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Creativity, Craftsmanship, and Connection: Large-Format Sculpture Design

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Abstract

Artistry is a concept that is not usually explored in engineering yet is an invaluable skill that touches everything from product design to systems thinking. This past summer I developed conceptual designs for a large format sculpture that required connecting engineering knowledge with artistic vision. The initial phase required constant inspiration and creativity. The first step was to look at previous sculptures showcased throughout the world, such as at venues like “Burning Man,” to understand the possibilities or limitations of the space provided. Sketching varied and numerous ideas was essential in our design process. Next, we took our favorite ideas and created three dimensional renderings using various computer programs (Blender, SolidWorks) which allowed us to bring theoretical concepts into model space and explore issues of dimensionality and spatial location. These models were placed in a virtual reality setting, allowing us to walk through these to-be-created sculptures to understand how a spectator may experience the piece. We also created small-scale physical models using a solid modeling computer program and laser cutters to implement structural integrity principles and redefine limitations. In this piece I reflect upon this summer experience and the ways it changed the ways I think about engineering, design, and art.

Keywords

Sculpture, STEAM, Interdisciplinary, Design, Art

Cover Page Footnote

Funding for this project and experience was provided by the University of San Diego, and the McNair Scholars Program. The projects included in this reflection were made possible by research assistants, volunteers, designers, and engineers that dedicated much effort and time to turn ideas into a reality.

Creativity, Craftsmanship, and Connection: Large-Format Sculpture Design

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Designing and building a large-format sculpture required me to indulge in creative thinking. Unlike other engineering projects, having complete creative liberty was fulfilling and exciting because it allowed me to take ownership of my ideas and make connections to the world through an artistic point of view. This project also enhanced my engineering skills by providing exposure to product design and systems thinking.

The research question for this project was “How can we design an interactive, large-format sculpture that sparks wonder in the audience?” To answer this question, we focused on four effects that we could potentially integrate into our design: sound, lighting, texture, and size. These effects allow the audience to experience artworks with all or most of their senses, leading them to feel things that the artist intends for them to experience. Meaning that another important question we needed to answer was, “What do we want our audience to feel?”

Prior to embarking on the design journey, the team members and I read several articles and a book to gain inspiration. A passage that became meaningful to me is, "it’s in the act of making things and doing things that we figure out who we are” (Kleon, 2012). Designing and building a large-format sculpture showed me that I am capable of expressing my artistic side through engineering. I am an artist and an engineer. We also reflected on previous sculptures built by peers to gage the difficulty of sculpture design. “About Time” and “Unfolding Humanity” showcased intricate geometrical structures that symbolized a complex thought that could be explored by interacting with the sculpture [Hoople et al., 2018, 2019]. It was also motivating to see that the sculptures were successfully developed from idea to artwork. Other readings gave insight to world issues such as climate change and racial justice, that could potentially be symbolized in the sculptures (Daggett, 2019, Francis, 2015).

The first step in creating a sculpture is gaining inspiration and ideating. Once I sketched several ideas, I used Blender, SolidWorks, AutoCAD, and a laser cutter to create three dimensional renderings. I then placed the three-dimensional renderings in virtual reality settings to experience how the audience would perceive the sculpture and to find possible ways to improve upon the design. During this stage, physical constraints were also taken into consideration for the redesigning process. A finite element analysis is modeled once the design is concretely rendered into SolidWorks with the appropriate dimensions. A full-scale model is built using machining tools and two by four or four by four plywood and balsa wood, after the simulation demonstrates that the sculpture can support its own weight. The model is then put into a tensile strength test to find the ultimate strength and fracture point as we do not want to endanger people who might wish to interact with the sculpture by climbing on it. Finally, the data collected, graphed, and analyzed using MatLab, and if the measurements are within standard the large-format sculpture is built.

During the ideation phase, team members and I came up with several ideas that were suspended. We started with a focus on the hand since it symbolized connection. Yet due to difficulties creating the fingers out of wood we shifted to ideas that integrated the DNA structure. As we continued to ideate, I became interested in memorializing the COVID-19 pandemic and created a three-dimensional rendering of gates that looked like rib cages protecting lungs from an aerial view. I struggled to make the shape of the rib cages more obvious through the right and front view and moved forward with another idea to continue with the pace of the project. Geometrical gates and tunnels were

also explored by teammates, and we found several interesting formats which led us to two of our final ideas.

My final concept from this summer is “I Am,” it features a person with an open chest, symbolizing that there is more to a person than what is externally seen. Identity, health, and interpersonal connections can all be explored by interacting and viewing the artwork. The team and I found this idea to be promising but found that in initial concepts the sculpture was easily perceived as a man. We sought to develop a gender-neutral rendering and went through several iterations until a larger and more round head shape emerged. When exploring how to connect the sculpture to the global pandemic we rendered two “I Am” models that were separated by 6-feet at scale. We imagined the two elements connected through sound or lighting to allow the audience to feel a connection even at a distance.

I utilized virtual reality (VR) tools to examine my computer renderings at scale in a life like environment. Using the VR to view the models was immersive, captivating, and thought provoking, radically changing my perceptions of the sculpture, and leading to dramatic improvements. The experience changed my design process by giving me spatial awareness. When viewing the first model of “I Am” in VR from an internal perspective I felt cramped. I made modifications since I wanted several spectators to fit inside of the sculpture and feel comfortable. When creating the second iteration of the model I understood how the dimensions I chose influenced the artwork. As I viewed every angle of the sculpture in its true size through the VR, I noticed in detail what I enjoyed and what I disliked from the models in a way that I could not from three-dimensional renderings in the computer. Virtual reality makes the design process more efficient and less costly since iterations can be made without using any material.

In conclusion, seeing the sculptures develop from idea to product motivated me to continue my journey as an engineer and expanded my ability to think creatively. Our ideas constantly shifted or were modified to fit constraints and this reinforced adaptability in all the team members. Future work includes but is not limited to creating a small-scale model of “I am” and submitting sculpture proposals to art events such as YOUtopia and Burning Man

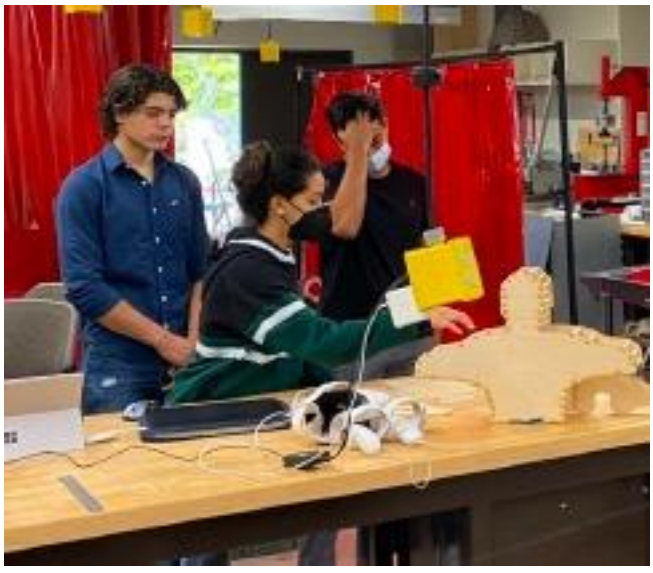

Figure 1: Demonstration of the first small-scale model of “I Am.”

Figure 2: Front view of the “I Am” Solidworks model.

Figure 3: Data acquisition testing the structural integrity of a prototype design.

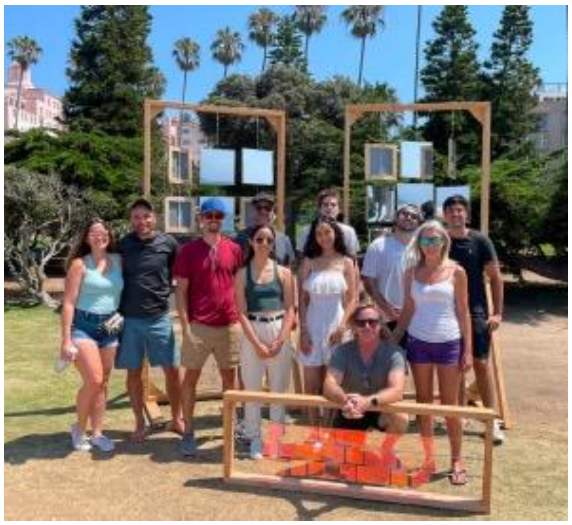

Figure 4: The project team is standing before several prototypes.

Author Contributions: JP led design efforts and wrote the first draft of the manuscript, GH provided mentorship through the design process and collaborated on editing the manuscript.

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