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Reflection Paper

At the epicenter of collective consciousness, eternally throbbing with ultimate energy, lies the MAVIO, a Musical and Visual Interactive Object. The MAVIO is an amalgamation of knowledge and passion, an imitation of nature and its universal forms, and an autonomously interactive entity. The honors thesis project gave me an opportunity to take up a studio practice in which I could combine things I learned in my hobby of electronic music production with the artistic sensibilities I gained from my classes as a visual arts major. In doing this, I found that my interest in metaphysics and the philosophy of aesthetics came to bear on the final product at least as much, if not more, than my training in design. The end result of this process is an object which, without requiring a human operator, can take in information about spacial activity around it, twist and trans-code that data, and respond with auditory and visual feedback.

I was first inspired to create what would eventually come to be known as the MAVIO by an experience I had nearly a year ago at the Colorado regional Burning Man festival, known as Apogaea. I had come to the festival on my own, as my curiosity about the festival outweighed the fact that I did not know many others who shared a similar interest. One evening as I explored the art installations that make the festival so special, I climbed to the top of a hill, where three gigantic flower sculptures covered in fur had been erected. The first two flowers were lit with tiny colorful lights which danced to a pattern I couldn't quite follow. On the ground under the first flower was a group of people talking and giggling, clearly fascinated by the glowing fur flowers. I approached the third flower, which lay dark and inactive. Suddenly, in a flash of understanding, I realized that the group of people were making noise as they interacted, causing the flowers above them to respond with flashes of light, and I who was on my own was silent, so the flower above me was dark. Simultaneously as I realized this, the group

noticed my presence and the dark flower I stood under. They called out to me, lamenting that the third flower was not as brilliant as the first two I had my didgeridoo with me, and in response to their lament I raised it to the flower and let out a fantastic blast. The flower lit up incredibly brightly, brighter than average voices lit the flowers, and the group of people cheered and called me over to them. I ended up making fast friends with the group of people I met at the flowers, and remained in contact with them after the festival was over. The experience with the sound-reactive light flowers demonstrated to me the inter-personal aspect of interactive art, that shared wonder could create social cohesion.

Upon returning home from the festival, I began to think of ways I could create my own interactive art works. I had been learning a lot about electronic music production in my spare time, and I was struck by the plethora of free software made available by benevolent programmers involved in the open source movement. Open source technologies allow access to their inner workings, giving tinkerers the ability to customize programs and devices for their needs, and even to release their own versions as a product. I found that using the open source computer operating system called Linux, and the many free programs created for it, I could accomplish things that would otherwise only be achievable with applications that cost hundreds of dollars. With my limited budget, I was quite pleased to see what could be accomplished for free, and I started trying to conceive away to present these accomplishments to others as art. A lot of my focus in this early research was in the essentials of how computers interface with their users, because the mouse and keyboard are not very conducive to the process of music making. I learned about an open source programming environment called Pure Data, which would allow me to design a custom interface between a video game controller connected to the computer and a software synthesizer which would produce musical notes. This led me to using some old controllers from a dancing video game – pads of buttons that sits on the floor. Using the dance game controllers I could create an interactive floor surface, making the sound a result of the user's position in space.

Having completed the basic mode of interaction between users of my art piece and the computer

to produce sound, I turned my energy toward providing some visual feedback as well. I knew that I wanted to use LEDs (light emitting diodes) in my project because of the brilliant colored light they can produce. I had already used some LEDs in creating “throwies,” an extremely simple form of street art in which a button cell battery and an LED are taped together with a magnet, allowing for a point of colored light to be fixed to a structure in a public space. I found that often instead of using the throwies for their intended purpose as street art, it was more satisfying to me to fold paper shapes and illuminate them with the LEDs, and then to give these small glowing shapes away as gifts. The way the colored LED light was diffused into a soft, even glow by the paper was pleasing to my eyes and later informed the creation of the sculptural part of the MAVIO.

If the throwies could be conceived as my doorway into the world of electronics, the Arduino micro-controller became the key to the doorway's lock. The Arduino is a piece of open source hardware that allows artists, engineers, or anyone else to attach lights, motors, and sensors to a small computer brain, allowing computers to interact more directly with the physical world. The wealth of information made available by the community of Arduino users is staggering, and it jump-started my understanding of the electronics I would need to light my project. I acquired a fifteen meter strip of LEDs that contained a red, green, and blue light in each LED, so that any color on the visible spectrum of light can be created with the right mix. To power the strip, I found an old laptop power adapter at Colorado State University's surplus property store. An aside here - the power adapter, along with the button pads and the computer that ran my project, were all old pieces of technology that had been cast aside; one of the most satisfying things about this project was re-purposing discarded technology for my use. I was extremely lucky that a programmer named Hans-Christoph Steiner had already created a means to interface the Arduino with Pure Data, called Pduino. With Pduino, I could avoid having to learn the Arduino programming language and could apply my pre-existing skills with Pure Data to control the LEDs.

The first step in the development of my LED control was to create a program that could be used

to select any color the LEDs could produce. Since the LEDs could be each individually scaled up to full brightness, I was able to overlap each scale in order to mix red and green, green and blue, and blue and red together. After having created my color mixer, I added to my program the ability to listen to an incoming sound and use the pitch of the sound to determine a color to display. Once the color is determined, the amplitude, or volume, of the sound is multiplied into the outgoing color values to determine the light's brightness. Completing the sound-reactive LED control system was a major milestone in my project, especially considering the fact I had been so inspired by the sound-reactive lights I saw at the festival.

At this point is when I learned that my work had been accepted to be exhibited as part of the Sound Through Barriers exhibition, which was held at ArtLab Fort Collins from April 20th to 29th. Knowing with certainty that what I was creating would be exhibited to the public gave me new impetus to ensure that the interaction involved was straight-forward. As I worked on the programming for the button pad interface, I tried to get as many of my friends and acquaintances as I could to try them out, so I could see how user friendly my design was. At one point in the development of the interface I had each button toggle on a loop which contained a melody or beat. While this mode of interaction allowed for a single person to build the layers of a song any way they wanted, the people I watched interact with the buttons seemed to expect an immediate response – they were unaware that they were toggling on different loops unless I explained it to them. Paired with the consideration of sound that was to be exemplified at the Sound Through Barriers exhibition, I decided it would be better to have the buttons trigger an immediate and not necessarily melodic sound. One of the main goals of the exhibition was to encourage close listening, and it seemed to me that using unexpected or strange sounds in my piece would catalyze that listening. A second advantage of moving toward immediately triggered, non-melodic sounds is that I could use Pure Data itself to generate the sound, rather than connecting it to an external synthesizer program. Simplifying the system was an important goal for me, because I needed to ensure that it could be set up and run by docents of the exhibition without my presence. This was one

of the most nerve-wracking parts of the creation process, considering that each piece fits together like a puzzle piece, and any variation in the set-up can cause the system to crash. Luckily, I was able to learn how to create a script that would run on the computer hosting the programs, so that the programs start up and connect to each other automatically. Even then, some of the settings for my Pure Data program would need to be initialized each time it was started, so I created a front end with simple buttons that could be clicked by docents to start the system.

To create the sound, I took inspiration from the natural forms that I wanted to imitate in the sculpture that would house the whole system. I had been researching the designer Buckminster Fuller for my art history class, and I knew that I wanted to play off of his famous geodesic dome design. Fuller points out that spheres enclose the most amount of space with the least amount of material – a ideal that was important to me with my limited budget. Another interesting property of spheres that Fuller talks about is that when stacked, they arrange themselves into a tetrahedral pattern, tetrahedrons being a figure with four sides of equilateral triangles. I used the sixty degree angle of the equilateral triangles to determine the pitch of one of two oscillators which generate the sound. Half of the buttons would increase the pitch by increments of sixty, reflecting the form of the sculpture. The other half of the buttons control the second oscillator, which increases in pitch in increments based on the Fibonacci sequence of numbers, in which each number is the sum of the two numbers preceding it. The Fibonacci sequence is related to the golden spiral, a pattern by which many structures in nature, such as sunflower seeds and pine cones are organized. So by modulating the increments of sixty on the first oscillator by the Fibonacci sequence from the second oscillator, the sound generated is a crude imitation of the influence of life on the basic structure of tightly packed spheres. I began to think more along these lines - of the basic structures of the universe and the fractal patterns of life's increasing complexity – as I packaged the MAVIO for exhibition.

With the technical details of the electronics, programming, and sound generation squared away, I began designing the sculpture that would house the lights and speakers. I knew that I wanted my

sculpture to be kinetic in some way; adding motion would imbue the MAVIO with life and make it appear more as not just a inanimate object but a reactionary entity. After exploring the possibilities of an unfolding structure or one that could inflate and deflate using a fan, I settled on making a large body with multiple limbs that could swing around, following the button presses. As I began work on the sculpture, it became apparent that I would need to simplify my plans in order to finish in time for the exhibition, so using multiple limbs became the best choice because I could easily implement the use of servo motors without drastically changing my programming. Though I created several mock-ups from paper and foam-core board before beginning the construction, I did not actually have a set image of what the final form of the sculpture would be. My approach to building the sculpture was very similar to the tinkering with building toys I did as a child. Since the triangles of the geodesic forms fit together in a modular manner, I could experiment with various shapes, manipulating them to fit them together. Since the triangles of the geodesic forms fit together in a modular manner, I could experiment with various shapes, manipulating them to fit them together. Having considered materials such as vinyl and Tyvek, I eventually selected much more rigid Styrene plastic sheets used in fluorescent light fixtures. The rigidity of the Styrene would allow me to treat the surface of the sculpture more like an exoskeleton, eschewing the need for inner supports. The light fixture sheets were also ideal because they were already engineered to diffuse light, so my sculpture would be more evenly lit. I used a rotary tool, similar to the well known Dremel tool, to cut the plastic sheets into triangles and hexagons. These shapes I taped together so I could make temporary constructions – when I was satisfied with the shape I hot-glued all the pieces together. I found my construction process to be informed by the experience I gained in a metalworking studio class I had previously taken. In that class as well as in the creation of the sculpture, I cut shapes from flat sheets and joined them along the seams. Building the sculpture was decidedly the most laborious and time consuming part of my project; if I undertake similar projects in the future I will certainly allocate more time for construction and seek out experienced individuals to collaborate with. With the sculpture finished, I needed to make the button pads match it in some way. I

found that DuPont Tyvek Wrap, which is usually used to protect unfinished houses from weather damage, is an incredibly cheap, lightweight, and durable material. I used the Tyvek wrap to cover the black, commercial surface of the pads, and added black vinyl flooring cut in the shape of hexagons to indicate the locations of the buttons. The final step in preparing the MAVIO for exhibition was to modify a plastic box to contain the speakers, computer, and power adapters. With the sculpture placed on top of the box, the MAVIO finally looked like a cohesive art piece that could be placed in a gallery.

After working on the MAVIO for a few months I started thinking about artistic justifications for my project in the interest of maintaining my motivation. One of the more influential classes I took while attending CSU was a course in the philosophy of aesthetics. This class led me to questioning the value systems used to evaluate art. I was interested in ascertaining what is the most basic element of an aesthetic experience which makes it pleasurable. It seems that many explanations of what makes art “good” or “bad” are tied to cultural norms and esoteric language. For example, Marcel Duchamp's *The Fountain* is nothing more than a urinal placed on its side with the artist's signature – what makes it art is its location in a gallery space, where objects are expected to be classified as art. As a contrast to *The Fountain*, I wanted to create artwork that would be recognizable as such without needing the context of a gallery or an explanation given in discourse. Something about the synesthesia of lights and sounds responding in tandem to movement is satisfying to humans, and this is a theme I hope to explore further in my future work. Creating the MAVIO was an incredibly educational experience, and I look forward to applying what I learned, in areas as diverse as software programming and fine art exhibition, to the pursuits I take on as an artist in the years after graduation.