Supersynthesis: A Communal Synthesis

Amay Kataria
Independent Artist
Chicago, Illinois, USA
studio@amaykataria.com

Abstract

This pictorial presents the journey of a light and sound installation called *Supersynthesis*, which collects data from its users through an interactive digital interface and expresses it through the physical installation. It begins by going over historical works and methodologies that align with this project, goes over the design decisions behind the sculptural form and its software architecture, and finally analyzes its function through the lens of a "*performative object"* to draw connections with the theme of *Mingling Spaces.*

Authors Keywords

audiovisual; communal; interactive.

Introduction

Supersynthesis began with the subject of waves and the data embedded within it. When I was invited to create a public-art installation inspired from this subject, I was immediately drawn to the sensory medium of light and sound. Like waves, they spread, move, affect, and get effected by the bodies it befalls upon. Combined with user interaction, *Supersynthesis* was presented as a 24-key audiovisual instrument.
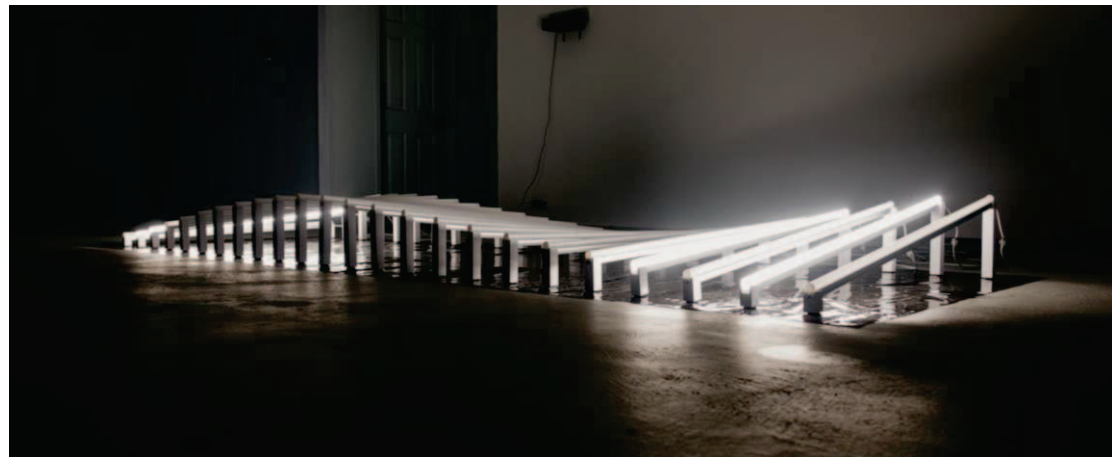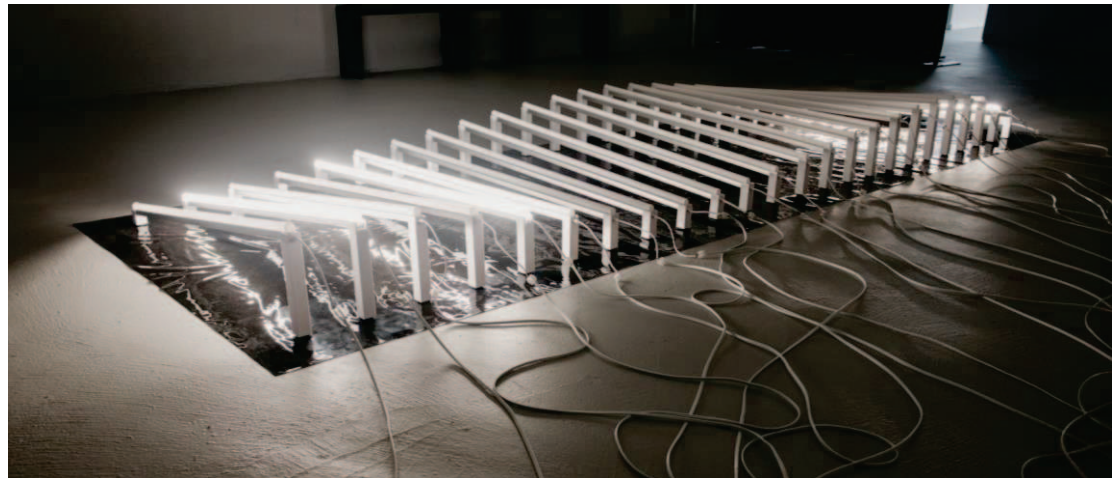
Related Works

Supersynthesis borrows from a rich historical lineage of works that are participatory in nature. Fundamentally, these are art installations or music-making applications, which expose some form of a digital interface that allows users to interact with it. The consequences of these interactions may or may not be disembodied from the actual device where they are taking place. With the help of a network methodology, this interactive data is collected, stored, and shared between multiple users to craft a social space in the physical world. For example, behind music-making apps like *Mesh Garden* [4] and *Ocarina* by Smule [5] or large-scale interactive light project *Open Air* [6] by Rafael Lozano-Hemmer, there is data that is visualized and communicated through the fabric of the internet to create audience mediated spaces for shared interactive experiences.

Ocarina by Smule [5] is a mobile app that allows users to create compositions using an aesthetic interaction mechanism and upload these musical score templates into a database, which can be accessed by other users. More than 100 million user-generated musical templates have been created by *Ocarina* users and stored in the Amazon Web Server database [5]. This allows sharing and reusing data between multiple users and extending it for their own creative purposes.

Supersynthesis doesn't differ a lot from Ocarina's approach, but it aligns more with the communication framework developed in *Open Air* [6] (as shown above), a light installation by Raphael Lozano-Hemmer that transformed Philadelphia's historic Benjamin Franklin Parkway in 2012. In Lozano-Hemmer's work, he uses the network architecture to allow remote participants to create data templates that affect a large-scale lighting system in the city. The physical installation is a performative device to visualize the data and is disembodied from the user-interface that the audience is interacting with on their personal devices. Like *Ocarina,* these user-generated templates are shared amongst multiple users to create a way of communication with others through a language of abstraction [5].

On the contrary, *Mesh Garden* is an example of a shared experience that allows users to collaboratively make music in real-time with their devices. However, the data template that is being modified here is common to all the participants and is simultaneously modified by each of them during the interaction [4]. This basically allows every single participant to be a cocreator of a musical piece, while the application mediates the communication of data between each participant.
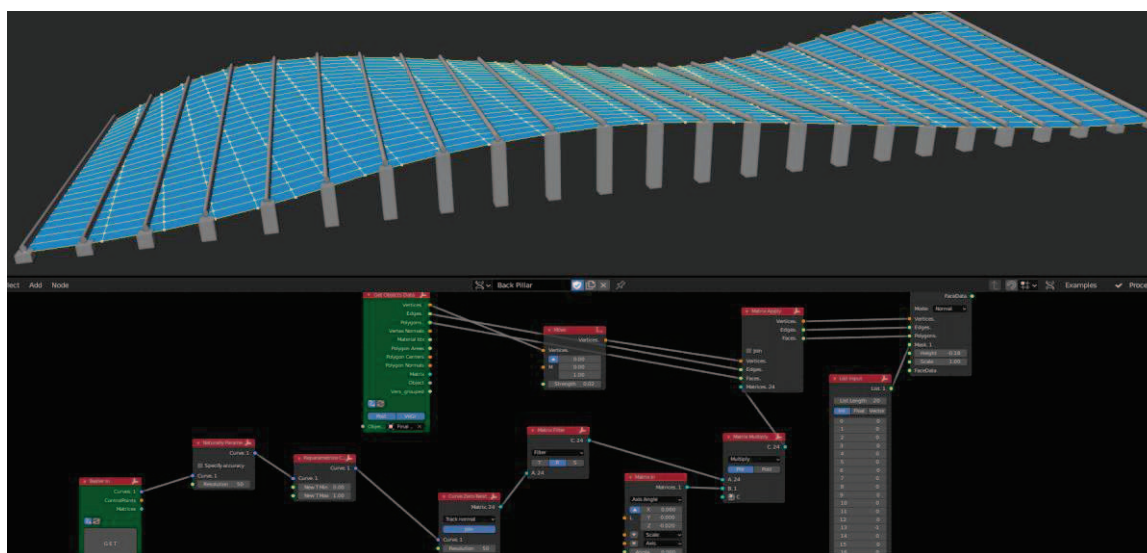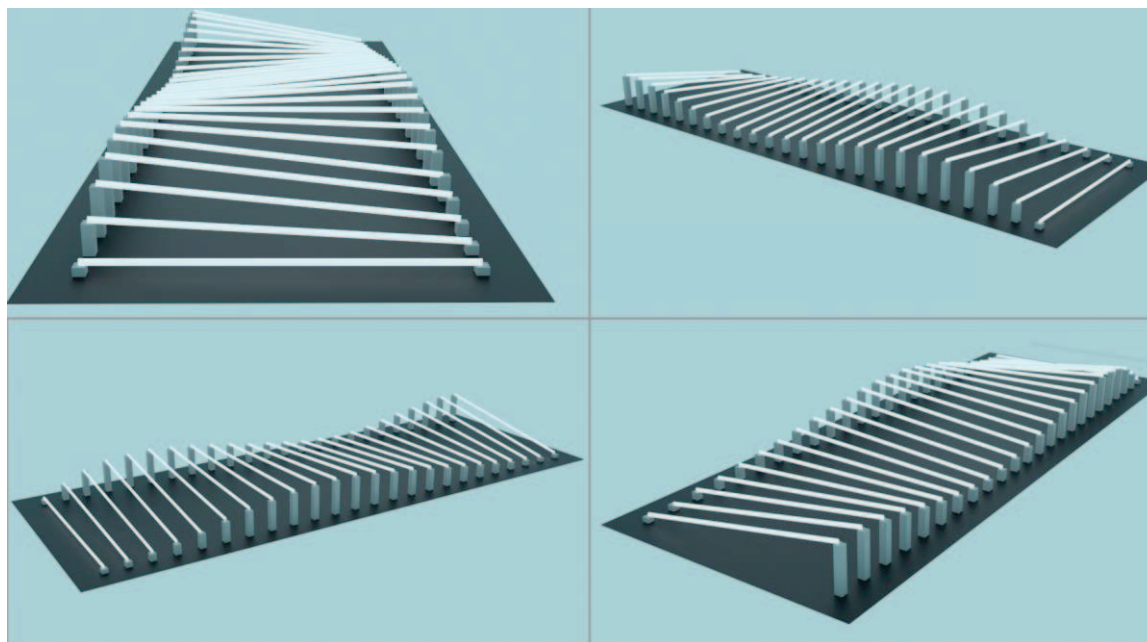
Is *Supersynthesis* a music-making application or an art installation? Just like *Open Air* by Lozanno-Hemmer, *Supersynthesis* has a strong physical presence as a light sculpture. However, like *Ocarina by Smule* and *Mesh Garden,* it also has a digital interface for people to abstractly communicate with each other by using the medium of light and sound emitted by the sculpture. Therefore, the digital interface and social interactive methodology in the physical space allows *Supersynthesis* to act like both. From here on, we'll go into the design process behind this work.

Parametric Form
My vision for the sculptural form was to represent a cross-section of an oscillation in three dimensions using light and sound. After deciding upon the size of the installation and the number of lights I wanted to use in the sculpture, I designed a parametric system in Blender that rendered my vision of a three-dimensional wave. This procedural design system was used to model the right height of the 48 pillars, which were 3D printed to support the 24 LED lights that made up the waveform.

Interactive Interface

The sequential arrangement of the LED lights began representing a piano roll and demanded a user interaction model to perform it. I decided to engineer two modes of interaction: Exhibition Mode and Performance Mode.

Exhibition Mode

In this mode, the installation operated as a 24-step digital sequencer - a programmable device composed of steps for storing sequences of musical notes and rhythms. This operation of the sequencer was exposed through an interactive digital interface hosted on the internet at https://supersynthesis.art. On this, the current score running on the physical installation was visualized by 24 rectangles, which corresponded to the lights in the installation. The moving red dot represented the current position of the sequencer.

Whenever the user interacted with this interface, they began creating a new data template of steps that could be transmitted to the installation through telepresence in real-time. This event also persisted the template into a cloud database as a memory of this interaction. The number on the left reflects the total number of entries stored in the database up till that moment.
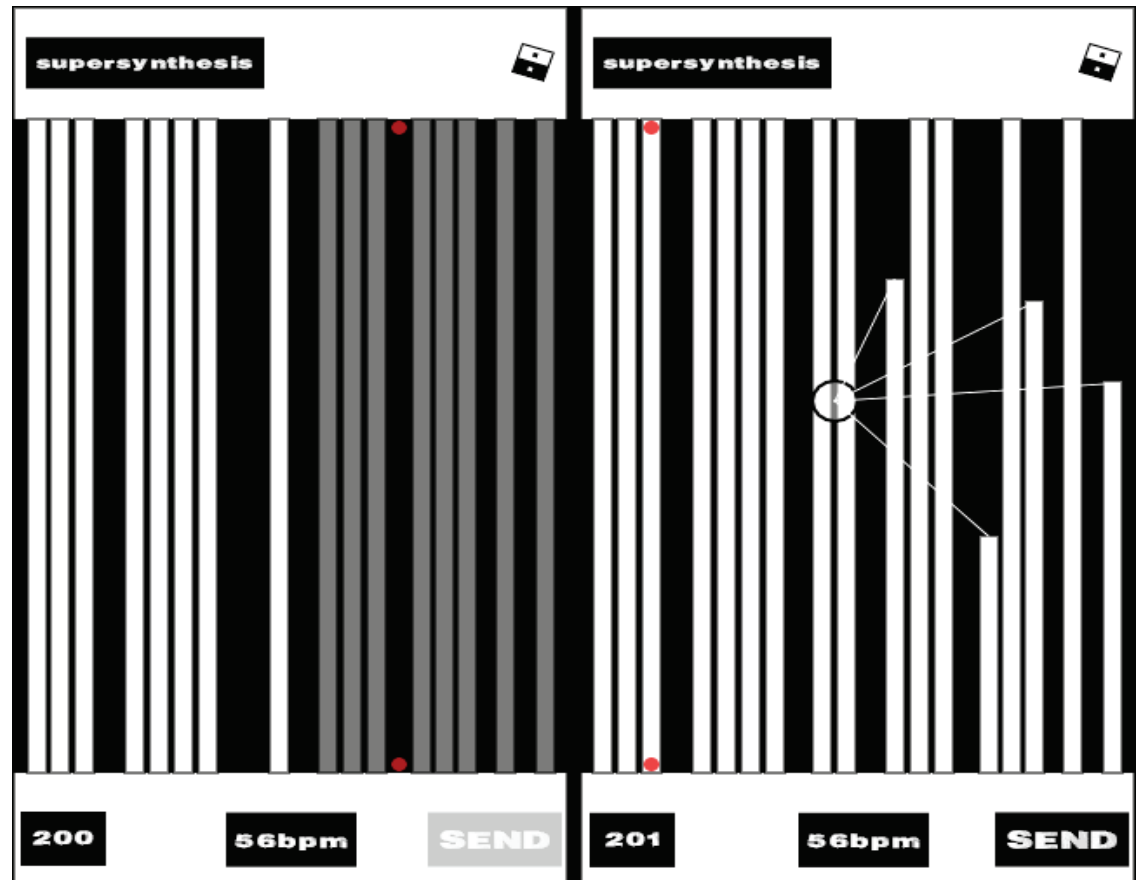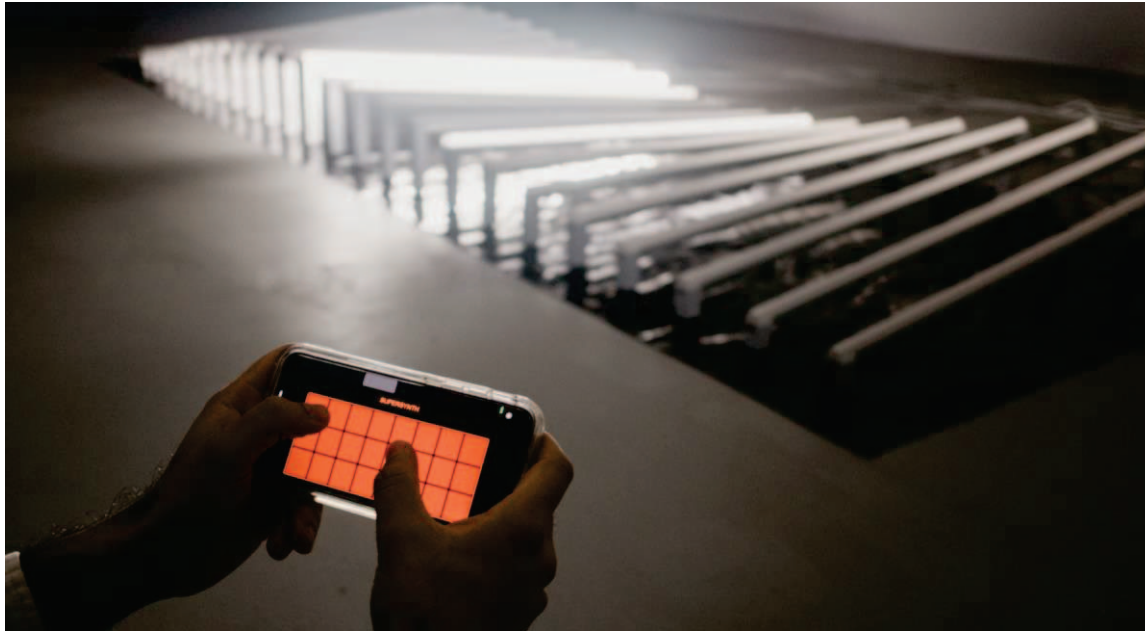
Performance Mode

A secondary interface was developed using TouchOSC to create a set of controls that allowed one to independently perform the instrument. Multiple performers with the same interface on their devices could control the instrument in real-time. The interface could change the character of the sound with effects, or play the installation as a piano, or launch pre-developed algorithmic scores on it. Multiple performers could control different parts of the interface at the same time.

Sound Design

Just like the keys of a keyboard, every light was associated with a unique sonic pitch. Every time a light was turned on, a sound was triggered. The data templates transmitted from the user interface were uploaded to the installation and played according to the current sequence it was running in. The sound for the piece was developed using PureData. The TouchOSC interface allowed the performers to change sonic parameters like volume, reverb, mute, delay, and others in real-time.
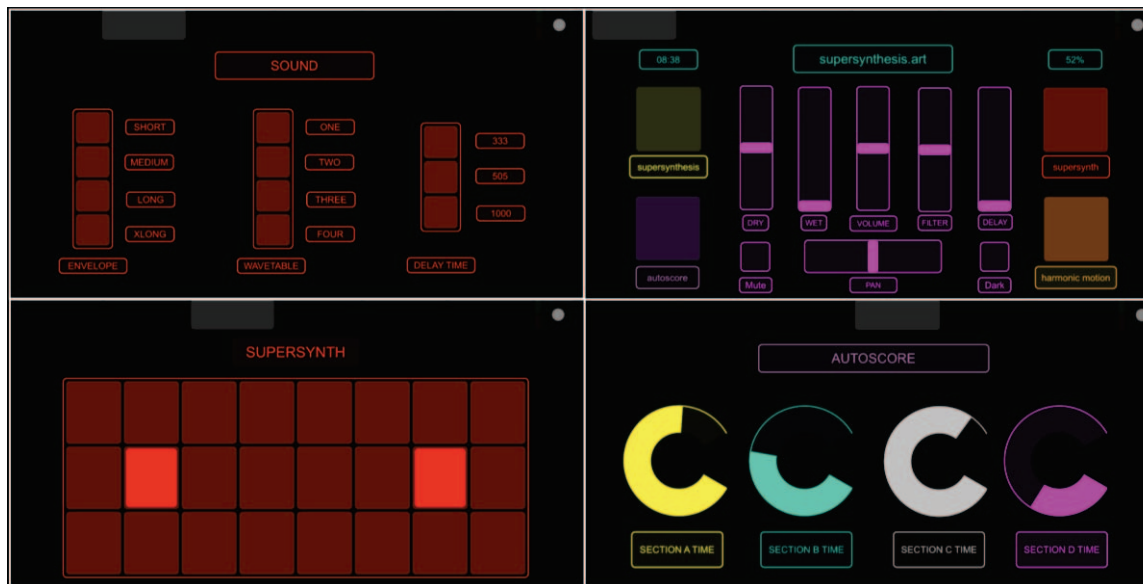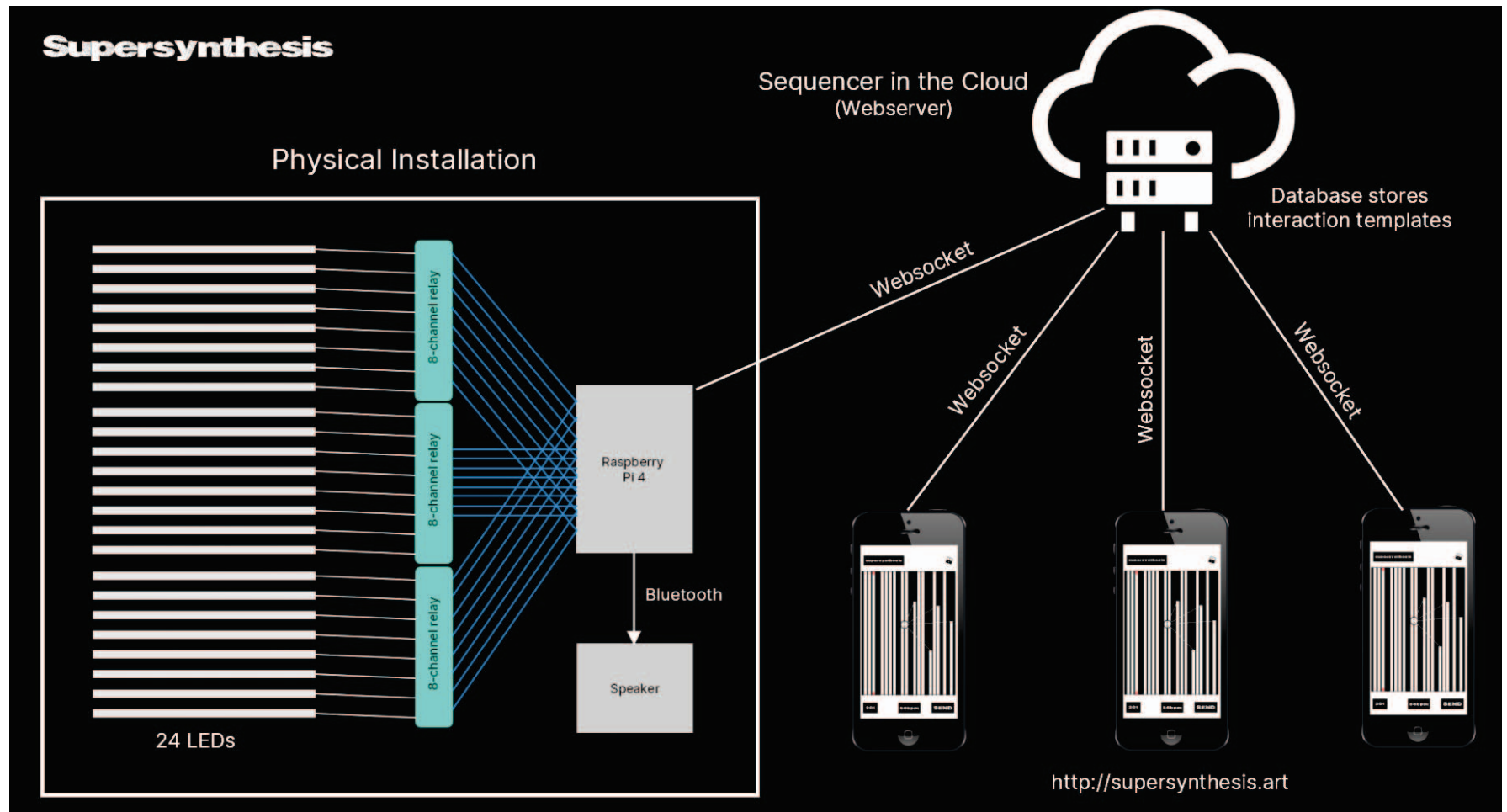
System Architecture

The physical installation consists of a raspberry pi connected with three eight channel relays that control 24 LED lights. The software consists of multiple systems that cohesively work together. First is a central web server that enables the communication between the installation and the audience. This webserver is called "Sequencer in the Cloud '' because it runs

the master sequencer, which sends messages to all the clients over WebSockets.

There are two types of clients: first is the exhibition mode interface hosted on https://supersynthesis.art, which is opened on devices and communicates with the master server to send and receive user-created template data.

The other client runs on the raspberry pi, which decodes the template data received from the webserver and executes them on the lights using the GPIO pins connected to the relay boards. Every time a new data template is crafted by the user and sent through the website client, the sequencer in the cloud persists a copy of that message in a database and transmits it to all the other clients.

Discussion

In this section, I will analyze *Supersynthesis* through the lens of a *"performative object"* [1], break down its usage patterns, and draw connections of this work with the theme of this conference. A *"performative object"* is an artifact that mediates social relationships through interaction. It presents an *"aesthetic interface"* [3] that visualizes the functionality and behavior of the instrument and invites the audience to enter an interactive state of play. According to Kristina Niedderer, the main role of a *"performative object"* is to invoke a reflection on the kind of social interaction amongst the users. This reflection is triggered due to the functionality exposed by the artifact, which leads to a cognitive shift in the relationship amongst the users as well as their relationship with the object [1]. The functionality of *Supersynthesis* resides in its digital interface as well as the network architecture that it employs.

For this discussion, let's begin with the exhibition mode interface that can be publicly accessed on https://supersynthesis.art. Just how traditional musical instruments are partially visualized in video games such as Guitar Hero [2], the online interface of *Supersynthesis* visualizes the steps of a sequencer, which correspond to the 24 lights in the physical instrument. Each step stands for a light and is represented by a

rectangular bar, which turns from gray (off) to white (on), when the sequencer (indicated by the red dot) moves to that step. According to musicology research, visualizing how musical instruments operate reduces the friction between the audience and the instrument [7]. This animation communicates the behavior of the instrument and lowers the barriers of engagement for the audience.

This digital interface of *Supersynthesis* can be classified as an *"aesthetic interface"*, where play is the critical element to draw the user's attention rather than expert musical composition [3]. As the user touches the screen and begins swiping, visual theatrics take over and the musical data represented on the screen comes in a state of animation; thus, modifying the step pattern locally on their device. Now, the new step pattern they are looking at mismatches the pattern running on the installation. Immediately a popup follows on the user's device to send and upload the new pattern to the installation in real-time. On a successful upload, all the lights in the installation immediately turn-on to indicate that a user has sent a new pattern to it. For any other user, who is accessing the application, the pattern on their screen immediately updates.

Communal Synthesis

Through repetitive use of this playful interface, one begins to grasp the lationship between the data visualized

through the digital interface and its consequences on the actual physical installation in space. This aligns with the idea that musical thought does not have to follow the rules of formal logic [3] and visualization of musical data tied with sound can enhance the overall musical experience for the users [7]. Therefore, through telepresence and a feedback loop of data translation between physical and digital spaces, an intersubjective, interdependent social-causal space is created for the audience, who is mingling not only with other bodies but also with the creative outputs of this machine. This leads to a network effect of individuals imposing themselves on their environment and vice-versa. Thus, *Supersynthesis* sets up conditions to collectively experience the self and individually experience the collective.

Future Memory

In *Supersynthesis,* every submitted template is stored in a database. However, currently one cannot access the previously created templates. Every template that is modified and stored in the database is operated upon by the next user who interacts with the interface. I perceive each stored template as a memory of the user's interaction with the piece. In the future, I plan to repurpose that data memory to be presented back to the audience in an aesthetic way to remember the usage of this piece in time.

Conclusion

To conclude, *Supersynthesis* is a piece of machinery operated by a collective memory of users who have interacted with it. As a "*performative* object"*,* it communicates its functionality as a musical instrument through its visual interface and as an art installation through its physical form that invokes users to interact with it. The results of that interaction are reproduced in the physical installation that translates the interactive data into rhythms of light and sound in the space. Through a sophisticated network architecture, *Supersynthesis* invites the audience to create a mingling space.

Acknowledgment

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Description Webpage
https://amaykataria.com/#/supersynthesis>

Project hosted on
<https://supersynthesis.art>

Public Programming
<https://muartgallery.com/amaykataria

References

1. Niedderer, Kristina. (2007). Designing Mindful Interaction: The Category of Performative Object. Design Issues. 23. 10.1162/desi.2007.23.1.3.
2. *Guitar hero (series)*. WikiHero. (n.d.). Retrieved May 27, 2022, from https://guitarhero.fandom.com/wiki/Guitar_Hero_(series)
3. Hinchcliffe, G. (2008). "Losing Control: Looking Beyond the Surface of the Aesthetic Interface." *ISEA2008: 14th International Symposium on Electronic Art*, 229–231.
4. Carson, T. (2019). Mesh Garden: A creative-based musical game for participatory musical performance. *NIME*.
5. Hamilton, Rob & Smith, Jeffrey & Wang, Ge. (2011). Social Composition: Musical Data Systems for Expressive Mobile Music. Leonardo Music Journal. 21. 57-64. 10.1162/LMJ_a_00062.
6. *Rafael Lozano-Hemmer - Open Air*. (2012). Retrieved May 27, 2022, from https://www.lozano-hemmer.com/open_air.php
7. Khulusi, R., Kusnick, J., Meinecke, C., Gillmann, C., Focht, J. and Jänicke, S. (2020), A Survey on Visualizations for Musical Data. Computer Graphics Forum, 39: 82-110. https://doi.org/10.1111/cgf.13905