



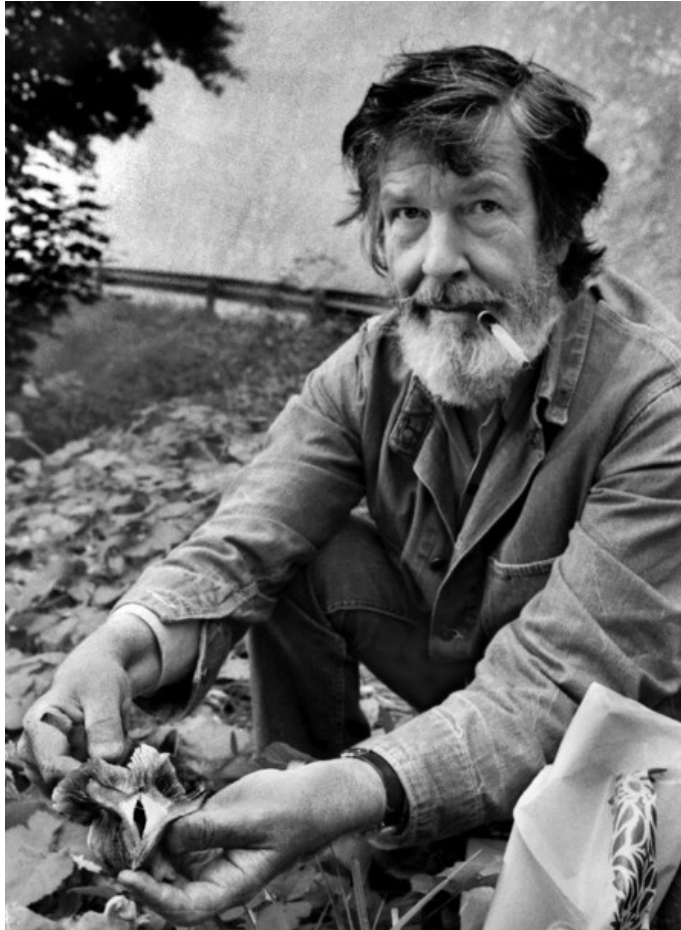
The Natural Soundscape Instrument



The Natural Soundscape Instrument

The Beginning

After the mid-semester reviews had finished, Design Studio Two began with Jan's tribute to famous musician and philosopher John Cage. The goal of the assignment was to design a musical instrument or experience based on John Cage's tropes and his work. We were invited to use any of John Cage's tropes: non-intention, indeterminacy, chance operations, I ching, improvisation, notation and mesostics.



Picture of music composer and philosopher John Cage

“Everything in this world has a spirit that can be released through its sound”

Oskar Fischinger told John Cage when Cage was his assistant

Research

I began researching John Cage and his work to gain a better understanding of his background, and the inspiration behind his work.

One of the most insightful articles I read about Cage was Sharon Williams’ “Uncaged: John Cage and Conceptual Approaches to Participatory Music-making.” It stood out to me because of its focus on Cage’s non-hierarchical performer-audience relation-based music-making approach. This paper was at the root of why I fell in love with Cage and his work. Below are two concepts from the paper and Cage’s work that I found worthy of further exploration.

Experimental Music/Approach: Williams mentions that Cage’s music is very experimental and non-market driven, and that his main goal is to explore concepts and demonstrate the process of music-making rather than the music itself. Through his work, Cage continuously tried to break the barriers of conventional music to redefine what could be classified as music.

This was a fresh and captivating perspective for me, as at that time I was in the process of developing and creating my own art and trying to break through stereotypical concepts.

Performer-Audience Relationship: Cage said the following in an interview with Hans Helms in 1972:

“I like... music by many, many people. I try to bring about a situation in which there is no difference between the audience and the performers. And I’m not speaking of audience participation in something designed by the composer, but rather I’m speaking of the music which arises through the activity of both performers and so-called audience. This is a difficult thing to bring about, and I’ve only made a few attempts so far and with mixed results, you might say.”¹²

¹²Cagetalk: dialogues with and about john cage. Univ Of Rochester Press, 2014.

I connected personally with this quotation by Cage as I’ve tried to explore this performer-audience equation in my own work from the beginning. I strive to blur the line between the performer and the audience by delegating the performance to the audience members, thus pushing the boundaries of their role in

the interaction. I like the roles of the performer and the audience to be interchangeable and even intersect and converge at times. A lot of Cage's work was influenced by natural occurrences. In "Chance and Certainty: John Cage's Politics of Nature," written by Benjamin Piekut. Piekut discusses work by Cage in which nature played a vital role. For instance, for his 1952 series, Music for Piano, he held a blank sheet of transparent paper against a lighted surface a window, observed and made marks based on the imperfections or creases on the sheet. He placed those marks on staff paper to represent musical events in terms of pitch and attack.

Cage also invented "quantization," in which the continuous marks on the paper were restricted and reduced to a smaller number of discrete values, by calculating the average of marks within a certain diameter. This was followed by the tossing of coins to determine the clefs of each staff. This became the music he composed the music in the Music for Piano piece!

I was intrigued by the way Cage made decisions based on factors he could not control, and how he allowed situations to follow their natural courses. Reading about this made me reflect on the amount of restrictions I impose in the interactions I create, and how much creative freedom I offer for interactions to evolve "naturally." I had not specifically used any natural event to govern any of my decisions, but it was compelling for me to include this approach in my next project.

I watched a documentary called A Tribute to John Cage made by Nam June Paik for Cage's 70th birthday. The video included some projects that caught my attention. There was a heavy use of percussion instruments, for instance, in a piece called *Living Room Music* that involved music made using windows, walls, papers, furniture, doors, etc. Another great work was 27 sounds manufactured in a kitchen, in which Cage used things we find in a kitchen to compose music. 12 sounds manufactured by the human body and 13 sounds manufactured in a car were two more examples of unconventional sounds used for composing music.



John Cage's Living Room Music performed by Cluster Ensemble

Related Research

Based on my interest in body movement and motion at that time, I looked at projects by several other artists that involved music-making guided by some kind of movement. This research helped me combine my thesis interests with Cage's tropes in a way that I found fruitful.



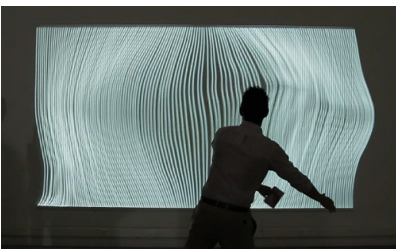
Alison Kotin's Radio Sea.

I found Alison Kotin's Radio Sea extremely intriguing; it was an interactive installation consisting of 11 glass jars filled with salt water that were connected to audio output in a way that when you dipped fingers into any of the jars, a certain sound would be played. It was a piece about Boston's Gallop Islands, home to a former military site now inaccessible to the public. Kotin made this project as a way of recreating the experience of going to the island through an aural journey. What I loved most about the project was that it was a musical collaboration composed by the act of touching water.



Antenna Design's Flower Power.

Antenna Design made a piece called Flower Power, where LED flowers were installed on a wall by a roadside. Whenever someone would walk on the street, the flowers would light up sequentially making sweet musical tones. I loved the element of chance used in composing music, with collaboration embedded in it seamlessly.



Nervous Structure by Cristobal Mendoza.

Nervous Structure by Cristobal Mendoza is a series of site-specific, interactive installations consisting of string and fabric structures illuminated with interactive computer graphics that react to the presence and motion of viewers. The motion of these projected lines is ruled by a simulation, which makes them act like soft ropes, and said motion is influenced by a viewer's movements as interpreted by a computer that surveys the scene

through a video camera. Thus, the physical gestures of the participant are translated into virtual forces that affect the computer-generated lines, while the physical strings of the sculpture remain motionless. The piece revolves around the idea of interface, which is interpreted as the point of contact between two different entities, and is displayed in the work in several ways: between the viewer and the piece (a human/computer interface); between the real and the virtual (the physical structure and its relationship with the projected structure); between the foreground and the background (as the projection interferes with the sculpture). Users are pushed to learn how to control the projected strings using their body movements.

My projects have the constant common thread of interaction using body movements, gestures or motion. Mendoza's string structures are controlled completely by the users' bodies,' which pushes people to move around and experiment in the interaction. It is something that I strive to do in each experience I design.

Composer and performer Judy Dunaway's improvised music-made with balloons likewise caught my interest. She's called the 'mother of balloon music' and has done many experimental compositions, improvisations and installations using balloons. She uses latex balloons to make sounds by creating friction and rubbing on them, by controlling the release of air from the balloon as well as by using resonators. I like the concept of making a musical instrument out of something that has not conventionally contributed to music-making; it is exciting to push the expected boundaries.

Experimentation

Mapping Silence: I did a small exercise based on Jan's suggestion after learning about John Cage's take on experimental music, specifically about classifying environmental noises as music. I started with a paper and pen in my room, where I decided to use a graph to depict the different sounds and noises I heard in one minute.



Judy Dunaway performing and composing balloon music.

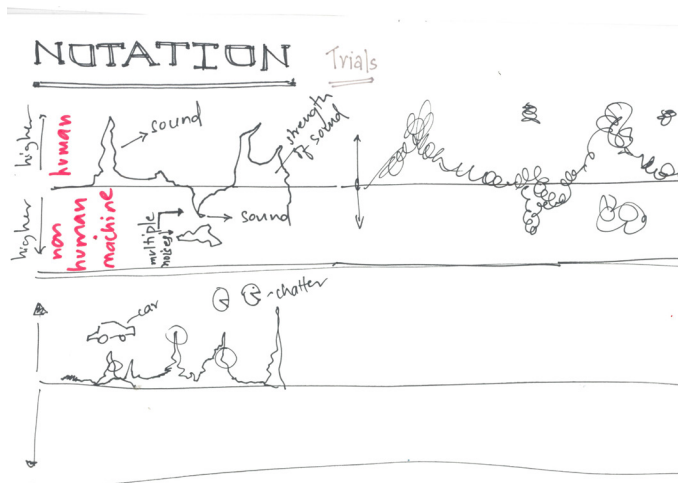


Photo of the experiment for mapping silence.

I differentiated the source of sound generation as either human or non-human. It was intriguing to see a pattern of strokes that appeared random when viewed on its own, but that made perfect sense when mapped to the surrounding audio sound recording. I had just found my unique way of representing music. This exercise was the tipping point for beginning my own experimentation inspired by Cage's work.

Topics of Interest

Based on my research about John Cage's work, I identified some initial areas of interest. Some of them were:

1. Unconventional Natural Sounds
2. Leaving it to Chance / Non-intention
3. Extent of Experimentation in Notation
4. Unpredictability in Silent Music
5. Combination in Improvisation
6. Element of Performance in his Work

Based on these concepts, I had two initial ideas for my instrument. The first idea grew into my final concept for this project, while the second developed further into my DrawMotion project.

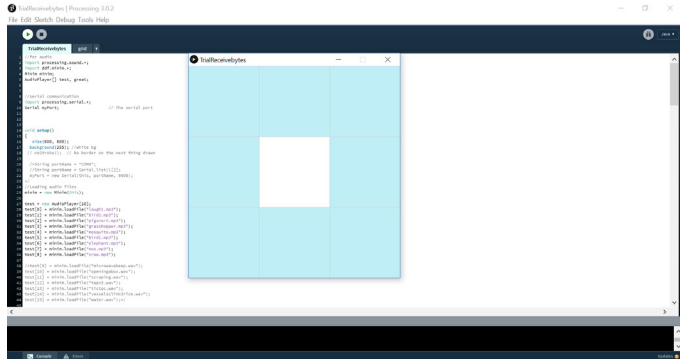
My basic idea was that participants create their own musical environment by playing different unconventional sounds in a confined space. Music would be composed by touching pressure sensors installed inside step-on pads distributed throughout the space. Participants would create aural environments, then collaborate and improvise with them.

I was clear that I wanted to use unconventional sounds for the musical elements in my instrument. So I researched the terms “noise music” and “aleatoric music.” Noise music is characterized by the use of noise within a musical context. It challenges the distinction made in conventional musical practices between musical and non-musical sound. Aleatoric music is music in which some element of the composition is left to chance, and/or some primary element of a composed work’s realization is left to the determination of its performer(s).

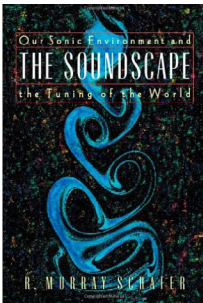
The next step was to begin experimenting with noise music. So for the next few days I took a little audio recorder with me everywhere I went, recording every kind of noise I came across. My aim was to generate a small database of sound samples to work from. The process of recording everything going on around me was very introspective. I never realized that I ignored all the tiny noises and sounds playing around me. Birds chirping, rain, soft breezes, and sea waves: everything sounded so new when I listened to it closely. I would listen to the clips at the end of each day, remember and visualize each place at which I had recorded the sounds. After recording for around ten days, I extracted certain distinguishable sounds from the recordings.

I envisioned a 3 by 3 grid, i.e. 9 step-on pads on the floor embedded with pressure sensors, which when stepped on would play these natural sounds that I recorded from my experimentation. I decided to make a quick prototype of this concept. For my first version I used Processing to code and design a small 3 by 3 grid on my laptop touch screen, and assigned a color to each individual square. I further assigned an individual sound to each square and programmed it in such a way that when you touch a square, the assigned sound is played. Users could play multiple sounds simultaneously by touching more than one square. I presented

First prototype of the concept of composing music through a 3x3 grid in Processing.



this screen-based prototype, and my classmates enjoyed playing the noises and sounds they were previously unaware of. They composed and collaborated. I knew the ingredients I needed for the experience and the form of interaction, but the binding factor for creating a compelling system was missing. I also got some great feedback during our class critique about needing a binding theme for the input and output of my system.



The Soundscape by Murray Schafer.

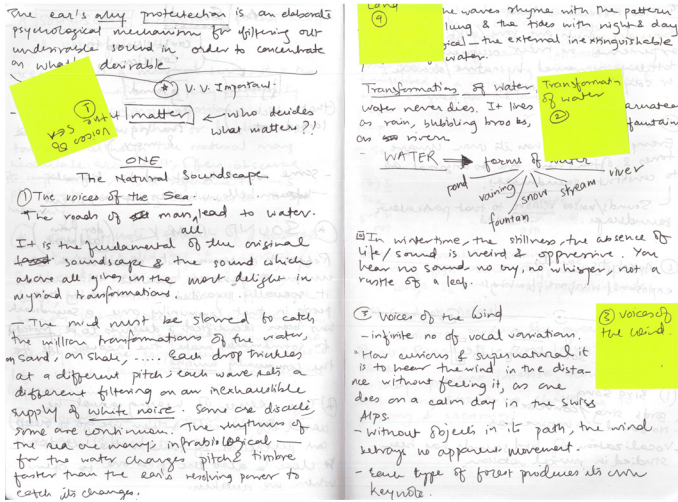
The Soundscape

I met with Fred Wolfink to talk about my project and see if he had any other innovative technologies that he could suggest for the project. Thanks to our meeting, I later discovered the binding theme of the experience. Listening to my concept, Fred strongly suggested that I read *The Soundscape* by R. Murray Schafer. That was a huge turning point in my design process.

Murray defines noise as the sounds that we have learned to ignore. He says, “Music is sound, sounds around us whether we’re in or out of concert halls.” This substantially expanded the definition of music for me.

“Music is sound, sounds around us whether we’re in or out of concert halls.”

- *Raymond Murray Schafer*



The portion of the book that resonated with me most is Murray's classification of different themes in a "soundscape." He defines a soundscape as something that consists of events heard and not objects seen. "Keynote" is a musical term; it is the note that identifies the key or tonality of a particular composition. The keynote sounds belonging to a natural landscape environment are those created by its geography and climate: water, wind, forests, plains, birds, insects and animals. These keynote sounds make up the main elements of natural soundscape music.

Schafer talks about the World Soundscape Project, an international research project he founded, with a main goal to explore the relationship between humans and the sonic environment through an ecologically balanced soundscape. The World Soundscape Project captured dying sounds in order to preserve these rare natural sounds, i.e. sounds from organisms on the verge of extinction from environmental soundscapes. He extensively toured in Canada and Europe recording sounds, which gave birth to the World Soundscape Library (which has now been digitized). I tried to figure out the reason behind the need for a soundscape library; have we stopped hearing what sounds are played naturally around us?

Murray says that our sense of hearing cannot be closed off at will. When we go to sleep, our perception of sound is the last door to

close and first one to open when we awaken. The ear's protection is an elaborate psychological mechanism for filtering out undesirable sound in order to concentrate on what is desirable. I was astonished reading this, as it meant that we have grown immune to all the noises playing in the background of our surroundings. We no longer listen to all the ambient background noises!

Further, Murray classifies the natural soundscape as: the voices of the sea for sounds related to transformations and different forms of water, voices of the wind for all the sounds that are caused by flowing air, the sounds of life consisting of sounds by birds, insects, water and creatures.

Four Elements of Creation

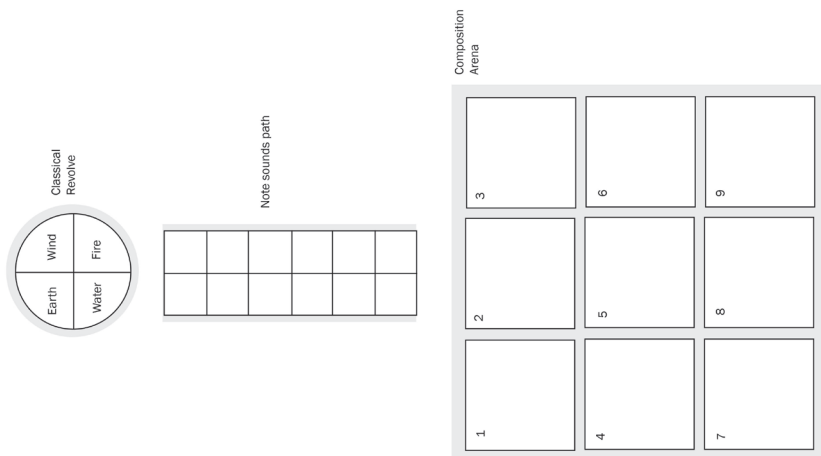
As I was reading all these different classifications of water, wind and other sound categories within soundscapes, I was reminded of the four classical elements of creation that I learned back in school. According to Hindu culture, as well as Ayurveda (the science of herbal medicine), water, wind, earth and fire are the four great and essential elements of cosmic creation. Based on these elements of creation, an exciting and noteworthy theme was surfacing. Participants could compose a music track using sound samples originating from the same four elements of creation, which puts them in a position of power and authority – the position of the Creator. This thought was appealing to me, as I made the connection between the participants being the creators as well as the performers. This gave me a chance to explore the performer-audience relation/ equation in greater depth.



Four Elements of Creation: Water, Earth, Fire and Air.

Interaction Design

At the beginning, I envisioned this entire interaction as a digital cum physical experience. Participants could perform and compose music on a touch screen monitor, after which, their selections would be applied to the pressure sensitive step-on pads where the composition of music would take place. After I shared this concept with my studio class, I recognized the disconnect when the digital medium became physical. I was disappointed by the absence of body motion and physical interaction, which was my main thesis interest. My final medium for composing music



was using these pressure sensitive floor pads where people could step to produce sounds. But my next goal was to find a tangible interaction seamlessly embedded in physical space.

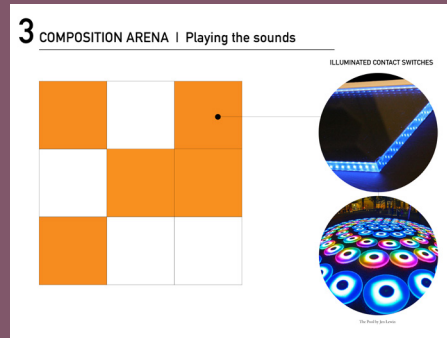
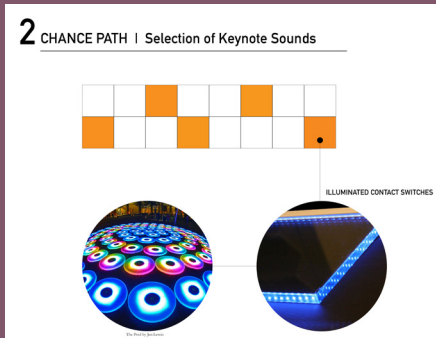
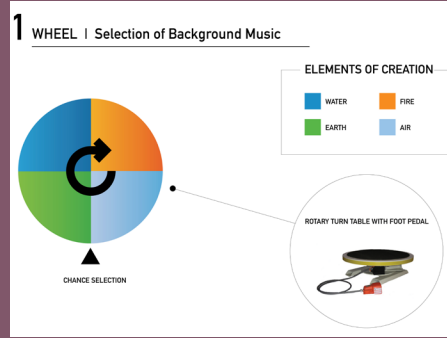
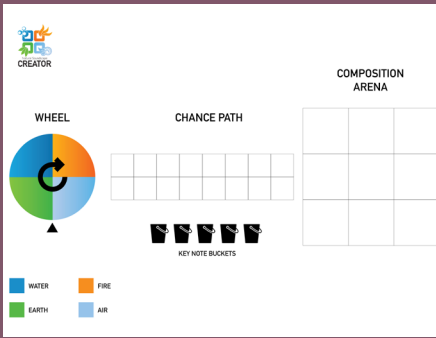
The three sections in the system.

How does the system work?

One of the four elements, water, wind, earth and fire, would function as the background score (playing as a continuous background track) in the system. I wanted to use John Cage’s trope of chance operation, and allow the participants to select this main element through a completely randomized procedure. I decided to use a wooden revolving server table with a foot pedal which would allow participants to select the “main element of creation” by chance. Thanks to our fruitful discussions, Fred introduced me to a revolving server table popularly called a Lazy Susan i.e. a rotary turntable. We tried several alternatives, like using dice and a bike tire with pedal to spin and stop at the end, making the decision of which element would be selected. The pedal with the bike tire and the revolving server were forms of interaction that could be controlled with participants’ lower bodies, which was in line with the step-on composition pads. The table would be divided in four parts, corresponding to air, water, fire and earth. There would be a marker fixed next to the table to indicate the element chosen when the table stopped rotating, and the foot pedal would be used by participants to set the table in motion.



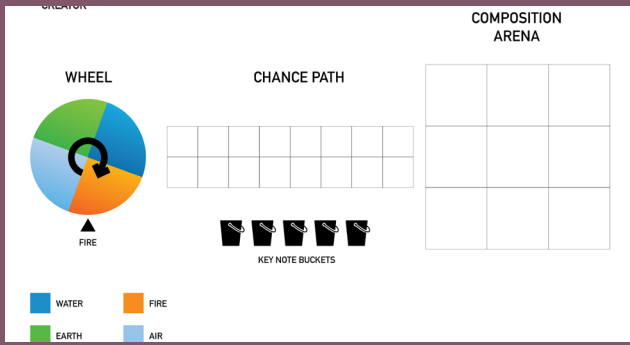
A rotary turntable, commonly known as Lazy Susan.



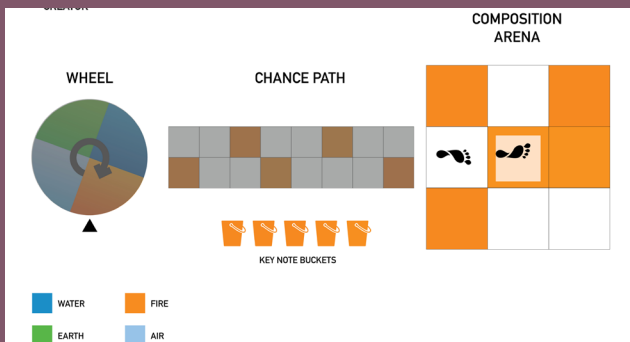
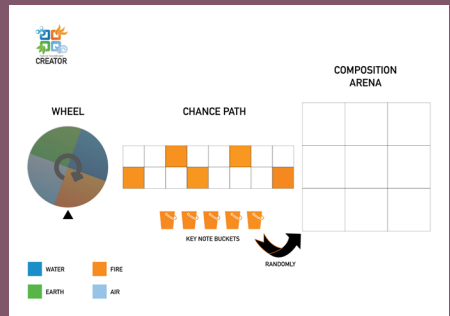
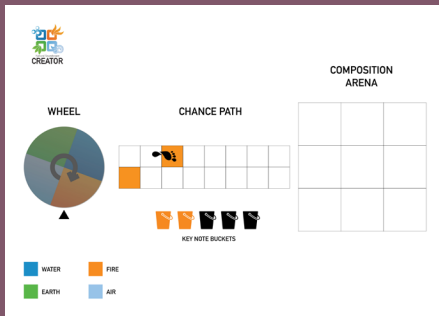
Main three steps in the Natural Soundscape Instrument.

To keep the interaction parallel to the floor and seamless, I decided to continue to let the participants select keynote sounds by the medium of the same pressure sensitive step-on pads. After the rotating wheel selection of main element, participants would walk through a seamless path built on the floor called the “Chance Path,” which was a grid of pads containing keynote sounds related to the main element (for example, if water is the selected main element, keynote sounds would include rain, gushing of a river, sea waves, etc.). Participants would walk through the chance path, with no prior knowledge that they were playing and selecting their keynote sounds as they walked through it.

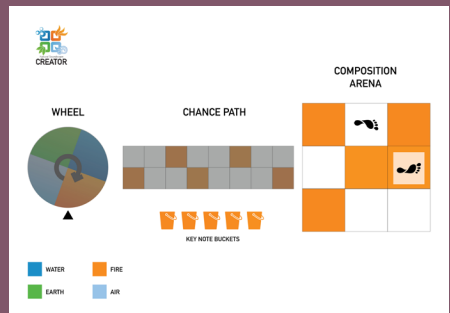
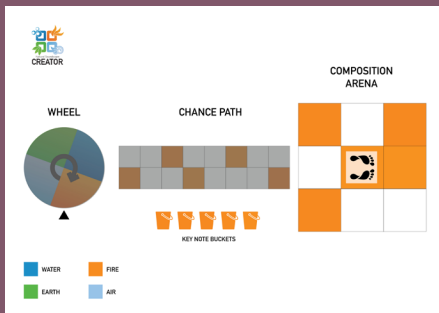
The chance path led from the table to the composition arena, which was the final step in the interaction: the composition of music. All the keynote sounds that were selected by participants as they walked through the chance path were assigned to the step-on pads in the composition arena, based on a random sequence generator. Once the assignment was done, participants could start composing their own music by playing and improvis-



Adjacent figures depict the choosing of main element through wheel and selection of sounds through chance path into keynote buckets.



Left, below: Allocation of keynote sounds into the composition arena; participant composing music by stepping on the pads.



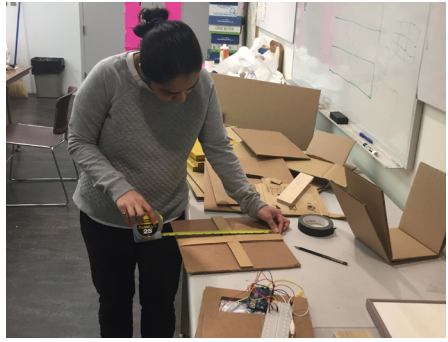
ing by stepping on different pads. Thus they could compose music using the keynote sounds for a predetermined period of time, which, based on the testing session, was 20 seconds, enough time for the learning and composition phase. The time frame limited every interactive session, which ensured consistency in time for all the music tracks to be composed by different participants. It also ensured that all participants got a chance to perform and play the instrument.

Language of Light

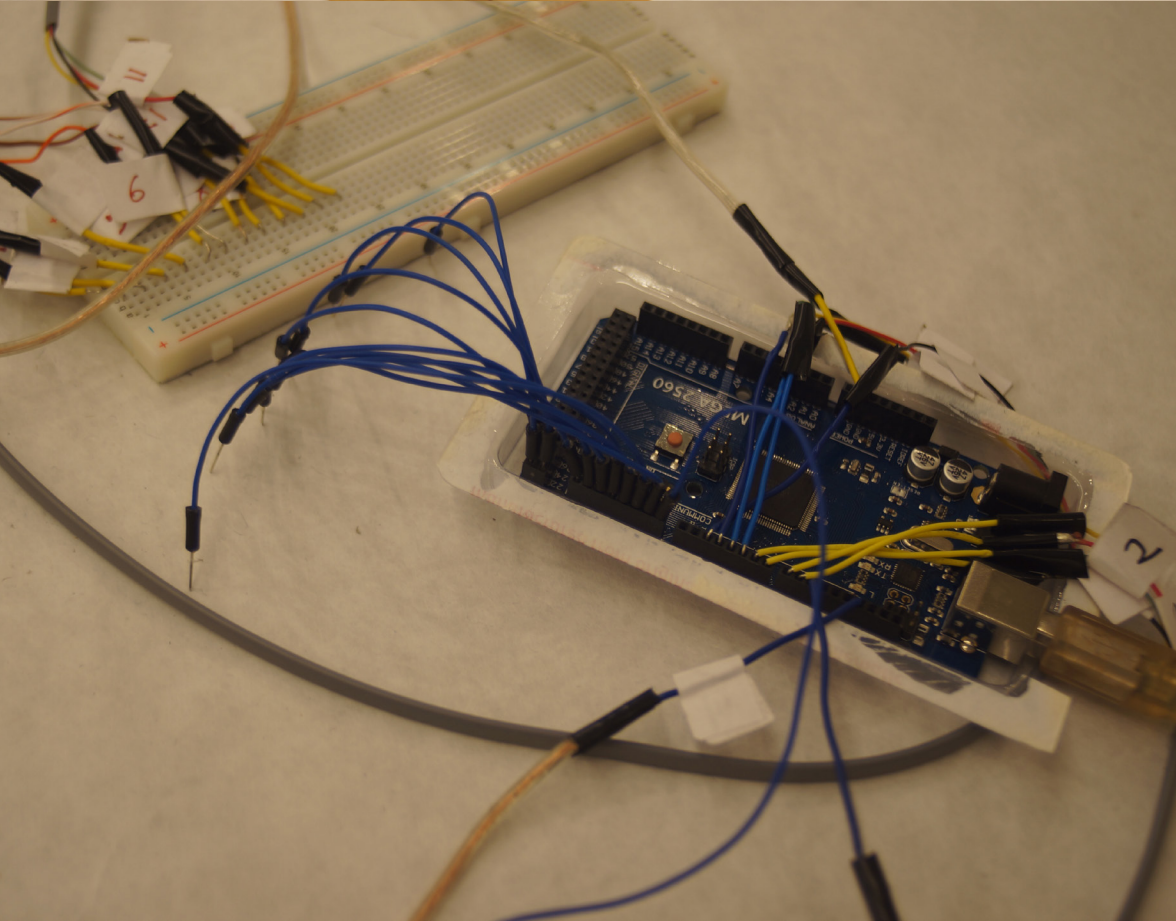
Along with the main aural element of the interaction, I decided to use the language of light to indicate the three stages of the interaction: the main element, the chance path and the composition arena. The pressure sensitive pads would be made of transparent Plexiglas with LED lights embedded on the edges which would light up when the pad was stepped on. The visual feedback would help participants understand clearly what the system was communicating to them. The lights would travel from the main element table, to the chance path and finally to the composition arena, indicating the flow of the interaction in the system. The color of the lights would be indicative of the element being selected: for instance water would make the LEDs glow in shades of deep blue. Of course, this was the ideal prototype of the soundscape project that I envisioned.

Prototyping

My first prototype of the Natural Soundscape Instrument was made of wood, cardboard, silver foil, wires and Arduino boards. I made simple contact switches by joining two pieces of cardboard, leaving space in the center. I pasted aluminum foil at the center of both the cardboard sheets. I connected both pieces of foil with wires to an Arduino board and wrote a simple LED blink code to make sure that the contact switch was working. Once I was sure that it worked, I connected Arduino to Processing for playing the sound samples that I had recorded. I made the composition arena as a 3x3 grid, having 9 contact switches in total to compose music on. The chance path had switches comparatively smaller in size than the composition arena ones, as participants would only select keynote sounds and not compose them explicitly.

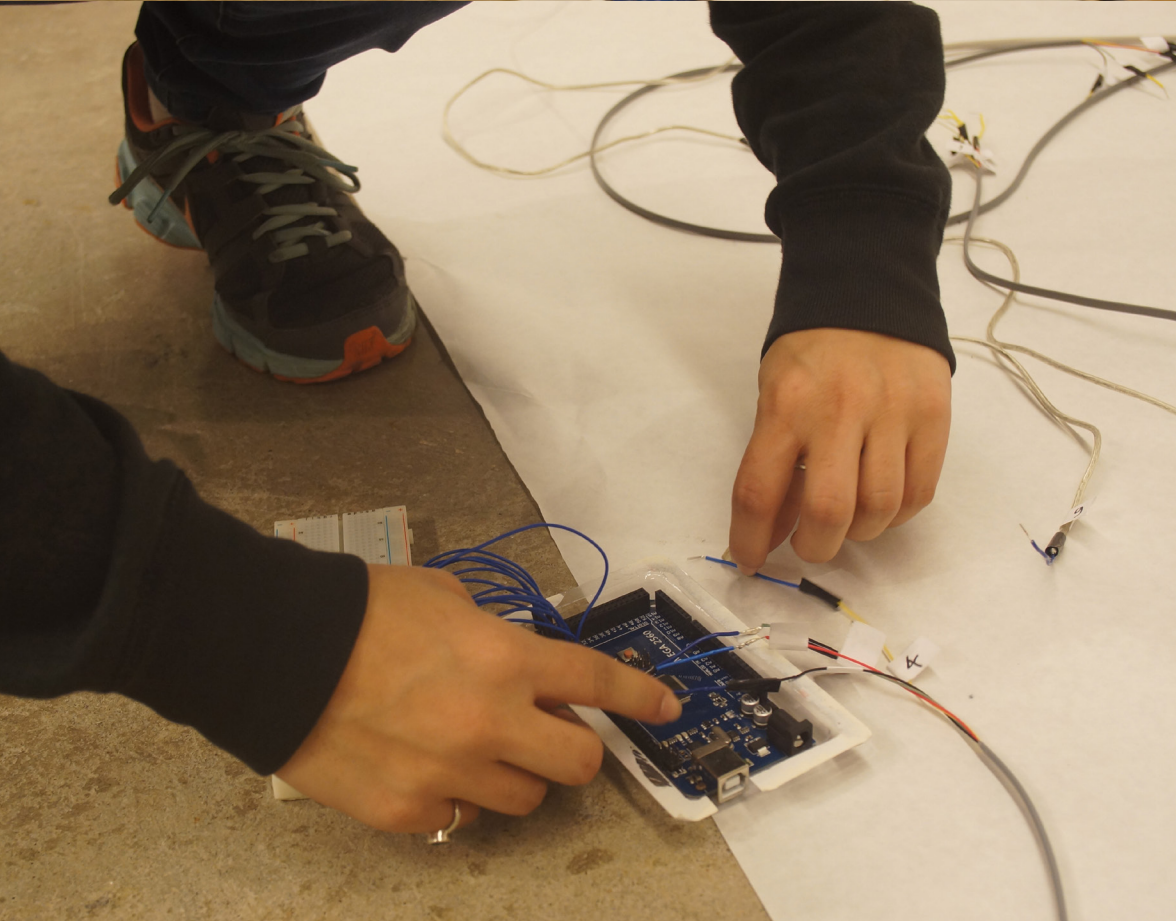


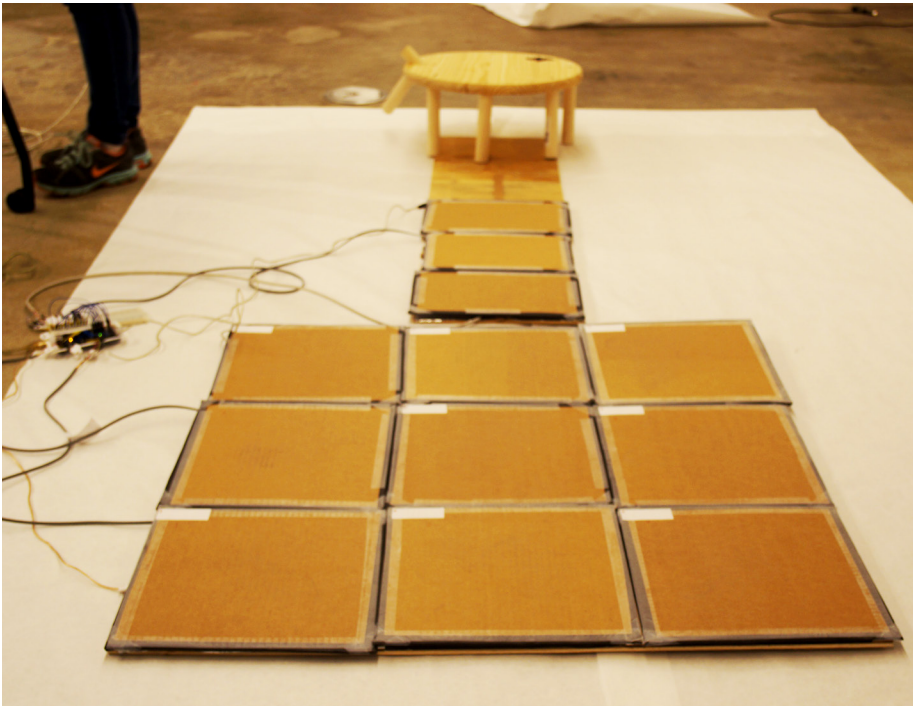
Building the step-on switches made out of wood, cardboard and aluminum foil.





Building the prototype for the instrument.





Testing of prototype of Natural Soundscape Instrument.

I made a small revolving server table with wood, divided it into sections for the four elements and connected it to a small motor with a step pedal that would set the table in motion. It took me a few days to build the switches and the table, all connected to Arduino and Processing.

I mixed audio tracks related to sounds of wind, fire, water and earth from the small database of keynote sounds I had gathered for my prototype testing.

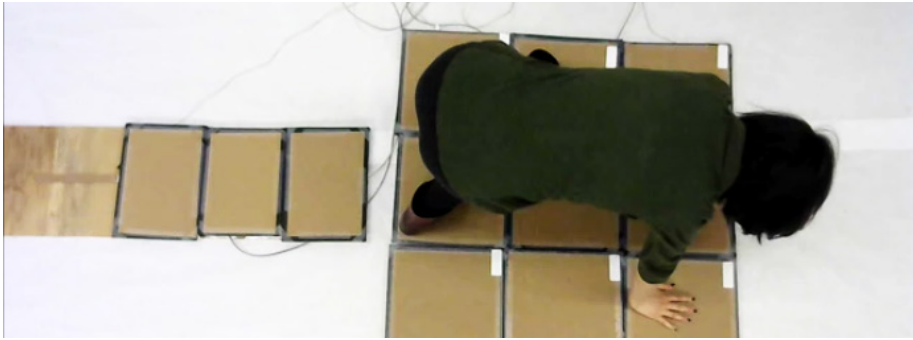
Testing and Observing

For testing my prototype, I installed the whole soundscape unit in one of the huge rooms in DMC. I installed cameras on the ceiling to capture how participants performed on the step-on pads on the floor. I faced a lot of technical challenges as I set up and connected all the switches to the Arduino and then to Processing. It took me some time to assign and transfer the keynote sounds selected while walking on the chance path to the pads on the composition arena.

I invited a few of my classmates to participate and play the natural soundscape instrument. I was extremely excited to see them entertained and captivated by the experience. Bing was surprised to walk on the chance path and hear sounds related to fire, as her main element on the table was fire. When she reached the composition arena, she started stepping on the pads with caution. For the first few seconds, she was fascinated by all the different sounds she could hear, which she tried to identify as she heard them. Once she had played all the sounds on the pads, she began composing music. She experimented with different patterns while stepping on the pads. It involved a lot of playing around with time, as the moments of silence between the sounds were important to her. She tried to learn certain combinations which she liked listening to. She was discovering the different sounds, starting to experiment with stepping patterns, trying out combinations of sounds to repeating certain patterns she liked;

Joey interacting with the instrument.





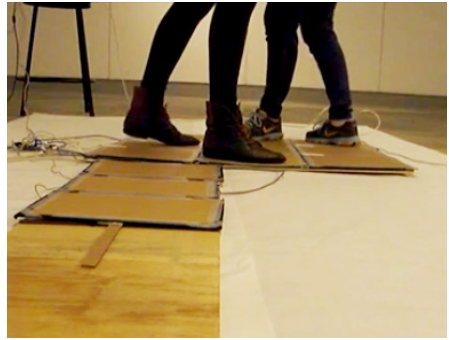
Above: Bing playing the instrument like a game of twister.

Bing had found a way to learn the system and to compose music. Through this composition of music, she was choreographing her own steps. She was moving, dancing and, most importantly, improvising. She enjoyed receiving the immediate reward of aural feedback.

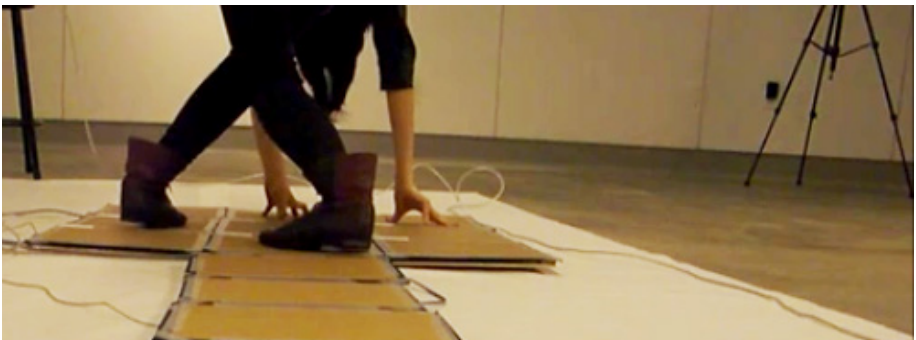
The best part of Bing's interaction was when she got bored of using her feet to step on the pads. She bent and started using her hands in combination with the pads. Watching Bing push the boundaries was a very special moment for me and expanded my expectations of the potential of the instrument. She brought the traditional game of Twister into my soundscape experience. The number of sounds played doubled as she used her two hands and two feet, and the combinations she was trying increased. The music changed drastically from what she played with just her feet.

Opposite page: collaboration based on gestures, actions and movements.

Collaboration: There was a fun moment, when I left my note-taking and recording and joined Bing in her performance. We collaborated and played the instrument together. We did not



have any verbal dialogue, but there was an unspoken understanding of playing and trying out different combinations together. At one point, she asked me to teach her some gestures from Indian classical dances to go with our movements and composition of music. This exchange of meaningful gestures along with the composition of music through body motion was an excellent example of non-verbal communication which lies at the core of my thesis.



Conclusion

Physical Interaction

My thesis focuses on making participants interact in physical space using their bodies. This project was successful in that participants were freely moving as they played and composed music in the composition arena.

Improvisation in Choreography

Through the process of composing music, participants performed and experimented with different patterns in their steps. They composed music by moving and dancing in an improvised manner, for which I use the term “improvised choreography.” Composing music was the stimulus for participants to move around, thus pushing them to let go and perform their own improvisations in choreography.

Discover, Learn and Play

Participants went through the initial process of discovering the different keynote sounds attached to the step-on pads, and played them along with the ‘element of creation’ soundtrack in the background. After this process of discovery, they learned the rules of the system and about the assignment and arrangement of the sounds in the composition arena. Once they learned the system, the participants began experimenting and playing. They discovered different compositions and tried various possible combinations with their feet (and hands!).

I believe that this elaborate process of discovery is one the most essential processes in all the systems I have designed. The discovery and understanding of the interaction leads the participants to play, experiment and break boundaries to find new ways to access the experience.

Open Exploration

Open Exploration took place after the participants learned how to use the system. Once they had a clear understanding of how the soundscape instrument worked, they explored newer ways to access the interaction. Bing played Twister as she composed music, while Joey literally jogged to a certain rhythm on the step-on pads to create a unique musical track.



Bing and Joey collaboratively testing the soundscape instrument.

Collaborative Aspect

I think there is a vital collaborative aspect to the soundscape instrument. I wanted to explore participatory music-making through Cage's perspective: bringing people together to make music.

The concept of composing music with someone, through the medium of body movement, creates a conjoined composer. There is non-verbal, bodily communication that takes place as two or more people begin to compose and play their tracks. It is a dialogue of decision-making and compromise that happens when participants perform together.

Audience – Performer Relationships

Cage tried to explore the audience-performer equation through his work. He gave his audience the chance and authority to actively compose music. I have strived to do the same through my work, focusing on improvised choreography and body motion. Through the natural soundscape instrument, I saw the audience roles blending into the performer roles as participants composed

music by moving and dancing in the composition arena. It was especially fascinating to see people join the already performing participants, breaking barriers and invading spaces.

Future Scope

I always imagined The Natural Soundscape Instrument project on a much larger scale and size than my prototyped version. To push the envelope on collaboration further, I envisioned the step-on pads from the composition arena to be distributed in a larger space, giving room for participants to move around more freely and make music in greater numbers.

Along with this I want to record and make the music tracks composed in every session, accessible on tape. Listening to a database of music tracks composed through the instrument would be engrossing, and reveal to future participants the full range of possible interactions with the instrument.

