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RESEARCH-ARTICLE

Multi-sensory Interaction for Meditation

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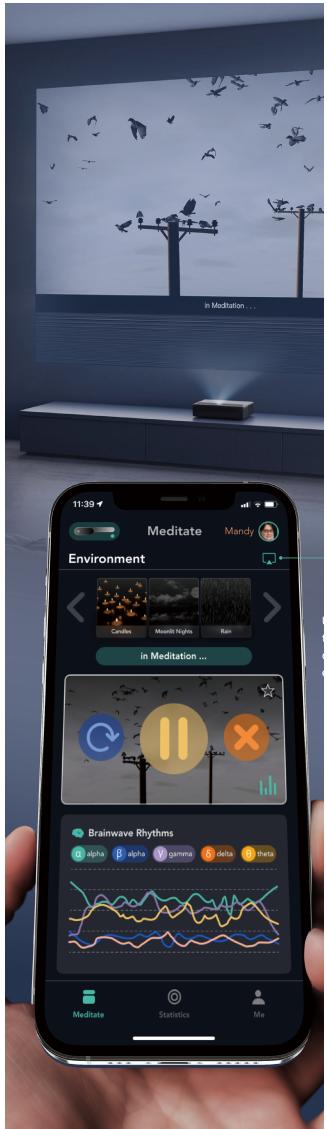
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Multi-sensory Interaction for Meditation: Art Gallery 2022 Chapter 5



Curator's Note

This chapter presents the work focusing on creating immersive experiences that bring forth inner peace in people. The authors of *Meditation Space* and *The Sound of Floating* create virtual worlds that can simulate or respond to the real world—by detecting from brain activities and body movements--while helping the wearers of VR and EEG headsets to mediate. *Window* takes a first-person approach to create a multimedia installment which is inspired by his quarantine experiences. The author of *Flow* creates a meditation device for people who suffer from somatization disorder—a physical discomfort transformed by emotional problems--by combining the breathing exercise with an imaginary action of painting the scent on a digital interface where colors and smells are digitally merged.

Exhibitors

Xingyu Lai, Zhaorui Liu, Xiya Jin, Xiaorong Shao, Borou Yu, Jiajian Min, Mengying Zeng, Shuting Chen, Qiao Liang

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Meditation Space: Brain Computer Interface Program

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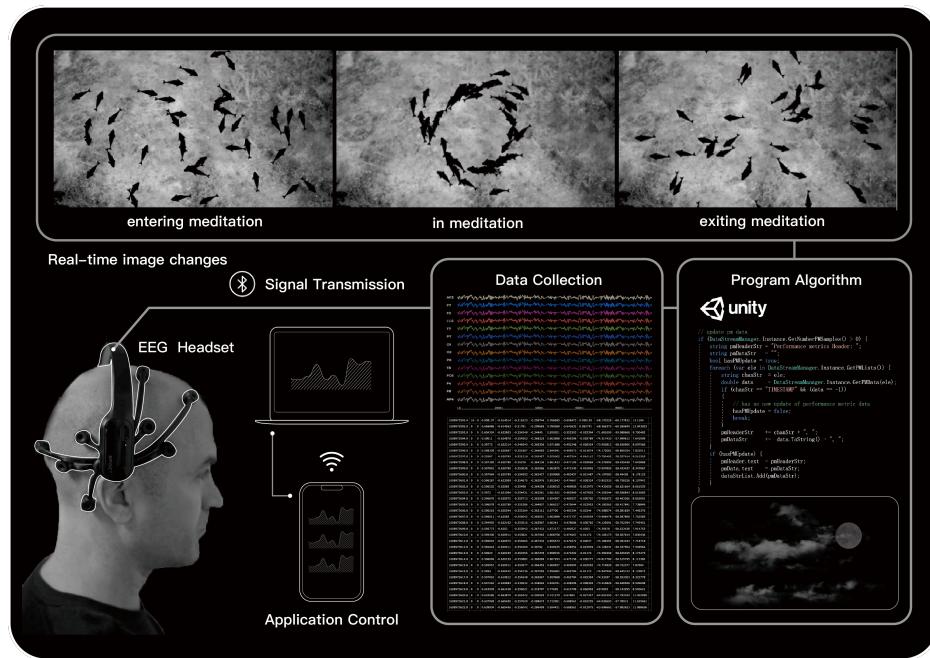
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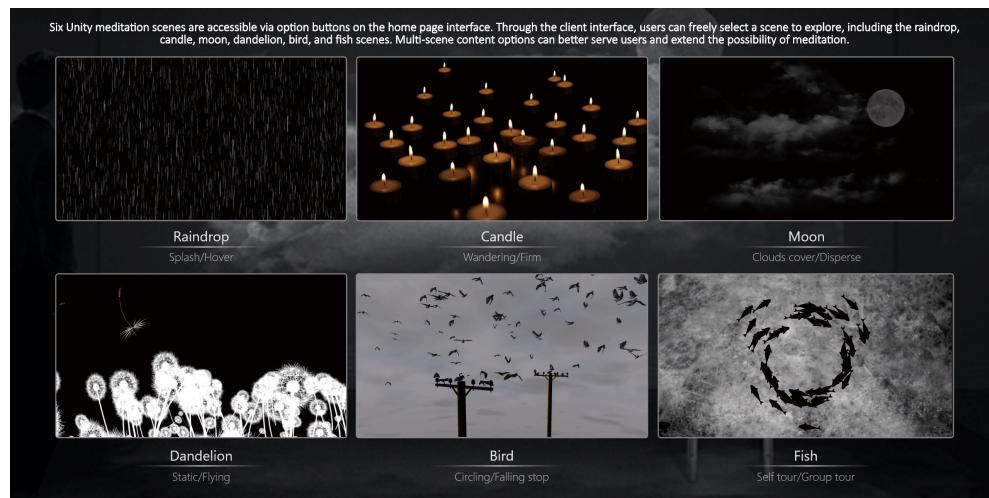


Meditation Space is a meditation training program system based on brain-computer interaction. It guides people to practice meditation in a way that is both scientifically sound and highly successful, using immersive graphics based on principles of natural beauty and real-time biofeedback information. Depending on the user's level of focus and relaxation, the dynamic pictures in its immersive theme scene can alternate between non-meditative and meditative states. The finest option for meditation is this meditation training system because it is made to assist users in understanding their own brain states.

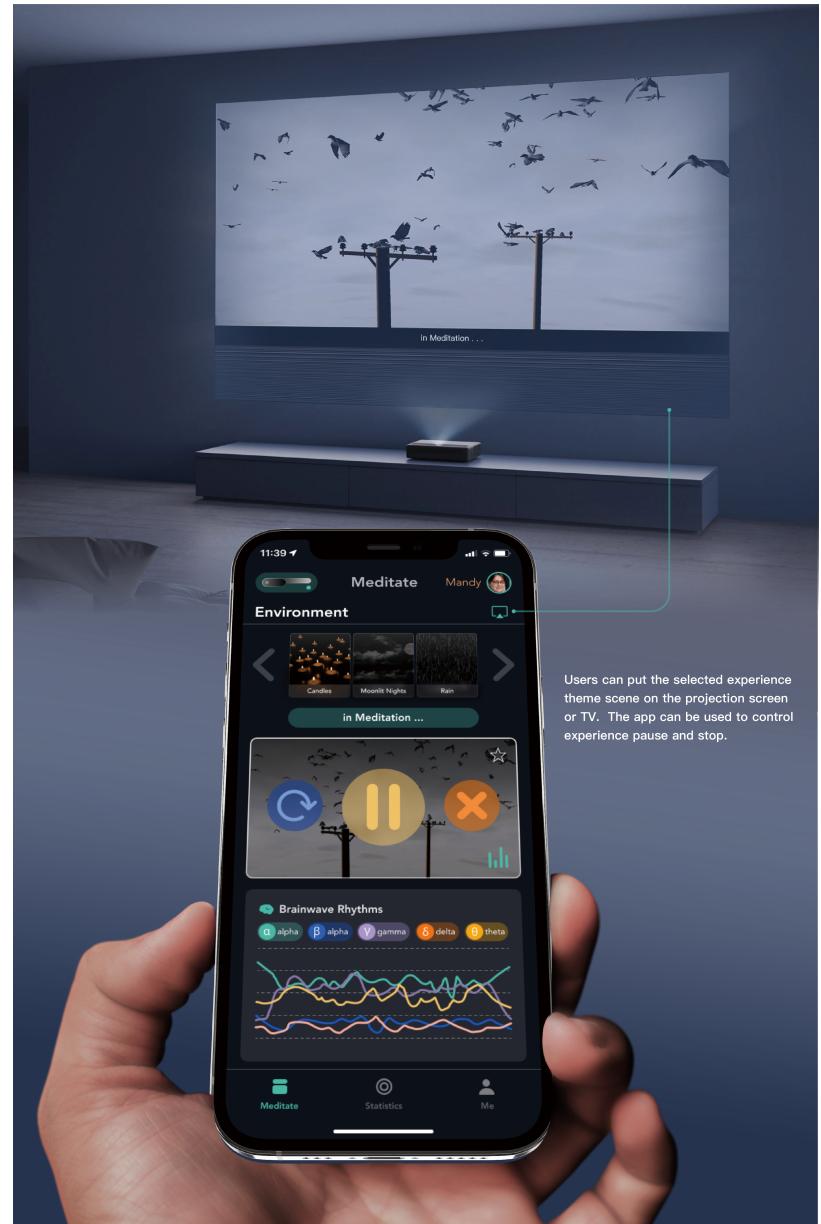
Six Unity meditation scenes are accessible via option buttons on the home page interface. Through the client interface, users can freely select a scene to explore, including the raindrop, candle, moon, dandelion, bird, and fish scenes. Multi-scene content options can better serve users and extend the possibility of meditation.



(a) Technology Supports Interactive Training for Meditation



(b) Multi-scene Enriching Meditation Experience



(c) Application control Interface

The Sound of Floating: Generative Art and Spatial Audio Design for Real-time GPU PSO Simulation

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"The Sound of Floating" is a work of immersive generative art for real-time GPU particle swarm optimization. It uses the real-time GPU particle swarm optimization written by Compute Shader to simulate the behavior of krill in the ocean and real-time rendering in VR HMD in the form of artistic light dots. The real-time data (such as the center of gravity position, the average speed, etc.) obtained from the algorithm simulation are processed and used for the spatial audio design in VR. In terms of sound design, granular synthesis is used to create the subtle and crisp dreamy sound of the particle swarm. With the whale songs from scientific research data and other atmospheric sound effects simulating the marine environment, the soundscape of the virtual marine space is jointly formed.

The work was designed using the DAW -- Ableton Live, the visual programming platform developed for multimedia interaction -- Touch Designer, and the VR HMD -- Meta Oculus Quest2. The technical framework of the whole system is shown in **Figure a**.

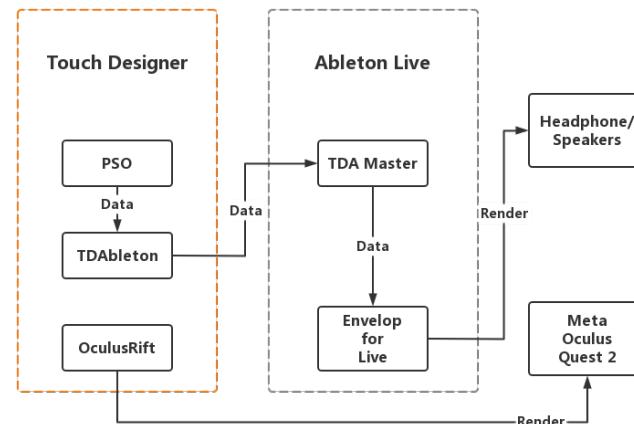
The visual content (**Figure e**) of the work is designed in Touch Designer, and the picture is rendered in VR HMD in real-time through the components of Oculus; the real-time motion data simulated by group animation is transmitted to Ableton Live through OSC protocol (**Figure b**); the audio data synchronized with the picture is rendered as spatial audio in Ableton Live through “Envelop for Live” (**Figure c**), and finally played in headphones or speaker system.

This work is based on the "prototype sound" theory (Keynote sounds, Signals, Marknotes) of Soundscape to conduct sound design for the visual content with obvious spatial expression.

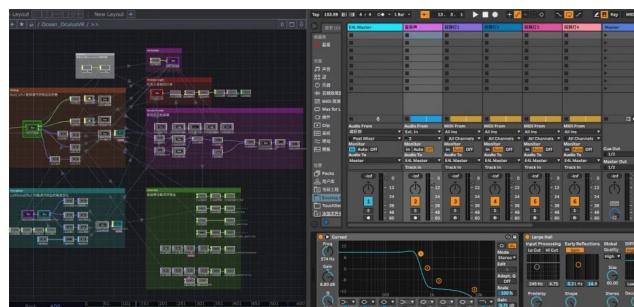
Reverb is added to the keynote sounds of the marine environment. At the same time, sound transmission is blocked because the ocean is filled with liquid. The sound is quiet and hazy, so it is necessary to use the low-pass filter of the Equalizer to adjust the dull sound.

The marknotes are designed for whales and krill. Whales sound from marine research data. And the sound of krill uses Granular Synthesis to create a subtle, crisp and messy sound (**Figure d**).

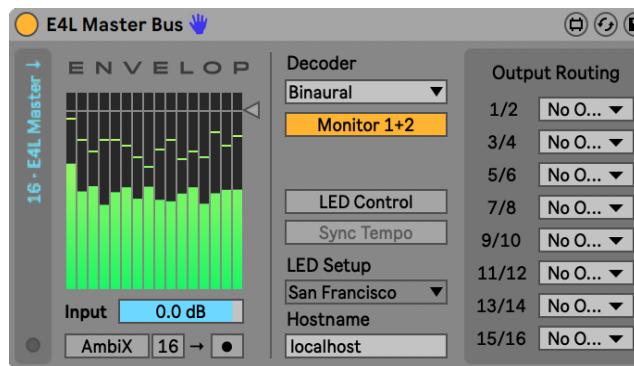
Signals: The VR HMD will appear in a photosphere symbolizing the submarine searchlight to represent human intrusion into the Marine environment. Therefore, we use the low-cut filter of the Equalizer to modulate the high, bright tone, and then through the Compressor to make its volume more prominent. Each photosphere is set with a fixed pitch and triggered by the MIDI signal. When multiple photospheres appear at the same time, they will form extremely discordant chords. The sound of the photosphere appears out of place in the entire ocean.



(a) Technical framework of "The Sound of Floating".



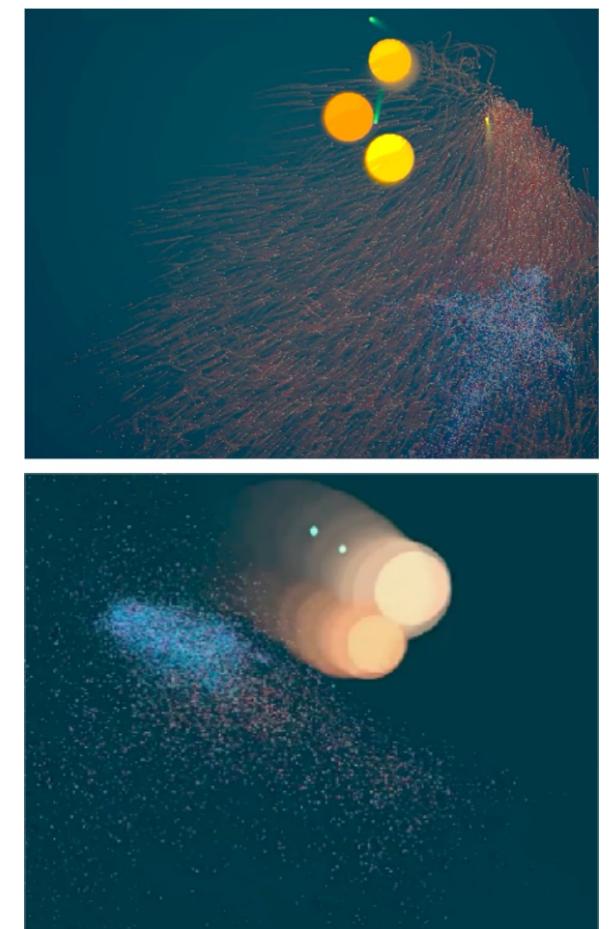
(b) Interface of "The Sound of Floating".



(c) Real-time rendering of spatial audio.



(d) Granular Synthesis of krill.



(e) Visual content of "The Sound of Floating".

Window

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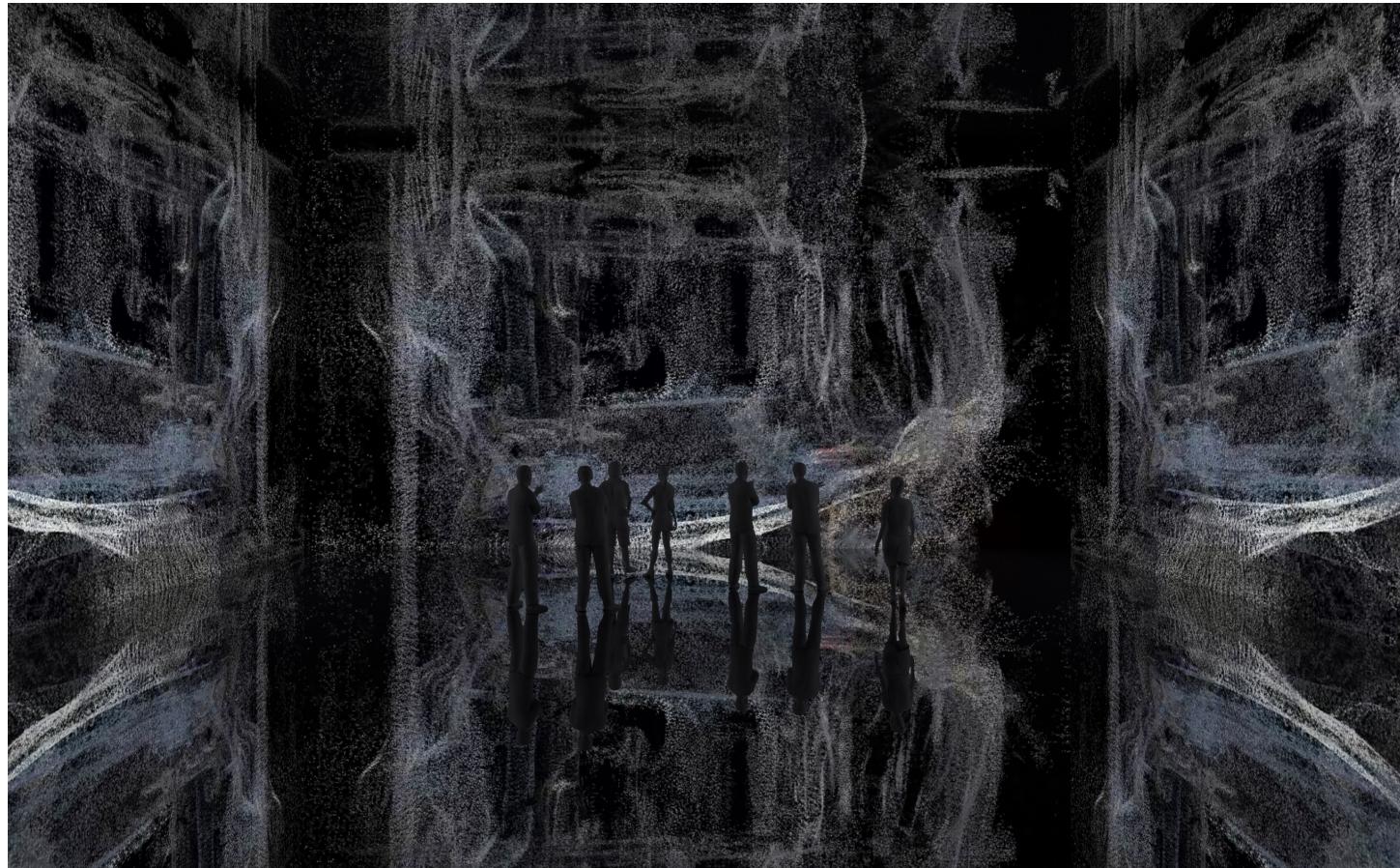
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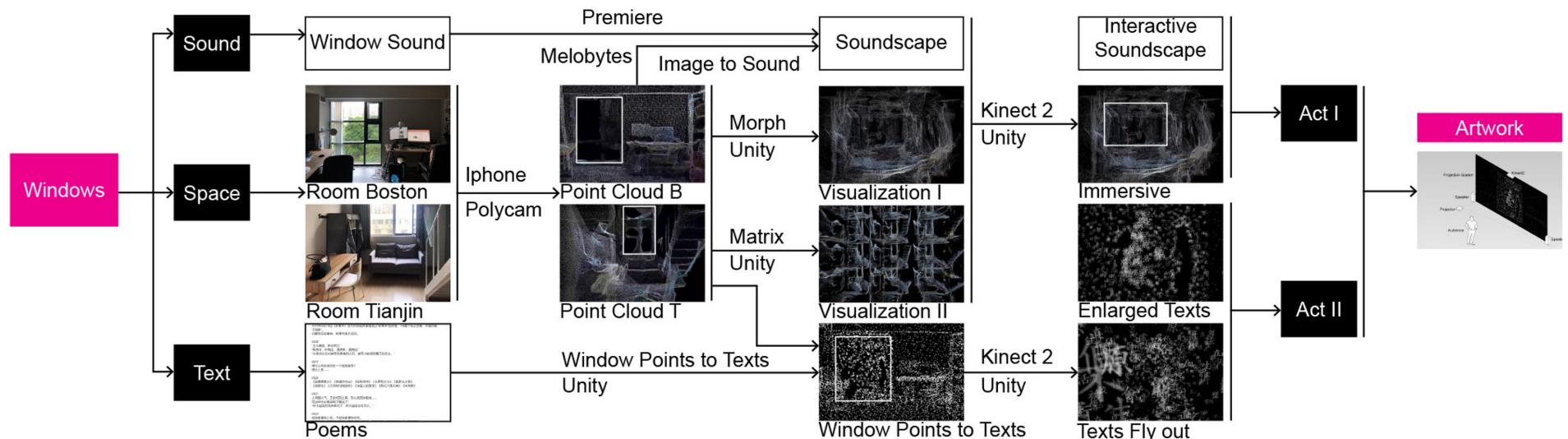
Independent Artist

Chicago, US

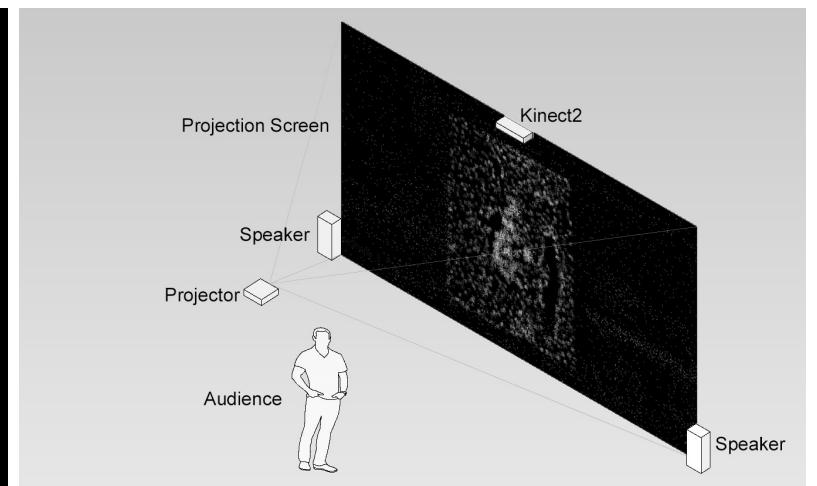
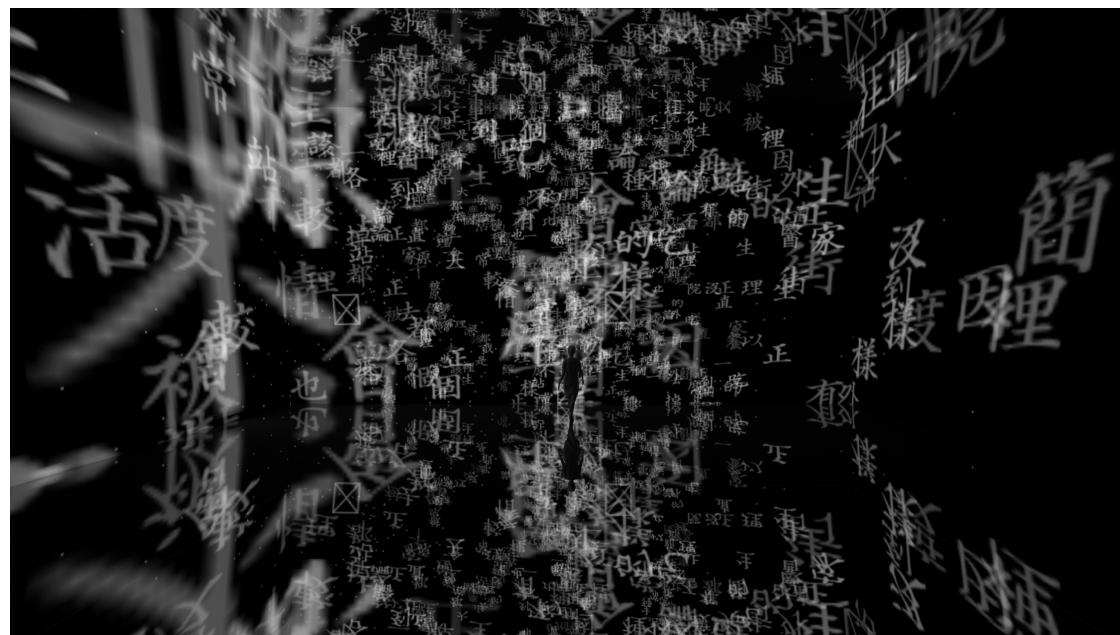
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Window is an interactive multimedia installation that reconstructs the Quarantine environment of the artist Borou Yu from the US to China, introducing the audience into the artist's memory and dreams. While the room was the container of the physical body, the window became the metaphor of hope, spirit and imagination to the outer world. The use of point clouds, sound, texts and the aesthetics of transparency and vanishing delineate the space, which is the representation of the mental projection. With Kinect depth camera, projector and speakers, the project developed an interaction system where the audience would immerse into the soundscape and ocean of texts from the monologue written during the quarantine periods. Window aims to create a poetic digital experience, arouse the audience's empathetic feeling together with the artist during the pandemic, and reflect on the relationship between body and space, the individual and the universe, the physical and the spiritual.



(a) System Pipeline



FLOW: a Dynamic Breathing Meditation Design based on Odor Synesthesia Effect

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The epidemic has been normalized, and many people have been attacked by somatization disorder, a physical discomfort transformed by emotional problems.

Based on the synesthesia effect of smell, this product is a multi-sensory fusion design for the process of breathing mindfulness. Guided by the unconscious decompression behavior of blowing bubbles, people begin to feel what smells look like between inhaling and exhaling. At this moment, the smell becomes the paintbrush that touches the emotional awareness about oneself.

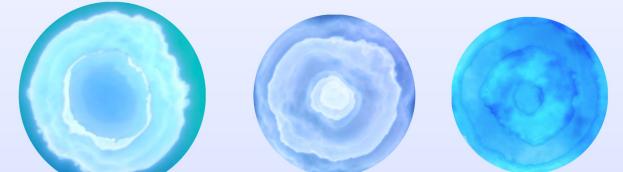
This design is also a digital attempt at art therapy and aromatherapy. Think of each breath as a paintbrush, each time you meditate, you can get a scent meditation painting. Day by day, you can feel the progress of mindfulness in every painting.



Spring Garden - - smell of rose, lavender, lily



Sea Wind - - - - smell of the sea



Rain Forest - - - smell of grass, wood

