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Music 66 Project Report
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The Thimbleizer

Overview:

Our goal for this project, dubbed the Thimbleizer, was to create an instrument that was easy to learn how to play and capable of producing actual music. To do this we built an instrument consisting of a row of 12 wires approximately 12" long stretched between two screws on a board, a smaller board with a number of effects knobs mounted in it, and a board with four momentary switches mounted in it. To play the instrument the player wears a glove with thimbles attached to the fingertips that are wired to a 5V power source, then touches any of the wires to play a note. Similar to a piano, the wires are arranged left to right from lowest pitch to highest pitch. While one had triggers notes the other is free to adjust the rotary potentiometers on the effects board that control patch-specific effects as well as the register of the notes. In addition the player can select the scale the Thimbleizer is playing by tapping one of the four momentary switches on the foot board. We based this design loosely on the Digital Washboard project from 2004, but made some important changes, including increasing the polyphony by giving the player five fingers to play with, raising the wires off the board and separating the controls into two different units to allow for more real time control. Another unique aspect of the project is the choice of sounds we give the user. In order to make it easy to play interesting and melodic music we avoided making the Thimbleizer play common scales such as major or chromatic and created a blues scale, a 24 tone scale, a Byzantine scale and a Chinese-Mongolian scale to offer a more unique experience. Each of these scales has a corresponding button on the foot board. A picture showing the configuration of the wire board, effects board, glove, and Doepfer box is show below. The foot board does not appear in this picture.

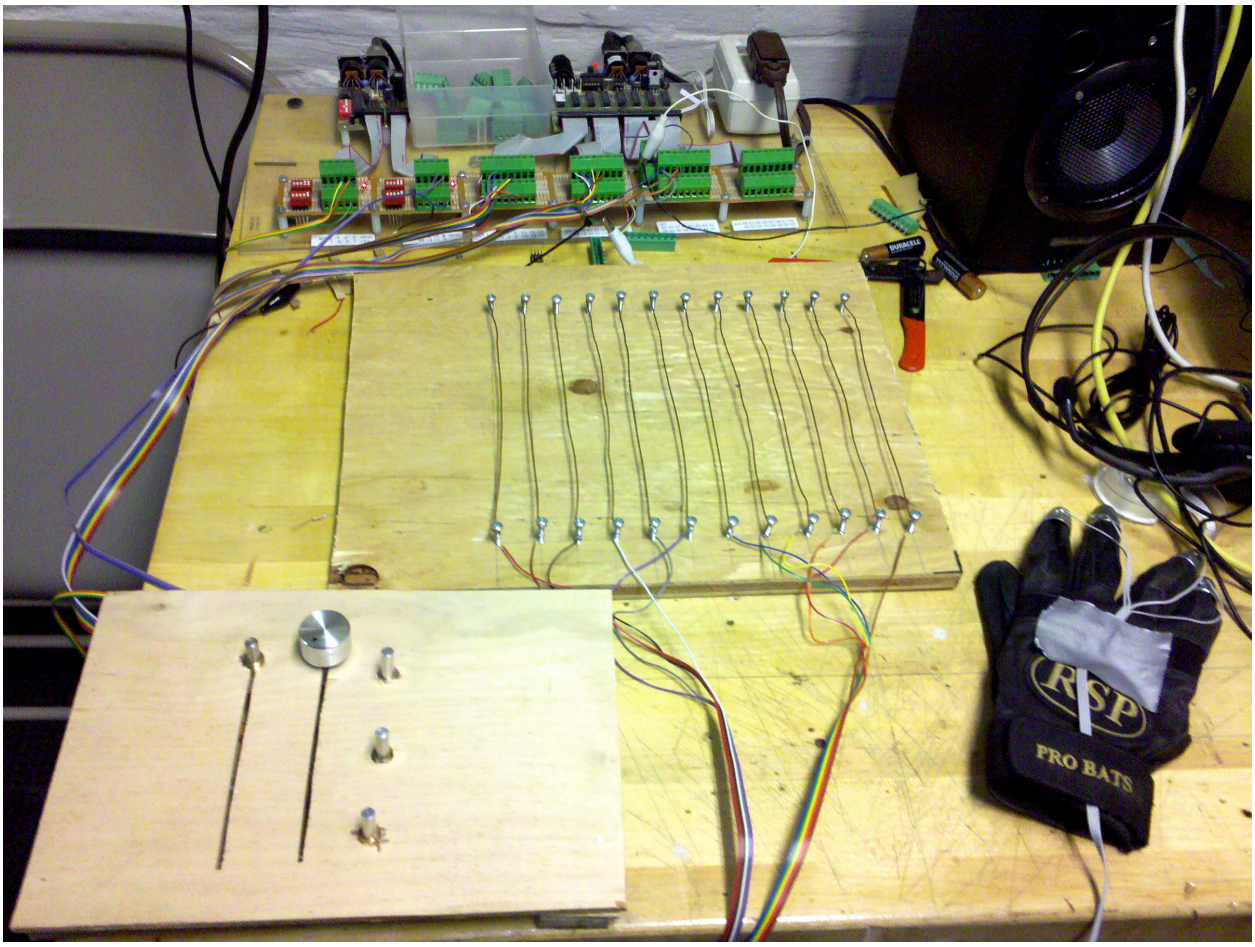

Figure 1: Configuration of Thimbleizer

Materials:

15’ of uninsulated copper wire

24 Screws

3 Wooden planks

5 thimbles

2 rotary potentiometers

3 rotary encoders

4 momentary switches

Hot glue, solder, and duct tape

Construction:

The Thimbleizer was constructed in three basic stages. First one of the boards was cut to about 24" x 18" and the 24 screws were drilled into it in parallel rows of 12 screws separated by about 12". The copper wire was then cut into 12 lengths and strung between each pair of screws so that the tension in each wire was approximately equal. This was done to provide the most consistent playing experience and make it so that fingers didn't get caught when strumming across multiple wires. The wires were then connected to the Doepfer box by soldering insulated wire to the screws.

Next, the effects controller was created by cutting a thin piece of wood to 6" x 8" and drilling five holes for the 3 rotary encoders and 2 rotary potentiometers. These sensors were mounted in the wood using hot glue.

Finally the foot board was constructed from another, thicker piece of wood cut to about 24" x 6". In this piece of wood 4 holes were drilled and 4 momentary switches were installed in these holes with the wires coming out the back. Another smaller piece of wood was attached at a right angle to the original piece to keep the foot board angled off the ground.

Software:

As described in the Construction section, the Thimbleizer is connected to the computer through the Doepfer Box, which outputs MIDI data. For this project we used MaxMSP 5 to process that data and generate the Midi signals that are interpreted by Reason. Our Max patch is divided into three main sections: the note controllers determine what to play when one of the wires are touched, the effects controllers determine what to do is one of the effects knobs is turned and the foot board controller handles the input from the foot board. A screenshot of the main patch is show on the following page.

Though the note controller section of the patch might look like a disaster, it has a purpose. Each noteon event from the Doepfer box is routed to its own individual note controller subpatch so that each wire can have an independent timer. This allows us to give quick touches a higher velocity than longer touches and gives the instrument more expressive potential. The NoteController subpatch takes in the note number; the velocity and the note offset and output a velocity that then feeds directly into a noteout in the main patch. A loadbang is used to initialize all the note numbers.

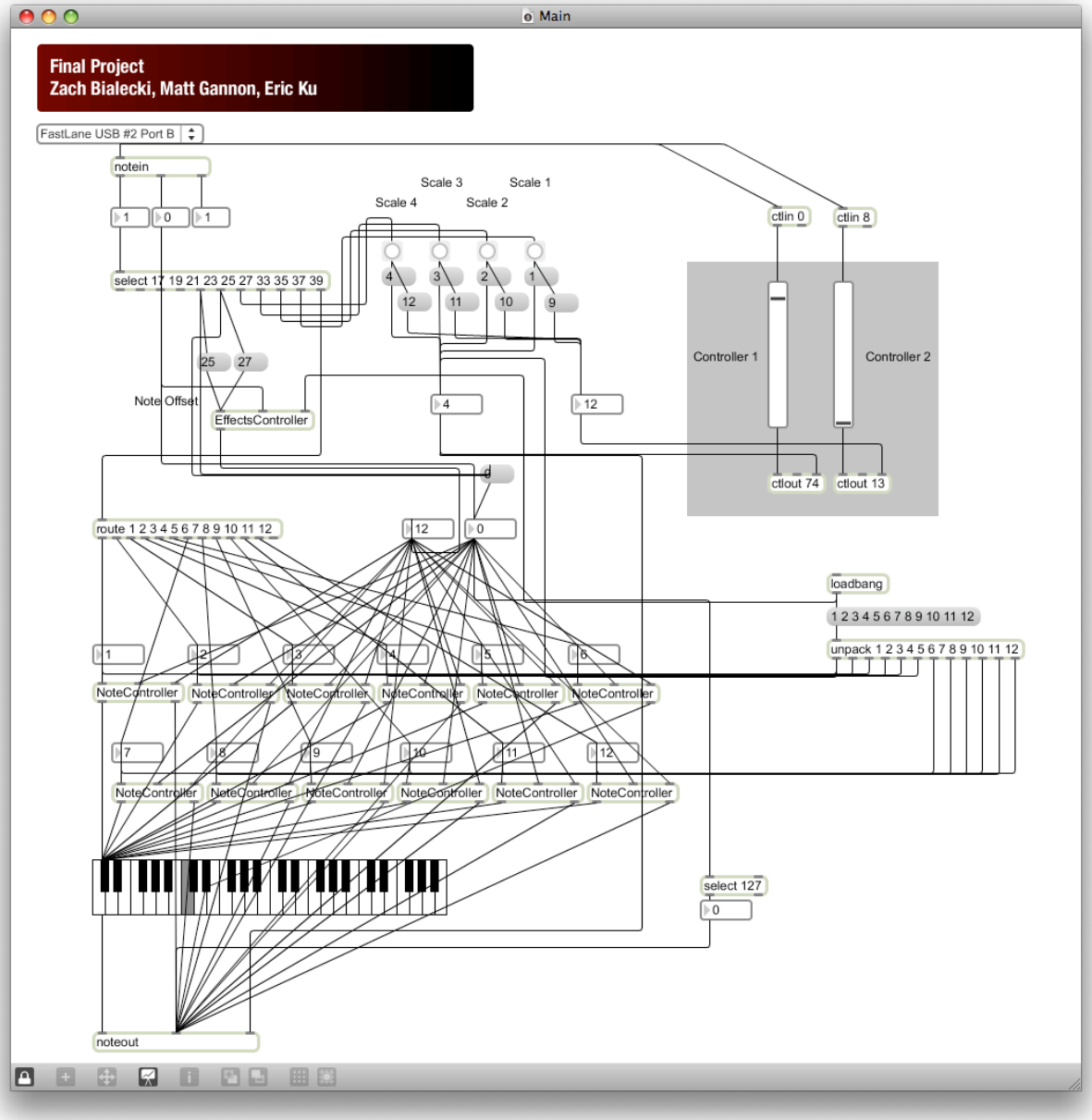

Figure 2: The Main Patch

The effects controller portion of the patch consists of the two sliders in the main patch, which are controlled directly by the rotary potentiometers, as well as the EffectsController subpatch, which is responsible for dealing with the input from the rotary encoder. Through extensive experimentation we discovered the only way to determine which way the rotary encoder was being turned was by comparing the last note number received and the last velocity received as well as the current note number and velocity with a table of known

values. Rather than implement this table as a huge mess of == objects, we determined a way to encode the four pieces of data as a unique sum using a third-party patch that returns the sum of a list of numbers. Having this unique sum allowed us to simply route the different possible values to one of three options that resulted in either the register shifting up an octave, down an octave or remaining constant. The output of this patch was then fed into all the NoteController objects. Finding an elegant solution to this problem took a fair amount of time, and I would encourage future groups using rotary encoders to look at this patch.

The last and simplest part of the Max patch is the foot board controller. This logic simply waited for one of the momentary switches on the footboard to be pressed, and when one is it switches the MIDI channel of all the note controller objects and the effects. The two messages triggered by the bang correspond to the channel for the NN-XT and the channel for the effects.

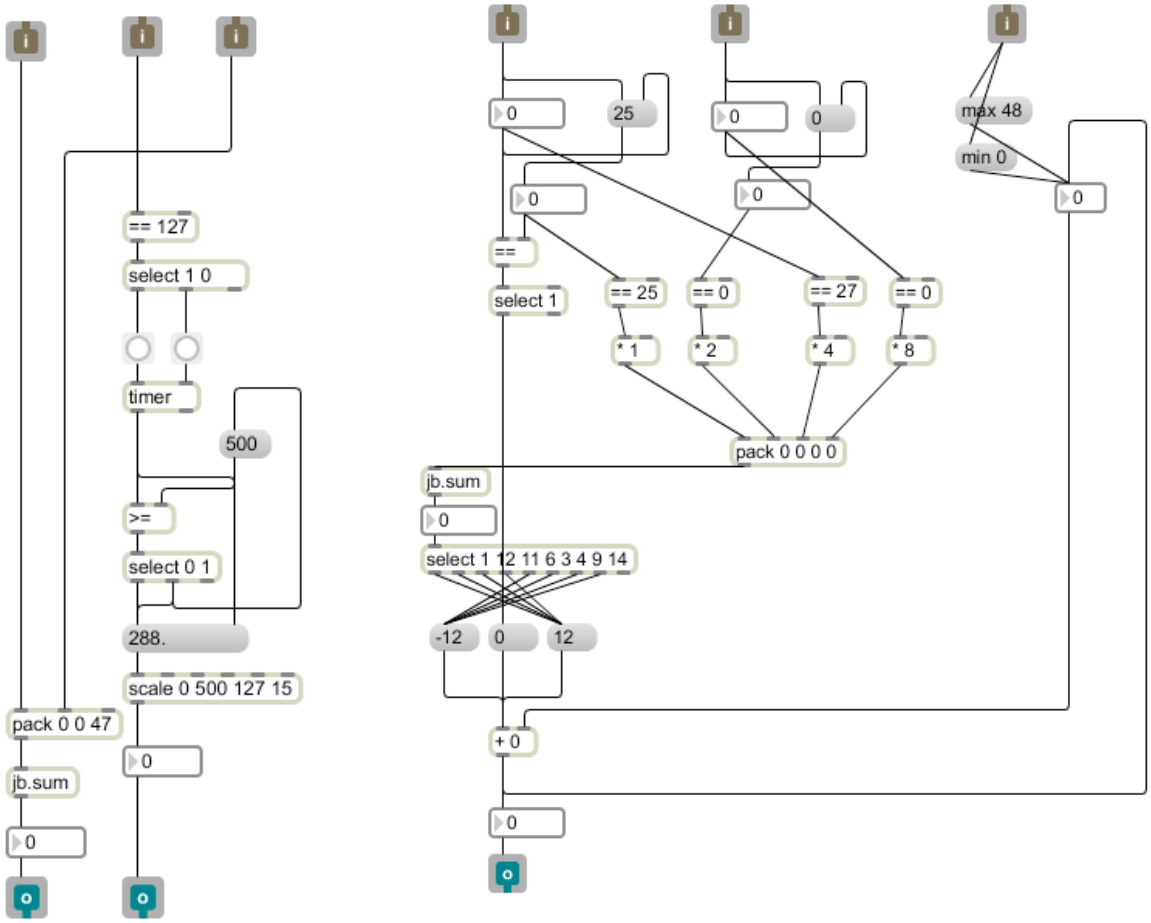

Figure 3: The NoteController and EffectsController Subpatches

This Max patch also featured a presentation mode, shown below, which gives the musician visual feedback about what notes he is playing, what scale he has selected and what level the effects knobs are currently at. This view has proved to be very helpful when playing the instrument, as it can be difficult to tell what is happening only viewing the live patch.

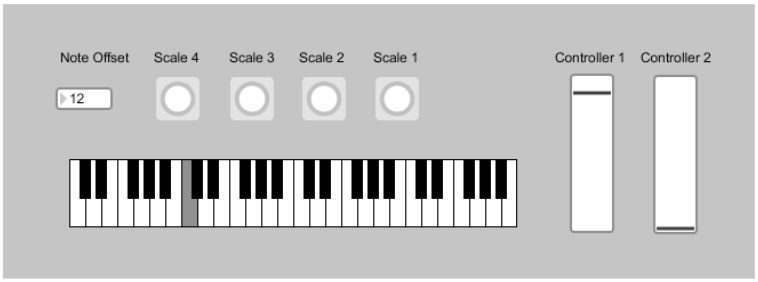

Figure 4: Thimbleizer Presentation Mode

Reason Patch:

One unique capability of our project is the ability to play non-tempered scales as well as scales that have more than 12 tones. In order to reproduce these sounds it was necessary to research the frequencies of each note in the scale, then adjust the tuning on each of the individual samples that made up the patch. For example, to create the 24-tone Arabic scale, every note in a normal 12-tone scale had to be repeated and tuned down 50 cents. The Reason rack we used consisted of four NN-XT samplers on MIDI channels 1-4 that held patches for the blues scale, the Arabic scale, the Byzantine scale and the Chinese-Mongolian scale. The only scale that didn't require special tuning was the blues scale. In addition to these modules, there were four effects modules, one for each NN-XT, on MIDI channels 9-12. These modules were controlled by the rotary potentiometers on the Thimbleizer.

Conclusion:

Overall, my group and I were happy with how the Thimbleizer came out and believe that it is an expressive instrument capable of playing some interesting and unique music. A definite advantage of having the wires arranged in a way similar to that of a piano is that the instrument feels very natural to begin playing without any training. Of course there were some issues that we came across when building the instrument. We abandoned the

idea of using slide potentiometers early on due to high levels of noise and inaccurate readings coming from the sensors. The wires are also not quite as responsive as we might like them to be, and as a result notes do get dropped fairly often when playing quickly.

In the future it would be interesting to add more features to the Thimbleizer, including more effects and more scales. We had originally planned on using all three rotary encoders, but due to difficulty programming them ended up only using one to control the register. The other two could easily be programmed to control other interesting effects. It would also be cool to add more buttons to the foot piece to enable the user to select from an even larger variety of scales and sounds.