The Lehr-emin

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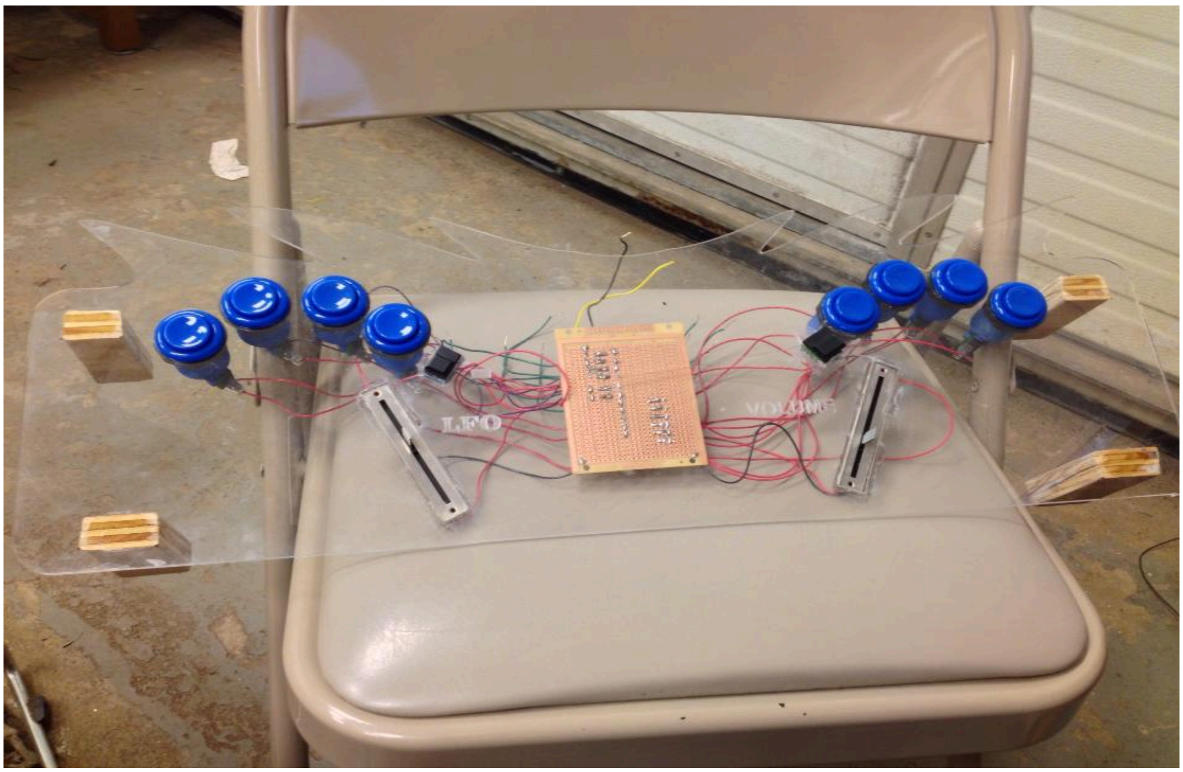
Overview

After succeeding in building the Acatellaphone, my group decided that we wanted our next instrument to have more playability and mobility. Taking inspiration from slide guitar virtuoso Robert Randolph, Jake came up with the idea to emulate the effects and motion of sliding a metal bar across guitar strings by mounting a controller platform on wheels. With a rotary encoder in one wheel, direction and distance could be measured to create a lot of pitch bend expression. We included eight buttons in the design to allow the user to easily place a heptatonic scale at their fingertips. With these features, we were able to integrate the playability and mobility aspects we had hoped to include.

We wanted to be able to put both hands on the platform and maximize gesture capabilities while at the same time develop an intuitive instrument. Therefore we have eight buttons to allow the user to play a C scale, two addition buttons that toggle through a diverse set of patches we designed, including one that sounds like a slide guitar and two slide potentiometers that affect parameters in Reason. The Lehr-emin is designed to be a performance instrument, with pitch bending expression that is easily observable through the motion of the instrument. At the beginning of the course, Professor Lehrman said something that really stuck with me. “If you are going to play big sounds, I expect to see big motions.” That is what my group hoped to achieve with the Lehr-emin, the instrument you can drive up, down, and around the bend.

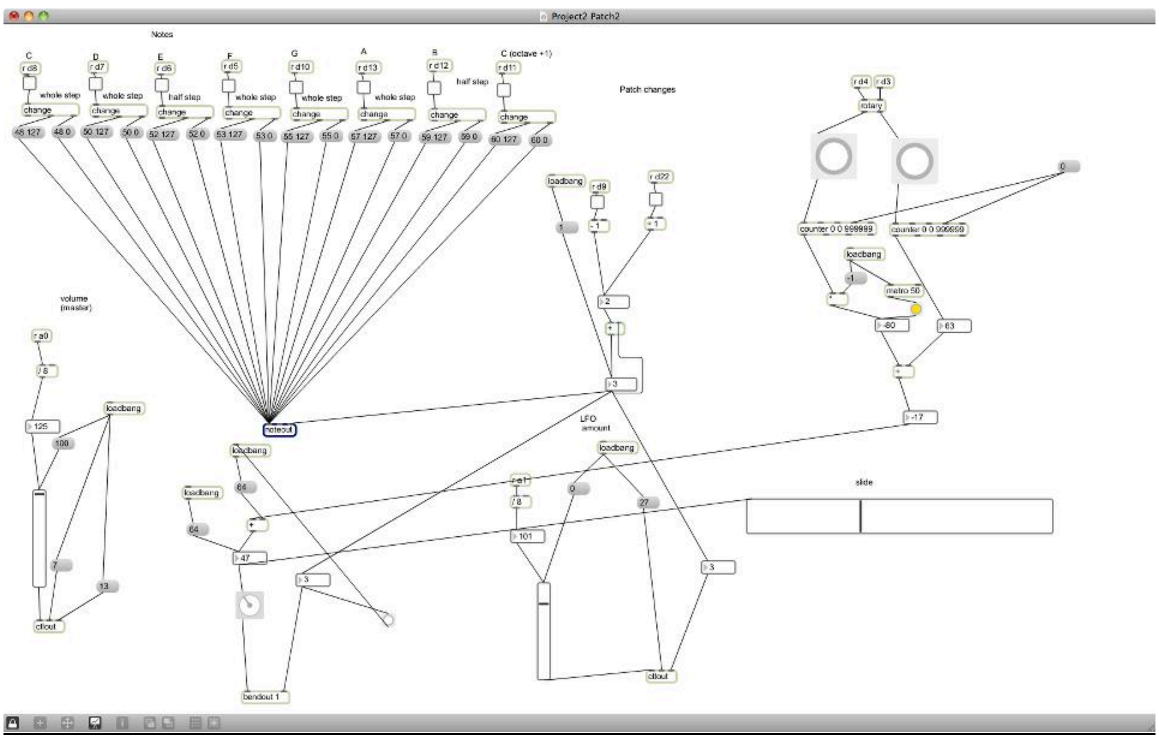
Sensors and Gestures

We have spatially organized the instrument in such a way that the user can place both hands in one spot to trigger everything without shifting hands further. Only hand gestures are used to play the instrument, which include tapping fingers, sliding thumbs and moving arms left and right.



Max/MSP

Creating the Max/MSP patch was a large portion of my responsibilities. In order to make an 8 note heptatonic scale (with a doubled root note) that would play a note for as long as the user held down the arcade button (momentary switch), I needed to use a change object that would switch the note velocity from 127 to 0 when the button switched readings from “1” to “0”. This was the best way to control duration. To control volume and LFO, Jake wired up slide potentiometers. I have scaled the data and have it read as the values for LFO amount and Mixer master volume through a ctlout object. I also figured out a way to toggle up and down patches, and connected the patch number to the noteout, bendout and LFO ctlout. The rotary encoder used to control pitch bend sends out a left and right bang that we use to generate a number that is added to 64 (which represents 0 change in pitch bend)t. I also wrote if statements so that when the pitch bend is between 60 and 68 in value, it becomes 64. This was advice given to me by Professor Lehrman to make it easier to have a central value.



Reason patches

I was responsible for 2 reason patches that I believe are unique and can be very enjoyable to play on the Lehr-emin. The first patch was designed using subtractive synthesis with the Subtractor synth. I have two oscillators, one that produces a deep bass sound and another that makes voice-like sounds. I slightly detuned them to create a chorus effect. The synth is run through Alligator, which chops up and filters the synth into a really cool rhythmic pattern.

I took a guitar strum sample and put it into the NN19 and put in a low pass filter. I am very pleased with the results and what is even more interesting is that the sample speeds up on higher pitches. When the user slides the instrument with this patch, it not only shifts the pitch, but it also speeds up the sample.

Troubleshooting

The biggest issue was figuring out how to translate the rotary encoder information into useful data for the bendout object. Nick and I ended up deciding to use a counter to count up every bang sent by the encoder in the right and left direction. Taking the difference of the values in both directions gave us a number we could add to the pitch bend object to give us bend direction.

Conclusion

To create an engaging performance aspect, Jake and I build a track out of wood, spray painted it, then Nick and I taped elastic straps to the track that clamped onto the instrument, so that the instrument rolls the same amount of distance left and right before the elastic strap gets taut (approx. 12inches). With the track, we can visually display and perform the Lehr-emin to show off pitch bend, since the instrument's direction correlates with the direction of the pitch shifts. All of the buttons and patches work and the instrument is ergonomically shaped for any user's hand. If I were to build this again, I would try to use capacitive sensors instead of momentary switch buttons, and I would put force-sensing resistors on the part of the instrument where the user would place their palms, possibly to control velocity or a filter. If the wires were longer, the arduino board could also be placed in a more stable location.

Group Evaluation

Given the efficiency of each aspect of the instrument, I have to say that this was truly a successful group effort. As opposed to the last project, we definitely spread ourselves out more in helping out in all areas of development. For example, Jake generated a lot more ideas about the instrument functionality and sound (including the concept), while I provided insight on the design and measured and sawed the track. Nick and I shared responsibilities with Max and Reason, which was effective because we were able to troubleshoot each other's problems. Jake did a great job with the glass laser cutter and wiring together all the buttons and switches we would need to play the instrument. Our team used Facebook as a good forum for proposing new ideas, posting pictures and scheduling meeting times. I am very glad that I had the opportunity to work with Nick and Jake again.