Auditory Selectivity:

Physical Form and Structure

IAT 320

Individual Prototype

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Concept Description

Our project is called auditory selectivity. Our main concept is to expand the user's umwelt of their surrounding sounds which they fail to perceive because the brain filters it out since one's attention is not focussed on the ambient sounds. In a larger sense, what one hears is very selective; when one is in a restaurant, one may not hear forks and knives clashing because they are not out or the ordinary, or the sound of pencils moving in a classroom. The filtering process is necessary so one will be able to focus their attention on what is important and it keeps the brain from overflowing with information. However, the downside of this is that one will lose awareness of common sounds in the environment and may forget what is happening in the surroundings. This project aims to remind the user who will interact with our project that many things are simultaneously happening in the environment and the sounds that the users are making are only part of the overall ambient sounds.

User Interaction

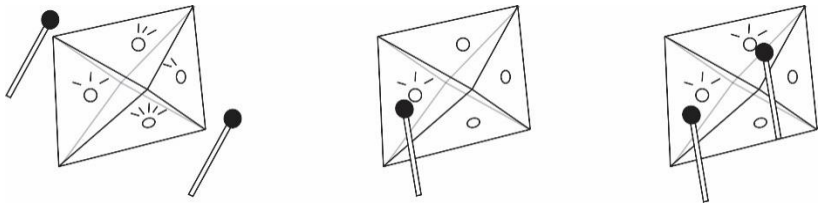

Figure 1. The figure on the very left represents the clusters of sound being played together with the LED lights in rhythm. The middle figure demonstrates that when the mallet touches one side, then only the side that is touched will play the sound. The right figure conveys that multiple mallets can be used together.

The process of the user interaction has three steps (see Figure 1). First, the user will enter a room and see an octahedron shaped object that is similar to the size of the drum. This object will make loud unfiltered noises depending on the environment that it is in. For example, if it is placed in the classroom, it will make sounds such as chalk writing on the chalkboard, keyboard on the computer typing and so on. Beside this octahedron shaped artifact are two mallets. The mallets afford the user to hold them and suggests to the user that they should hit the sides of the octahedron shaped artifact. In addition, the sides will also have a similar look to a drum's batter head which encourages the user to hit it. Once the user hits it, the cluster of the sounds will disappear and only the unique sound of the side that the user hits will be played in sync to the hit. Since there are two mallets, this allows the user to hit different sides simultaneously. The mallet is a metaphor for the filtering done by the brain. Hence, it can filter, out the rest of the sounds and only focus on one particular sound or focus on two sounds at the same time. Once, the user stops hitting sides, just like how the brain stops filtering out all the noises, all the sounds will be played after a short pause.

User Experience

When the user first sees and listens to the octahedron artifact, they will feel as if they are overwhelmed by the disarray of sounds and lights blinking. This will make them feel uncomfortable and confused since they cannot depict what each individual sound is. This is the feeling that one will have when the brain stops filtering the sounds from their surroundings. Beside it will be two mallets and afford holding and hitting the sides of the octahedron artifact. Since they are overwhelmed by the noise, hitting the sides of the octahedron can act as a way of relieving stress. The moment they hit one side, the collection of sounds will disappear and only one

sound being the one they hit will play. This will encourage the user to continue hitting the sides of the octahedron and trying hitting different sides. Through this process, the user will learn that hitting the sides of the octahedron artifact is a metaphor for the brain filtering out the sounds in the entrainment and only focusing on one, or two if two sides are hit. Through this process, the user will learn that the brain does an automatic, but crucial task of filtering out sounds in their surroundings. Without that process, they will be overwhelmed. More importantly, they will learn that many things are simultaneously happening in their surroundings that they are not aware of because the brain filters them out. Hence, this project will expand their umwelt of their surroundings by helping them realize what is happening in their environment.

Experience Prototyping

Figure 2. I have imagined that this pressure cooker pot is the form of our final project and tried tapping it like how I would normally.

For this individual prototype, not the entire group project, I am focusing on the form and physical structure of the project. This excludes the creation of the mallets, the electrical wiring or programming aspect of the project, the placement of the phone and the Arduino, nor the conductive surfaces which detects the mallets.

The first design method that I have used was experience prototyping. During this phase, I have tried hitting different shaped objects until I have found the octahedron shape. I was inspired by the steel pan, an instrument that was first created in the 20th century which uses the principles of hitting different areas of the pans with a drumstick or a mallet to play different pitches [asdf]. Rather than using what was already done, I have decided to hit different shaped objects and understand the experience.

I have first tried exploring everyday object and hitting them. I have tried hitting a pressure cooker and the experience of hitting the top portion was comfortable but not the sides. Being inspired by the steel pan, I marked sports on the pressure cooker that I was going to hit. When hitting at a fast pace, I realized that if the target is too small, it is quite difficult to hit the right place. In other words, there cannot be a lot of different sounds as each sound will take a large space. In addition, there targets can only be placed on the top portion of the object, but not the sides.

In order to minimize the volume of the shape and maximize the possible different sounds, I have began exploring different geometric volumes. These volumes can have a single target on each side allowing me to easily hit it. In addition, they allow me to rotate the volume which allows all sides to have targets, unlike the pressure cooker which has a single orientation. This maximizes the efficiency of the object by maximizing the number of different possible sounds while keeping the volume compact.

The first geometric volume that I have explored is the cube. The problem with the cube is that it is only comfortable hitting a single side being the top side. Hitting the sides feels quite

uncomfortable as it requires me to place my arms in an awkward manner similar to the pressure cooker. This means that only one side can be hit at a time comfortably which defeats the purpose of controlling the filtering of the brain by having it focus on one or two sounds simultaneously. In a larger sense, I cannot be using two mallets and hitting two targets on the cube. In addition, there are only 5 possible sides of the cube that can be hit at a time considering that one side is rested on the table. This will result in not enough variation of the sound.

I have learned that the human mind on average remember up to 7 bits of information or 7 seconds. By having 8 sounds, the human mind will be overwhelmed so this encouraged me to explore geometric volumes with 8 sides or more. I have decided to test the octahedron because it has 8 sides. Also, as the number of sides increases, the area of each face reduces resulting in a smaller target. Considering that two mallets are used rather than multiple, an octahedron can allow more than two sides to be stroke comfortably since the sides aside from the main side facing directly up is at a slight angle, similar to how certain drums are angled in a drum set. After testing this volume, I have realized that this will suffice for the purpose of this project.

Iterative Process and Prototyping

Another important design method that I have used is the iterative prototyping. Through this method, I have explored many different materials and ways to construct a sturdy prototype that can withstand the force of collision with the mallets.

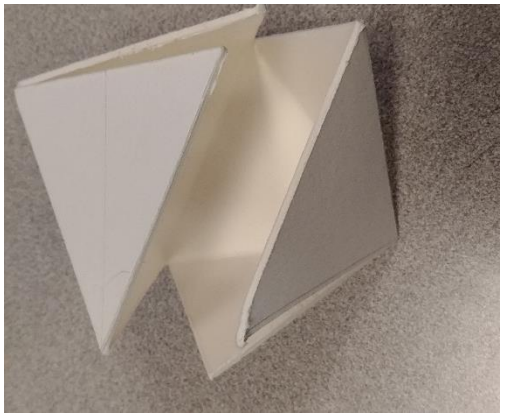

Figure 3. This is the first iteration of the prototype using the cardstock.

One material that I have explored was card stock paper, a very hard and flat cardboard paper that can be cut. By folding this paper, I was able to achieve an octahedron shaped volume easily. Considering that we have decided that the sides should be see through, I could have cut out the sides leaving a small frame and gluing a transparent sheet of a material, which I will cover later on in the report. However, the problem with this method of construction is that since the octahedron will be really big, it is necessary for us to purchase a large sheet of cardstock which will be extremely expensive. In addition, cardstock is extremely heavy which will result in a heavy artifact. Most importantly, considering that our project will be used in different environments such as parks during different weathers including rain or snow, a cardstock artifact will simply be soaked in water and lose its form and break.

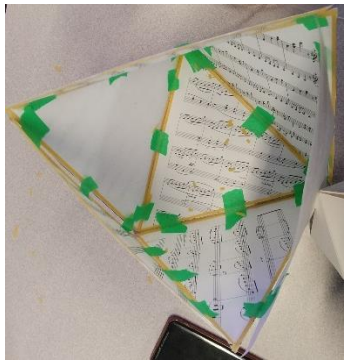

Figure 3. This is the second iteration of the prototype using the paper and spaghetti to simulate wood and plastic.

I know that thick wooden dowels are extremely strong so I was thinking of creating a structure with them. I have worked with wooden dowels prior to this project so I know it is possible. First, I needed to figure out what the structure will look like so I have assembled a quick prototype with paper and spaghetti. Spaghetti is frequently used in seismic testing in place of wood since they have similar properties (ability to withstand torsion, tension, shear and so on); hence, it will be an easy, cheap, and accurate substitute for wood.

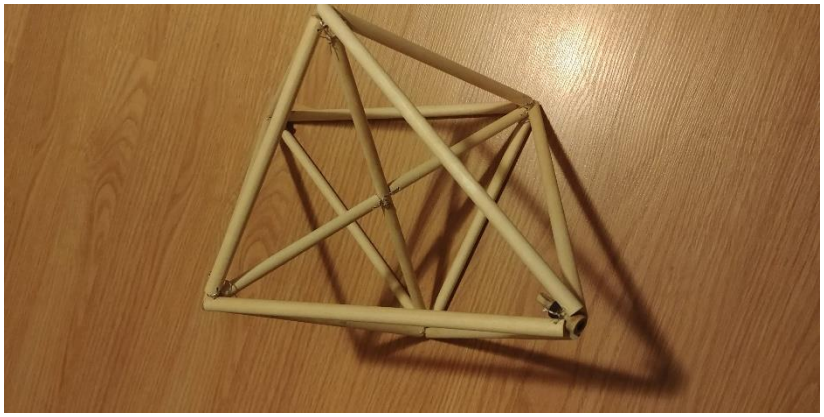

Figure 4. This is the wooden frame of the prototype constructed with dowels.

After the spaghetti prototype was constructed, I knew that this will work for wood so I found the dihedral angles of the octahedron and calculated the angles of each side. In addition, we limited the length of each edge to 24cm because the largest internal component, being the phone with the OCG cable attached can fit inside and we wanted the final prototype to be as small as possible with since it will be carried to different locations. Once that was decided, I began cut the wooden dowels with loppers since hand saws do not work well and sanded them to angle. Then I began to

glue sides together on a cardstock mold which I have made.

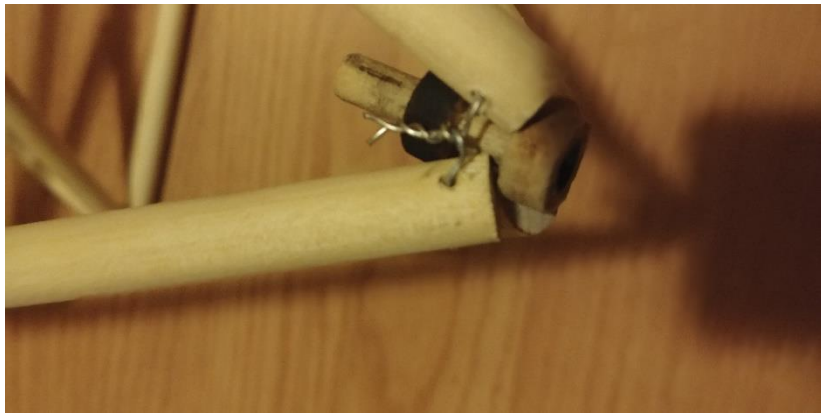

Figure 4. The dowels are connected by metal wires, but the two end joints require a spacer so I have used a smaller dowel with two end caps.

Unfortunately, the glue was not strong enough so I had to look for other options. In order to ensure that the wooden frame is extremely strong, strong enough for a child to use as a seat, I have drilled small 3/32-inch holes, the second smallest drill bit that can be purchased since the smallest drill bit is know to snap. Then, I have connected it with a metal wire. I have tightened the metal wires enough so the wooden dowels will not slide; however, I have not tightened the wires to max tightness because that may shatter the wood and increase the force of tension and shear at the joints when hit by the mallet. By reducing the tightness slightly, I have created a bit of a wiggle room so force can be dispersed from the joints to the other parts of the wooden frame. This will prevent the wooden frame from shattering upon impact. In addition, this will also allow wood to expand and contract as temperature and moisture changes, similar to the idea that bridges have spacers. I was inspired by the fasteners on cables of the bridge, so for the two ends of the octahedron, I have used a similar design for the spaces. These spaces locks and connects the four wooden dowels in a sturdy manner so they will not slide.

Inside the frame, I have also installed a few connectors which will relieve stress from the joints which further strengthens the overall prototype. The X shaped connect is perfect for a surface to be built on to which will contain the internal components such as the phone or the Arduino board.

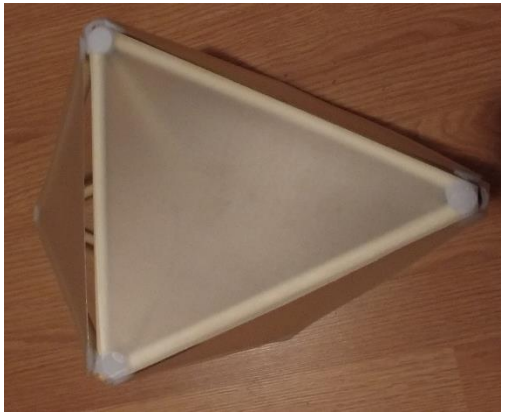

Figure 4. The solid plastic panels are used on the outside to act as a surface for the mallets to hit.

The last component to this prototype was the side panels. Considering that we wanted a translucent material that is flexible and hard, but is able to be cut without special machines, we have chosen this particular plastic cutting board. This is also extremely cheap which is one of our constraints. Its beautiful matt surface on one side provides a translucent layer so that light from the inside will look dispersed rather than focused and bright. In addition, this material has the front side glossy (backside is matt), so light from inside the prototype will reflect off the sheets slightly so give it an

overall shining affect, reducing the potency from one side, yet it will still be clear which side is the intended side to be lit.

Once this was done, I needed a way for the plastic sides to connect onto the wooden frame so that they can be detached for internal components to placed inside. Initially, I was thinking of adding small screw which can be screwed on and screwed off. The screw was quite expensive and each time they are screwed in, it damages the wooden frame. The only possible solution that I have thought of was using Velcro or snap fasteners. Snap fasteners were small so they require screw to attach. Velcro on the other hand can be glued on with super glue as the adhesive surface it came with was not strong enough. However, the glue is not extremely tight and will loosen through multiple disassembles. Nonetheless, this doesn't matter because the end use will not be taking it apart. As long as the plastic sides are attached sturdily to withhold the force of the mallet, it will suffice. Therefore, Velcro is an excellent idea.

Future refinements.

Through exploring many different materials, multiple prototypes, and experience prototyping, additional refinements are not necessary for this model. If this product was to be sold in the market, I will further improve the workmanship of this product by ensuring more accurate cuts on the dowels, side panels, and the metal work for the wires. Aside from future improvements, this prototype will still require the mounting of internal components.

References

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