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ES-95
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Final Project Report

Introduction

My team members for this project were Nick Gang, and Paul Alvarez. Our final project

was inspired by the Peter Frampton talk box. The vision was to create a multi-dimensional

instrument that utilized voice information as well as additional user input to generate and

transform the sound. The final instrument consists of a headset microphone to pick up the

voice input, as well as eight force sensing resistors, a push button, and a track pad to alter the

audio signal.

Instrument Design

An emphasis was placed on a user-friendly interface for the physical design of the

instrument. We wanted the instrument to be aesthetically pleasing, yet simple enough to

facilitate the learning and playing of the instrument. We also wanted the instrument to be light

and portable. A clear, acrylic plexiglass plate was used as the main body of the instrument.

This provided a slim, lightweight platform that was extremely smooth. This allows the user to

smoothly and easily slide their fingers across the device to aid playing quickly. Force sensing

resistors (FSRs) were chosen to behave as binary pitch selectors for similar reasons. As opposed

to buttons, the FSRs are very slim and allow the user to play more rapidly by easily sliding their

fingers over and between the FSRs. Eight total FSRs provide the ability to select each note of a

full eight note scale. The FSRs are surface mounted in two staggered rows of four to be easily

reached by the fingers of one hand. One additional push button lets the user swap between

the two program modes. A Wacom Bamboo Pen-Tablet trackpad is attached next to the FSRs.

The track pad is playable with the user's other hand and controls both the scale select and

octave. The track pad plugs directly into the computer through a USB port. The Logitech

headset microphone also connects to the computer with a USB cable. The FSRs and push

button are each wired through a 10 kΩ resistor to a MidiTron so the sensor information can be

transmitted through a MIDI cable to the computer to be processed. The side and top views of

the instrument are shown in Figure 1 and Figure 2. Figure 3 is a picture of the accompanying

headset microphone.

Process of Creation

During the brainstorming stage, the group all liked and ran with the idea of creating a

talk box as part of the instrument. We began by simultaneously building the Max patch to

receive the incoming data from the headset microphone and constructing the physical user

interface. We initially planned to use eight FSRs and a track pad so that was considered and

accounted for in the instrument design. While the heart of the talk box programming was

completed near the beginning, many modifications and adjustments still had to be made to

filter the voice data and adjust the sounds and effects.

Due to some difficulties implementing the track pad, partway through the project we

limited the instrument to just the FSRs and microphone. However, we were not able to achieve

all of the effects and controls we wanted and so we worked together to get the track pad

working and back as part of the instrument. One of the final steps in the design was to include

a push button to select between the two modes in the Max patch.

<u>Programming</u>

      The Max patch we used is designed to read in the incoming voice data from the head mounted microphone and sensor data from the FSRs, push button, and track pad. The voice data from the microphone and a saw tooth wave are split into the source signal and filter for the spectrum. The spectrum information comes from the incoming voice signal. This gives the user the ability to alter the sound generated by the instrument by altering their embouchure or the sounds they make into the microphone. The pitch information for the saw tooth wave comes from the MIDI data from the FSRs. These two signals are then combined into one signal which is the output sound data. The track pad is handled in Max so that flicking the pen horizontally to the left on the track pad chooses a major scale and flicking to the right chooses a blues scale. Flicking the pen back to the middle of the track pad chooses a harmonic minor scale. Flicking the pen upwards on the track pad increments the octave whereas downwards decrements the octave. Each FSR is treated as its own controller and mapped to an individual note within the chosen scale and octave. Although the FSRs are continuous sensors they are used as binary switches in the Max patch. The push button toggles between this normal operating mode and the granular pitch shifting mode. The granular pitch shifting mode uses the track pad as a pitch modifier. This mode is a little more dynamic and expressive than the standard mode but lacks the precision auto-tuning. The FSRs are still programmed to affect the pitch in the granular pitch shift mode, but their effect is minimal compared to the pitch shifting of the track pad. Since we were able to perform all of the sound effects within Max we didn't need to transform the audio signal and send it through Reason. A screenshot of the Max patch is shown in Figure 4.

Breakdown of Work

As a group we initially decided that Nick and Paul would focus on the software of the instrument and I would focus on the hardware. This breakdown remained for the duration of the project although there was significant collaboration and teamwork between the three of us. Paul was the all around contributor as he helped Nick with the Max patch and aided in some of the instrument construction. Nick completed most of the Max patch. The Max patch was a great learning opportunity for me as I was able to help with some of the logic for the program while Nick taught me about many of the Max objects he used in the patch. I designed and constructed the physical instrument as well as all the installation and wiring of the sensors and MidiTron. Both Nick and Paul provided continuous input for how they thought the instrument should look and be played.

What I Learned

I mostly learned about some of the capabilities in Max and about the science behind the creation of a talk box. I also learned how to use the MidiTron to help make the instrument more mobile as well as the MidAir system, although it wasn't used in the final design. Overall, I truly enjoyed the experience I had with this project. I cherish any time I can work on a project from cradle to grave and watch an idea transform into a tangible reality, especially when I can play with it afterwards.
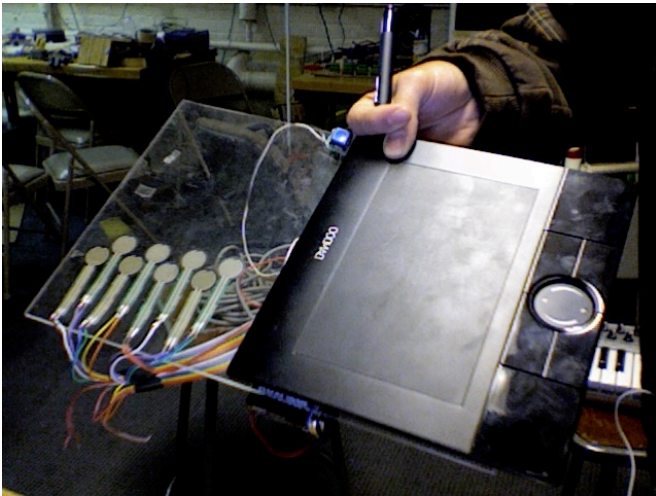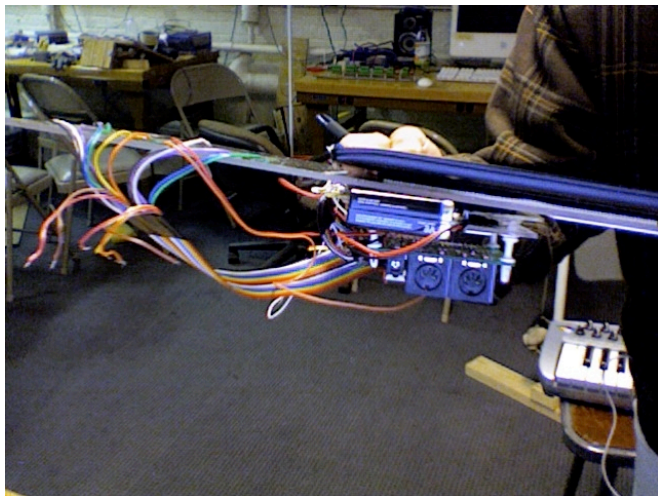
Figure 1. Top view of the instrument

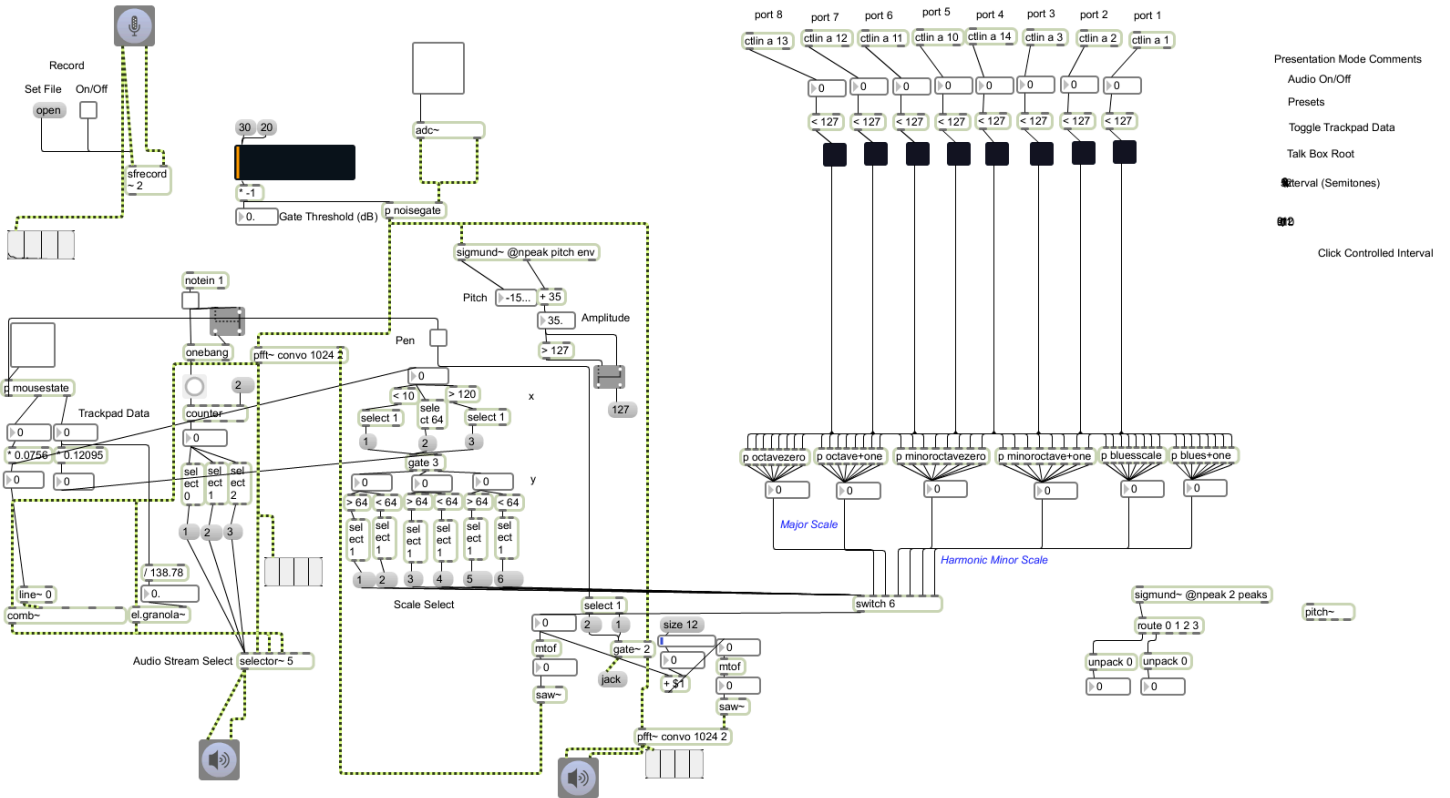

Figure 2. Side view of the instrument

Figure 3. Logitech USB headset microphone

Figure 4. Screenshot of the Max patch