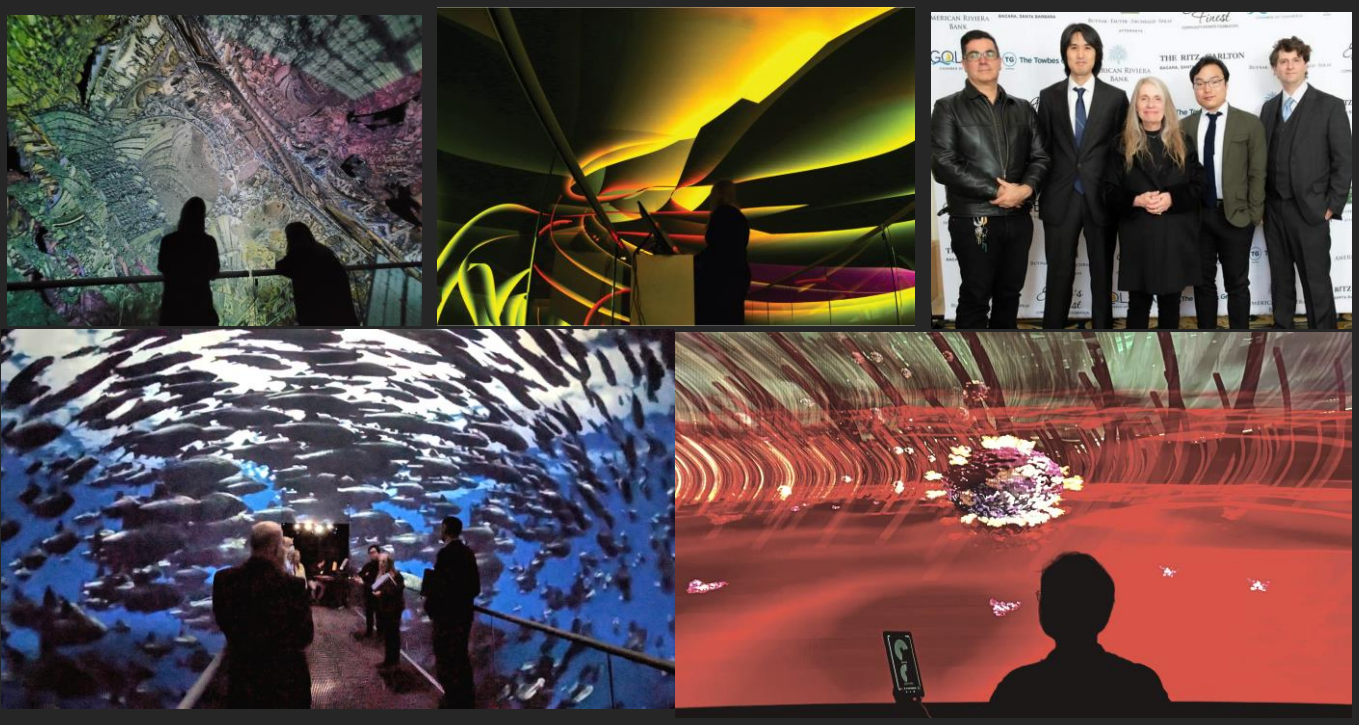
Video Available at
https://www.myunginlee.com/allothresher

AlloLib & AlloSphere (2018 - 2023+)

Interactive Audiovisual Development Platform

| AlloSphere & AlloPortal, UC Santa Barbara, USA

Introduction Video:
https://www.myunginlee.com/allosphere-allolib



The AlloSphere is a three-story full-surround, multimodal, immersive facility in the Media Arts and Technology at the University of California, Santa Barbara to represent large and complex data, including immersive visualization, sonification, and interactivity.

AlloLib is a cross-platform suite of C++ components for building interactive multimedia tools and applications.

Role in the Project:

- Developing and improving the software/hardware/interface
  - github: https://github.com/AlloSphere-Research-Group/allolib
- Developing and demonstrating projects using AlloLib inside and outside of the AlloSphere
- Teaching audiovisual composition class with AlloLib
  - github: https://github.com/AlloSphere-Research-Group/allolib_playground
    https://github.com/MyunginLee/MUS109IA-2022

AlloLib Playground (2018 - 2023+)

Interactive Audiovisual Development Platform

| AlloSphere & AlloPortal, UC Santa Barbara, USA

| CREATE ENSENBLE, Laptop orchestra performance,

The Center for Research in Electronic Art Technology (CREATE), UC Santa Barbara, USA

Role in the Project:

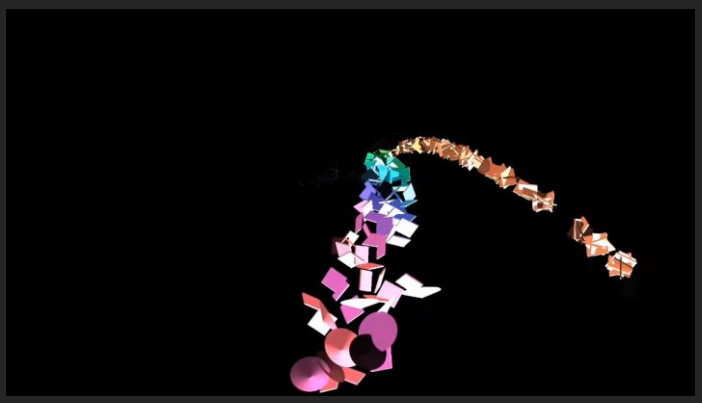
Core development of general-purpose audiovisual instruments for artist creation and education dealing with graphic rendering, sound sonification, interactivity, and simulation.

GitHub:

https://github.com/AlloSphere-Research-Group/allolib_playground

Footage of the Exemplary Works

Audiovisual Bach Sonata No. 1 In B Minor BWV 1014



Dynamic Audiovisual Improvisation

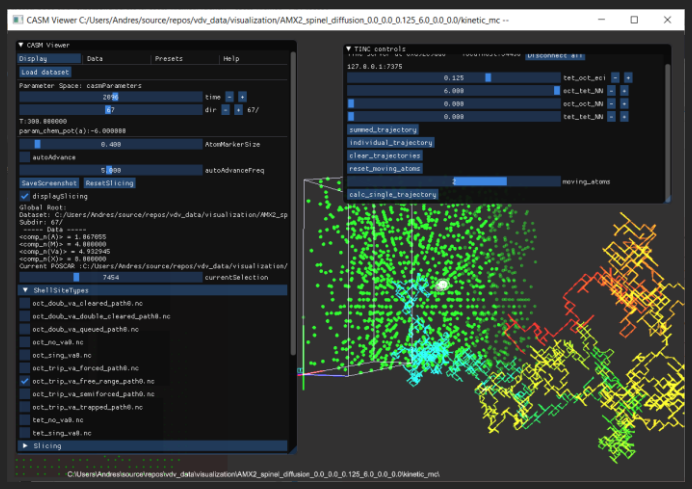
CREATE ENSENBLE Laptop Orchestra
Audiovisual Performance

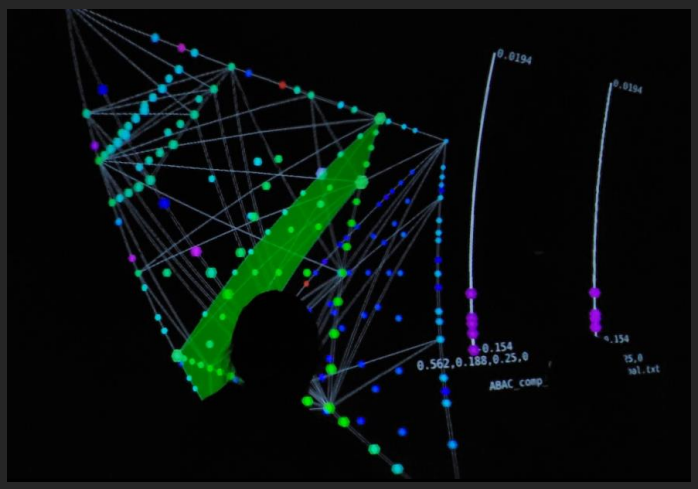
Network Music Jam with
Professor Chris Chafe's group in Stanford

AlloLib Applications:
TINC (Toolkit for Interactive Computation)

National Science Foundation Grant No. 2004693: 2021 – 2023
- Elements: Cyber-infrastructure for Interactive Computation and Display of Materials Datasets

Role in the Project:
Collaboration with senior engineers in the AlloSphere Research Group.
Core development of interactive computation and caching of data.
Made exemplary works demonstrating interactive quantum computation and machine learning using Jupyter notebook and C++.





The Toolkit for Interactive Computation (TINC) provides a set of C++ and python classes to assist in the interactive exploration of large datasets by managing parameter spaces, interactive computation and caching of data.

TINC allows exposing C++ application controls to the network. This simplifies the development of distributed applications as well as creating applications that can be controlled through python without having the application itself depend on python.

A great use case is by interacting with the C++ application through a jupyter notebook.

TINC can also be used standalone in python to assist exploration of complex datasets that are spread out through the filesystem through interactive computation prototyping.

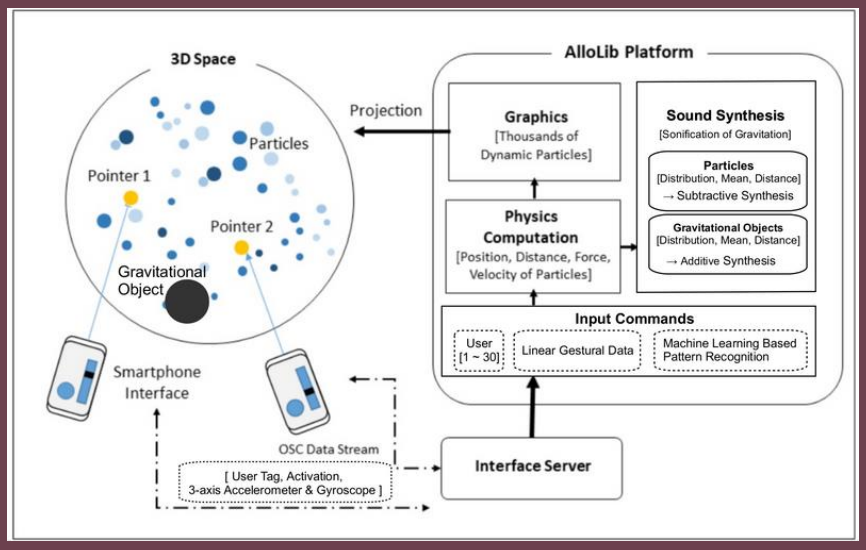
TINC application has been used for audiovisual interaction with high-power computation including Monte Carlo simulation, Quantum computer, and machine learning.

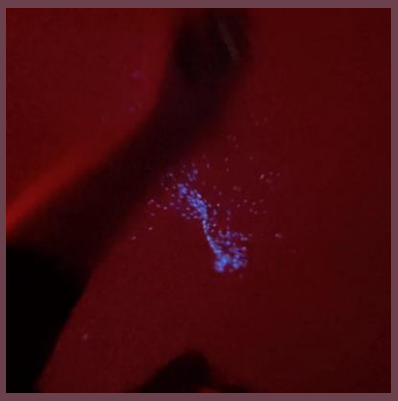
GitHub:
https://github.com/AlloSphere-Research-Group/tinc
https://github.com/AlloSphere-Research-Group/casm_viewer

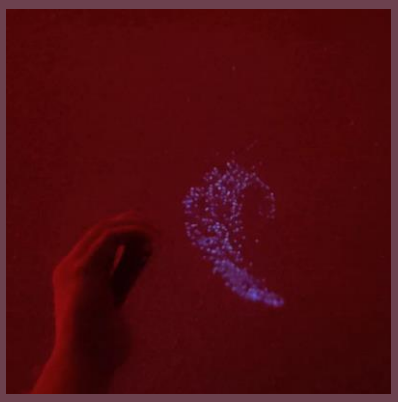
Entangled (2021)

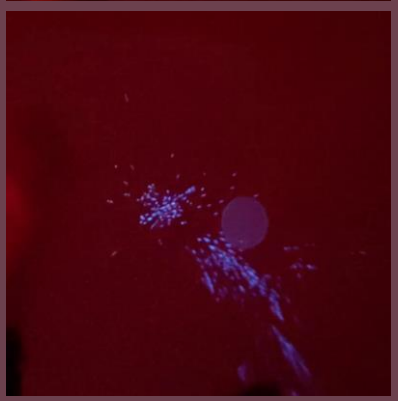
A Multi-Modal, Multi-User Interactive Instrument in Virtual 3D Space Using the Smartphone for Gesture Control

| New Interfaces for Musical Expression (NIME'21)









Snapshoots of the performance
The environment is designed for a dark 3D XR space (AlloSphere, AlloPortal)

Entangled, a multi-modal instrument in virtual 3D space with sound, graphics, and the smartphone-based gestural interface for multi-user is introduced. Within the same network, the players can use their smartphone as the controller by entering a specific URL into their smartphone's browser. After joining the network, by actuating the smartphone's accelerometer, the players apply gravitational force to a swarm of particles in the virtual space.

Machine learning-based gesture pattern recognition is parallelly used to increase the functionality of the gestural command. Through this interface, the player can achieve intuitive control of gravitation in virtual reality (VR) space. The gravitation becomes the medium of the system involving physics, graphics, and sonification which composes a multimodal compositional language with cross-modal correspondence.

Entangled is built on AlloLib, which is a cross-platform suite of C++ components for building interactive multimedia tools and applications.

Audiovisual Demo available:
https://www.myunginlee.com/entangled

Inspiration (2018)

Deep neural network-based music source conducting system
| International Computer Music Conference (ICMC), 2018

"What if we can conduct the music that we are hearing?"

Reproduction of music signals based on the interpretation of music & gestures

Developed and performed a machine learning-based real-time music signal interpretation and reproduction using musical gestures derived from the cell phone.

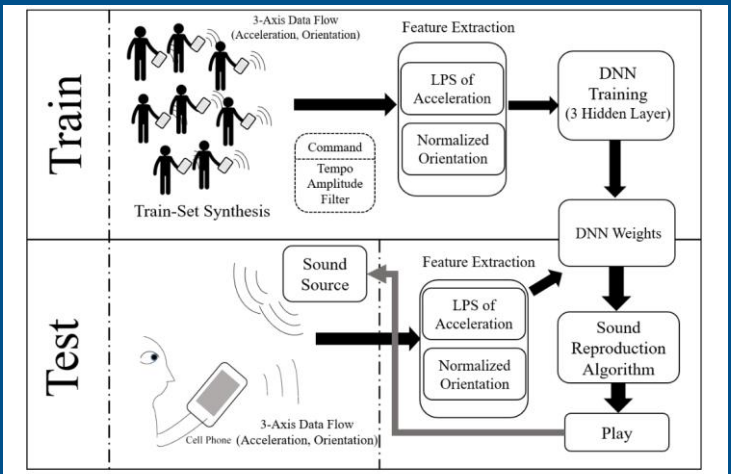


Figure 1. The structure of the proposed DNN based music source conducting system.

Conducting is one of the most exquisitely developed connections between music and gestural activity.

I proposed a system that can interact with music sources using a gyroscope and accelerometer-based controller inspired by conducting activity.

The system gives interactive and intuitive musical experiences to the user with the existing music source using a smartphone with the sensors. By using a deep neural network (DNN), the algorithm simultaneously derives the temporal, amplitude, and frequency response from the input data.

While conventional studies on the analysis of conducting gesture have a limitation with modeling complex model, the proposed system classifies various messages with high accuracy.

Demonstration and presentation on the research in ICMC 2018

Audiovisual Demo available:
https://www.myunginlee.com/music-source-conducting-system

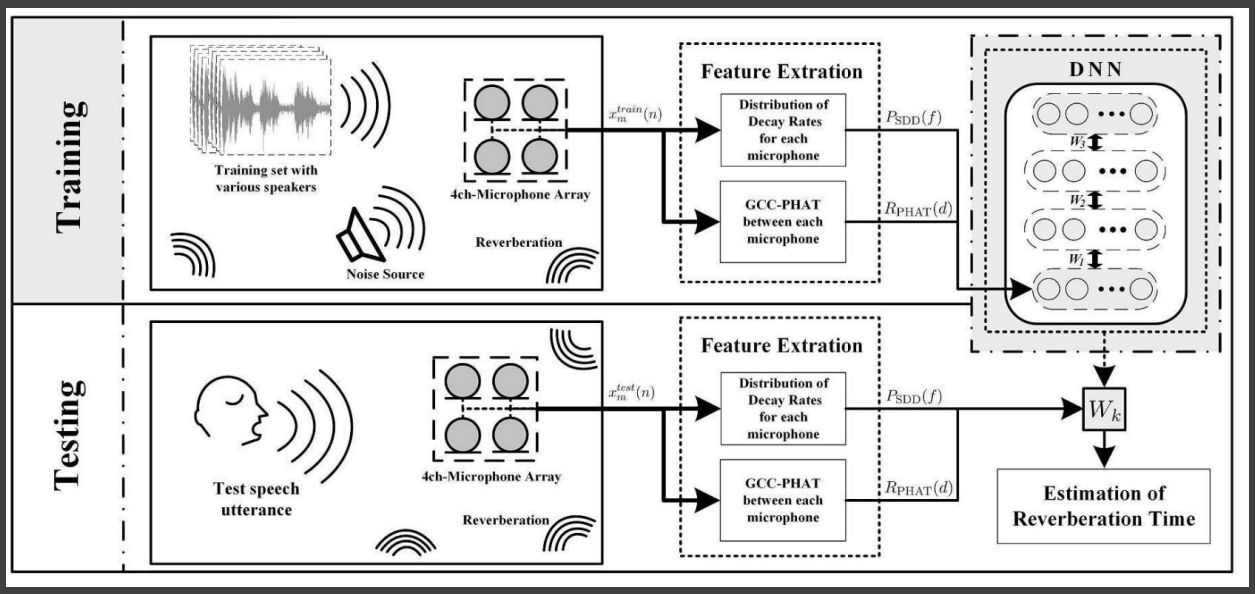
Blind Reverberation Time Estimation (2015-2017)

Machine learning-based room acoustic information from sound sources received by microphones.

| Published in Acta Acustica united with Acustica, 2018.

| Published IEEE International Conference on Network Infrastructure and Digital Content (IC-NIDC), 2016

| WO/US/KOREA Patent



Proposed blind reverberation time estimation using deep neural networks (DNN) using multi-channel microphone

Reverberation causes a performance degradation in distinct speech processing. For this reason, quantitatively estimating the amount of reverberation from the signal received by the microphone has been an important task for characterizing room acoustics and compensating for degradation due to an algorithm.

In this research, a novel method that estimates the reverberation time (T60) based on multi-channel microphones using a deep neural network (DNN) is proposed.

Each channel's distribution of the decay rates for each frequency and the generalized cross-correlation with phase transform (GCC-PHAT) between the microphones are adopted as the input feature vectors for DNN training.

Those refined features enable the DNN composed of multiple nonlinear hidden layers to learn the nonlinear relationship that labels the reverberation time from the input features, which is known to be challenging with low-order features.

The proposed algorithm is evaluated with extensive noisy conditions, and the results show the advantage of employing multi-channel signals with spatial features when compared with conventional methods.

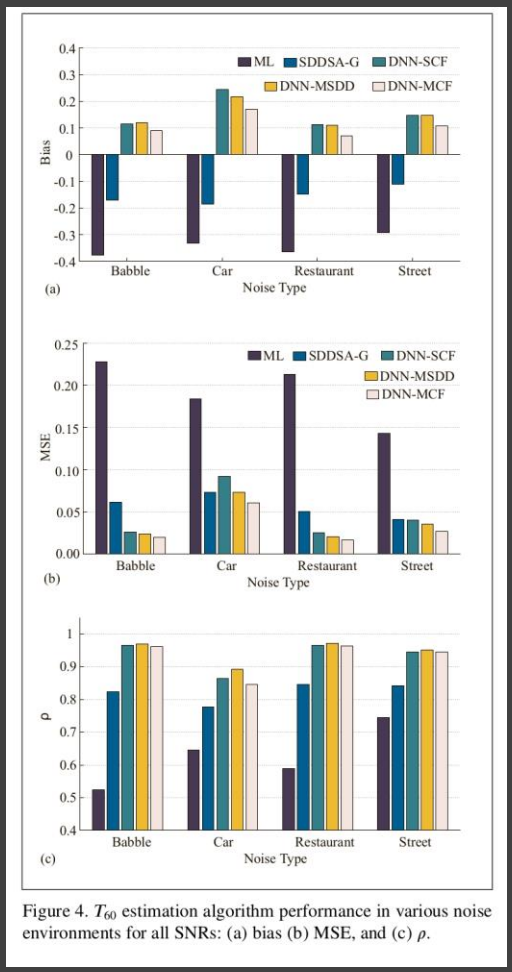


Figure 4. T_{60} estimation algorithm performance in various noise environments for all SNRs: (a) bias (b) MSE, and (c) ρ.

Webpage with the Paper Access:
https://www.myunginlee.com/reverberation-time-estimation

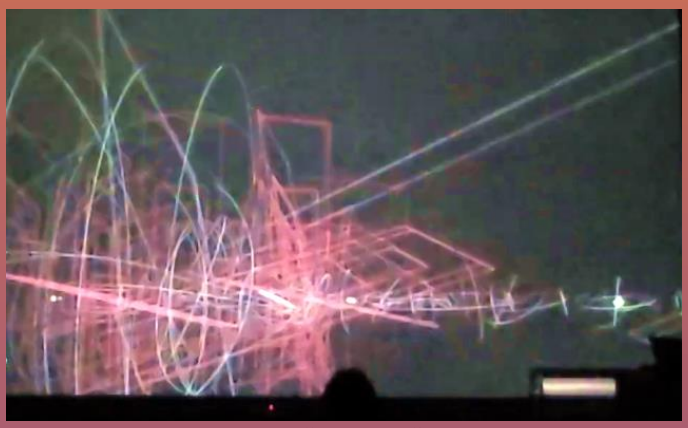
SELECTED STUDENTS' PROJECTS

AlloLib Audiovisual Concerts (2022)

| MAT 276IA, MUS 109IA, MUS 209IA
: Direct Digital Synthesis - Processing and Composition

Instructor: Myungin Lee
(Spring 2022, Fall 2022)

Graduate Students



"Vibrato" - Sabina Hyoju Ahn

MAT 276IA, MUS 109IA, and MUS 209IA are undergraduate and graduate-level combined courses for real-time audiovisual composition.

Using C++-based AlloLib, students extend their own creativity in audio, visualization, composition, programming, and interactivity.

Their final works are performed as an immersive audiovisual concerts and exhibitions

"Congestion" - Deniz Çağlarcan

"Strings" - Jack Kilgore

"Unfolding Dimensions" - Pau Roselló Diaz

"Sitting on A Swing at the Event Horizon" - Yifeng Yvonne Yuan

Class materials including the concert & catalog:
https://www.myunginlee.com/teaching

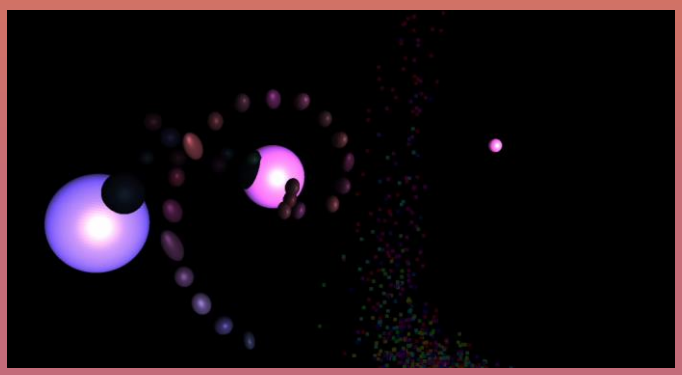
SELECTED STUDENTS' PROJECTS

AlloLib Audiovisual Concerts (2022)

| MAT 276IA, MUS 109IA, MUS 209IA
: Direct Digital Synthesis - Processing and Composition

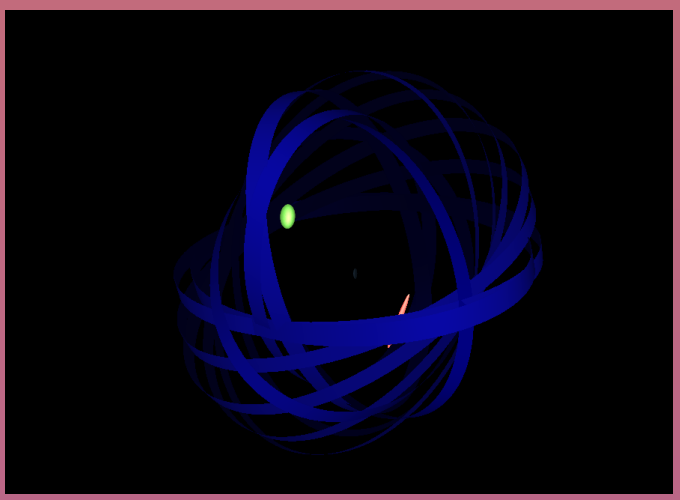
Undergraduate Students

"Alien March" - Brandon Nadell

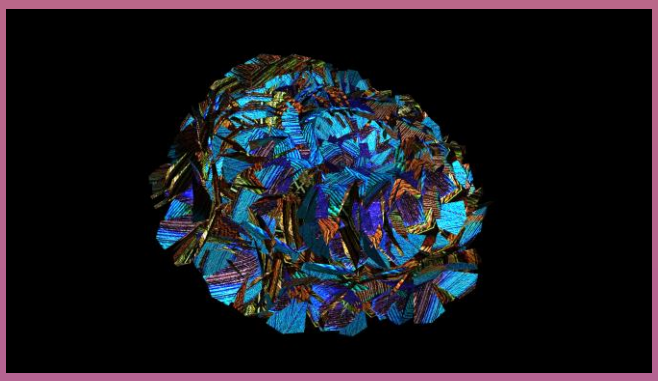


"Space" - Selina Liu

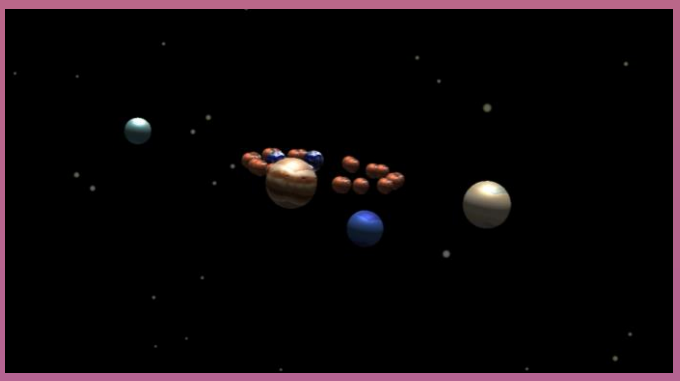
"Meshed" - Tommy Crahan



"Imprisoned Devotion" - Laila Roshan



"Bloom" - Tal Halperin



"Planetary Emissions" - Henry Jurney

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