# Relational Matter:
# Monument of Urban Connectedness

Tech Valley Center of Gravity
Maker-In-Residence Project Proposal

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# 1 Introduction

## 1.1 Personal Background

I am a PhD student in Architectural Acoustics at Rensselaer Polytechnic Institute, doing research at the Collaborative-Research Augmented Immersive Virtual Environment Laboratory (CRAIVE Lab). My current research is situated in the domain of virtual acoustics, where I intend to use the CRAIVE-Lab's human-scale, immersive panoramic display and its surrounding multi-channel spatial loudspeaker array to render realistic acoustic environments that can be navigated in game engines. I have also completed my Bachelor's degree in Architecture with minors in Music and Architectural Acoustics, also at RPI.

Besides research, I am an experimental artist who is passionate about the intersection of art, community and technology. Specifically, I am interested in producing human-scale interactive installations that involve the combined use of customized sensor platforms and some forms of virtual environments. This interest is driven by a robust communal ethos: that the experience and aesthetics of any art forms in the virtual world should best serve the purpose of meaningfully connecting their participants in the real world *as they are* (vis-à-vis as their alternative digital representations), thereby fostering a sense of collective embodiment and authentic togetherness amongst themselves. The CRAIVE-Lab has been my artistic arena, but I am now also eagerly searching for ways to transport my creative concepts outside of it.

## 1.2 Overall Concept and Project Goals

*Relational Matter: Monument of Urban Connectedness* is a monolithic human-scale multi-sensory interactive installation that is situated inside the makerspace. Its digital presence engages the makers' leisure movements, and its surface texture provokes an organic yet dream-like sensibility. With its interactivity of lights, touch, and sounds, the installation becomes a metaphoric digital creature that not only celebrates the creativity of Troy makers, but also manifests the intimately connected nature of the city's urban community at large.

This installation is greatly inspired by the technical skills I learned during my earlier time at the CoG. My goal for this installation are two-folds: 1) to navigate the possibility of using modular design philosophy and local technologies for the development of a decentralized interactive system that can meaningfully engage with DIY culture; and 2) to demonstrate the process of community building as informed by the design process of a technology-driven physical artwork.

The notion of *participatory aesthetics* in this project is to be emphasized. Typical in this concept is the initiation of a simple iconography or aesthetic language by the artist as a framework for group activities, from which variations are developed. The concept has been around in the realm of contemporary visual art for decades, perhaps most notably promoted by artists such as Sol Lewitt, but more importantly one of my personal idols and the legendary pop artist Keith Haring. While very few examples so far extend participatory aesthetics to other kinds of senses, the makerspace becomes an ideal test bed for it. With the proposed project, I would like to experiment with the possibility of engaging a multi-sensory aesthetic language as a framework for the engagement of others. Specifically, I would like to design an interactive system as a simple aesthetic framework that can allow everybody to engage in the process of the artwork's production, and doing so using the multitude of making machines that the CoG provides.

# 2 Project Specifications

The development of this project is divided into two phases:

- Signature Project Phase: where I complete my duty as a maker-in-residence and the main structure of the installation is designed and constructed with sensing and interactive features; and
- Project Extension Phase: where the structure will be modified to incorporate a DIY spatial audio component.

In the following, I would like to discuss these development phases in greater detail.

### 2.1 Signature Project Phase: Structures and Interactivity

In this six-month period, the main structure of the installation will be fully designed, with its components (panels) prototyped and installed. In addition, the prototyped panels will be used to organize and instruct workshops during the residency.

The main structure of the installation is shown in Figure 1. The structure is proposed to be 8' tall, and will occupy approximately a $2' \times 2'$ footprint. The skeleton of this installation is constructed using 1-inch-diameter aluminum extrusions (also called "maker beams"). This makes it easy to not only attach panels to the structure, but also embed microcontroller circuits in between the panel. Two types of panels are produced for this installation: one is the LED infinity mirror panel, which is constructed using MDF particle boards and reused plexiglass; the other is the Mycofoam panel, produced with formwork using Ecovative's mushroom material. Some of the Mycofoam panels will be used to embed the HC-SR04 ultrasonic distance sensor, which is used to detect proximity of makers in the space. To study the exact attachment mechanism, a partial prototype of this structure was also produced at the CoG back in 2017 (see Figure 2).

The anatomy of the panels can be found in Figure 3. For the Infinity Mirror panel, the plexi glass is laminated with insulation mirror films commonly used for UV protection on windows. The frame in the initial prototype is composed of 4 finger joints using stacked wood particle boards.

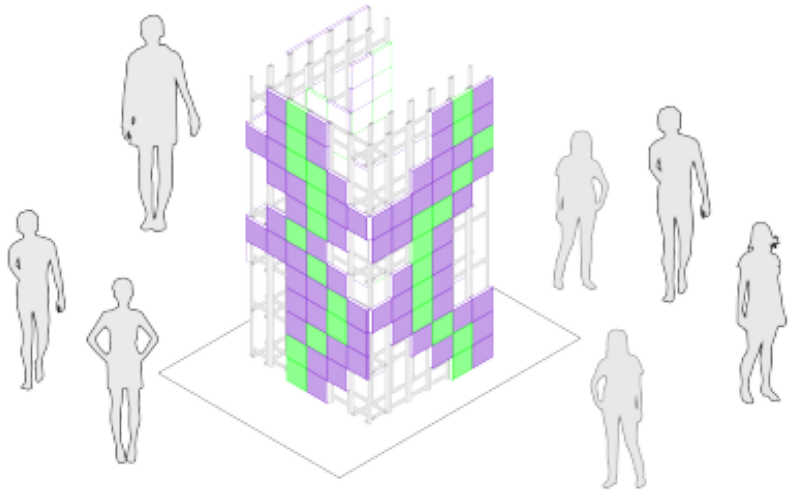

*Figure 1: Isometric rendering of the installation. Green panels: LED Infinity Mirror; Purple panels: Mycofoam boards (some with proximity sensors).*

All non-electronic components for this panel will be fabricated using the laser cutter. The Mycofoam Sensor panel proposes the use of the Ecovative Grow-It-Yourself kit, which provides the culture that mycelium needs to create form. For this panel, a master form will be designed using 3D-modeling tool, and fabricated using the vacuum former and CNC machine at the Prototyping Center. During its production, pre-soldered distance sensors will be insulated and inserted into the culture, so that its positions can be fixed when the panel takes shape.

The interactive mechanism of this installation is very simple. The distance sensors embedded in the Mycofoam panels serve as digital input data for Arduino, to which the LEDs are also connected. These data are used to manipulate the brightness, color, and timing of onset for the LED strips, forming the tunneling effect within the mirror panels. Due to the multitude of input data, different patterns of interactivity can be formed, and here I would like to leave the exact signal flow somewhat open-ended (e.g., using it as a potential discussion point for communal feedback).

### 2.2 Project Extension Phase: Incorporating Spatial Sounds

The time period after the Signature Project Phase will be used to extend this installation in the direction of audio. Specifically, the main structure of this installation will be adjusted to make room for embedding a small-scale, programmable ambisonic sound system. When people in the CoG stand inside the installation, they will be able to listen to soundscapes that are designed or generated for this installation. It is also my hope that people will be able to use the embedded ambisonic sound system as a compositional device (namely that makers at the CoG can create spatial music of their own choice for the installation).

*Figure 2 (left): An initial prototype of the panel attachment mechanism (as partial structure) completed in 2017. The four corners are attached with little machine screws that can be slided into the maker beam.*

## 3 Accessibility and Community Engagements

The installation proposed in this project involves a highly modular design strategy. Because of this, its process can fully involve members of the TVCoG community and the Troy community at large. The modality of engagement can be considered as two-folds. First, to the extent that the general creative vision is not significantly altered, the design process can be partially open to the community in formats such as design charrettes and expert knowledge integration. Second, the

production process can easily be designed to engage members of the TVCoG community, especially through workshops. In the following, I would like to discuss these modalities in greater detail.

### 3.1 Design Charrette and Expert Knowledge Integration

Prior to the start of production, feedback from the TVCoG community regarding the design of this installation will be engaged. For this reason, a design charrette will be held during the Signature Phase. During the charrette, community members are given an opportunity to provide inputs such as design aesthetics, specific location and timing of display, and associated events.

### 3.2 Workshop Design and Facilitation

There are two components in the installation that can be fabricated collectively: one is the infinity mirror LED panel, and the other is the proximity sensor panel embedded into Mycofoam. These panels are ideal materials for workshops. Specifically,

- **Infinity Mirror Workshop** can be designed as a two-part series that teaches the participants 1) how to use laser cutter at the CoG, and 2) how to solder LED strips and program them using Arduino (or other microcontrollers alike); and
- **Mycofoam Sensor Workshop** can also be designed as a two-part series that teaches the participants 1) how to solder with the HC-SR04 proximity sensor and work with it in Arduino (or other microcontrollers alike), and 2) how to fabricate the Mycofoam panel with the sensor embedded into it.

Currently, each of these workshops are proposed to be (ideally) 2-hours per session in length, with materials provided using the given supply budget. For better accessibility, I propose a no cost participation model, in which participants' names are acknowledged in the installation, but the ownership of their work during the workshop belongs to the CoG and me. At the end of the workshop, all participants will be given a handout consisting of instructions on how they can reproduce the work by themselves.

## 4 Future Goals

With the proposed project, I would like to conceptually explore the possibility of engaging participatory aesthetics and state-of-the-art audiovisual system design in DIY culture. In the future, I may introduce new concepts to the installation, and re-adapt the installation to these concepts accordingly. I would also like to use the technical knowledge I acquired through this process to better design virtual reality infrastructures at the CRAIVE-Lab, and enhance the installation for people to control virtual spaces in it. In either scenario, I am excited about the potential to further develop this installation.