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Development Module

Element 2b

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ASSIGNMENT OVERVIEW

Create an instrument. This could be:

- A plugin software instrument created in a programming environment such as Max MSP, Pure Data or Native Instruments Reaktor.
- An analogue electronic instrument

INTRODUCTION

For this assignment, I wanted to create an instrument that I would actually find useful as a music creator. Ideally I wanted to create something bespoke that could sit in my studio and get regular use. I also wanted to create something that I could make together with my young son and involve him in the entire process of making and playing the instrument. When thinking about my instrument I was drawn to making something analogue because, as a musician, I enjoy the experience of playing music and the tactile experience involved with playing an instrument.

I also wanted to build something that would spark creativity within me whenever I used it because at times the process of producing music can become very sterile and uninspiring when you are using sound libraries to drag and drop samples into your music. By creating a process that allows you to play library sounds in real time into your projects, my hope was that it would make the process more inspiring and enjoyable.

RESEARCH

I became interested in how electronic music developed, and in particular Musique Concrète, developed by French composer Pierre Schaeffer in the late 1940s. In an article for Sound Matters, Marc Henshall writes 'The idea behind Musique Concrète is that the composer begins with a set of "concrete" sounds and arranges them into a piece of music. This concept means that the composer is not limited by traditional musical instrumentation and theory. They can, in fact, collect any sound that appeals to them and use it in the realisation of a final piece of music.' (Henshall, 2011)

This approach to making music interests me due to its organic nature, and the fact that each piece of music created is completely unique due to the sounds that have been collected specifically for it. We are now in the Splice generation of music producers - a term named after the popular music sample site. In an interview with Tech Crunch in 2018, Splice founder Steve Martocci said "the percentage of Top 40 music made with our platform blows my mind."

(Constine, 2018) While services like Splice have helped to make it easier for producers to make music, the downside is that we may spend less time making our own music, and more time scrolling through samples that other people have made trying to find the right one. Pop music in particular often sounds homogenous, and it certainly doesn't help when producers are using the same sounds and samples from the same source.

Foley artist, Andrew Hockey when describing the process of using samples in music say this: 'Being a computer musician can often be akin to being a glorified spreadsheet user, activities that help us break out of the technical mindset and push creative thinking should be encouraged.' (Hockey, 2019)

THE INSTRUMENT

After doing my research, I wanted my instrument to achieve three aims:

1. Be useful to the modern producer / Something that I would use in my own home studio
2. Something that could be easily built with my son, and allow for customisation
3. Bring the fun and creativity back into some of the more mundane aspects of producing

What is it?

The instrument I decided to make is an FX Trigger. It is an interactive instrument that I created with my son, that triggers FX sounds when the Lego levers are pressed.

As a modern pop producer, I tend to use a lot of FX samples in my music - these are sounds such as risers, sweeps, impacts, and crashes. Often I will leave these until the end of the song, as it is a fairly mundane task of dragging and dropping samples into the project. I wanted my instrument to bring back some fun and creativity to this process, by giving the user the ability to play the sounds into the project in real time, as if they are being played by an instrument.

Who is it for?

This instrument is aimed at both children and adults looking to explore sounds, by capturing and manipulating them for playback. It is also aimed at music producers who want to add some fun into the process of making music, by adding some playfulness to some of the more regular and mundane processes involved in making music. I also think that the process of building or assembling your own instrument/gear allows you to create a stronger attachment to it and the music made through it. I believe that the building process, along with the customization options available through the use of Lego, helps to spark the creative process of music making and encourage new and unique sounding music to be made.

I approached the creation in three stages:

- Materials
- Sounds
- Software

Materials:

After doing some initial research, I found an idea on a Maker website called MakeyMakey.com. Makey Makey create easy-to-use invention kits initiated by two students at MIT Media Lab. (Silver and Rosenbaum, 2019) By connecting Alligator clips to an object, when you touch that object, the computer thinks you're pressing the keyboard. By mimicking a keyboard and mouse the Makey Makey lets you control any computer program with everyday objects.

The benefit of using a kit like the Makey Makey one, meant that I could combine the kit with any material I wanted to create the trigger. Given that I wanted my project to be both fun, and something I could create with my son, I chose to create the triggers out of Lego. This would allow for both flexibility and customisation in the creation and look of the instrument.

It also meant that I could build a lego case to house the Makey Makey board and the Alligator wires, which would make the instrument easily transportable.

- **Kit List**

- 1 x Makey Makey Board
- 10 x Crocodile Clips
- 1 x Aluminium Tape
- Lego Pieces
- Field Audio Recorder
- SoundPlant Software
- Soundflower Software
- Logic Pro X

Sounds:

After being inspired by Musique Concrète I decided to make field recordings with my son to create some original FX sounds that could be used with the instrument. I felt that it would help to make the process using samples feel more rewarding, if I had created some of those samples myself. I took inspiration from some modern Foley artists, such as Andrew Hockey and Francesco Pellegrin, who use everyday objects to create their own unique sounds and samples. Hockey says of the process: "Spending the time editing your field recordings and categorising them can be tedious but it is worth it, your productions will become more unique to you when you have a library of your own sounds ready to use." (Hockey, 2019)

Software:

The final part of the creation process involved the software needed in order to allow the instrument to be played and recorded into a computer. I found two suitable pieces of software that allow samples to be triggered using the keyboard:

- Soundplant 47
- qwertyGO!

Although qwertyGO! Had some more advanced features, such as the ability to loop and crossfade samples, I decided to use Soundplant as it was a free and I wanted to see what I could achieve on as small a budget as possible.

As well as software to trigger the samples, additional software was required in order to route the audio from Soundplant into Logic, in order to enable the samples to be recorded live.

Unfortunately the Mac OS does not make it easy to route audio internally between software programs, but help came in the form of Soundflower. This is an open source kernel extension for MacOS, designed to create a virtual audio output device that can also act as an input.

Fortunately it's author Matt Ingalls has made it available for free on GitHub, which again was helpful in keeping the project affordable. (Ingalls, 2019)

BUILD PROCESS

The build process was fairly straightforward. The main challenges involved making sure I had enough Lego pieces to build the kind of trigger keys and case that I wanted, and then coming up with ideas for our own foley recordings.

The build process was broken up into 8 Steps:

1. Create Lego base and keys

This involved creating weighted keys that would return back to an unpressed position after being pressed. I chose to make only three keys for sake of simplicity and space. I also labeled each key with the type of FX sound it would make. These labels can easily be removed and replaced with a different label / sound.

2. Connect to Makey Makey Board

Makey Makey is a printed circuit board which uses closed switches on digital input pins. In order to close the switch for each key I needed to use aluminium tape to make a connection when each key was pressed. I used alligator clips to connect to each key, as well as an earth. These clips were then connected to three of the inputs on the front of the board - the 'left', 'up', and 'down' keys.

3. Test using Piano app

In order to test the connections and make sure the keys were working, I plugged the Makey Makey into a computer via USB. I then loaded up the free Makey Makey piano app on their website to test the keys were working.

4. Collect field samples

I wanted to create some original samples with my son using materials and objects that we had in our house. The most commonly used FX samples that I use are reverses, crashes, and risers. To create a crash sound, we used a saucepan and some bolts which were dropped into the saucepan. To create the reverse sound, we captured the sound of a stick being swung rapidly through the air. Finally, to create a riser sound we ran our fingers along the teeth of a comb. All of these we recorded in my home studio using a microphone.

5. Edit samples in Logic

After capturing the samples, I imported them into Logic on my Mac and started manipulating them by pitching shifting, reversing, distorting, and adding reverb to them. I then exported each sample separately as a WAV file.

6. Load and test samples in SoundPlant

After creating the samples, I opened the SoundPlant software and simply dragged each sample onto the keys that corresponded to the correct inputs on the Makey Makey board (left, up, down). I then tested that each sample was working by pressing each Lego key trigger.

7. Route SoundPlant into Logic via Soundflower

Perhaps the trickiest part of the entire process was routing the sounds from SoundPlant into Logic so that they could be recorded into projects. Soundflower allows you to route all of your system audio through it. In Logic you can then select Soundflower as your audio input, allowing you to record any sounds being played on your mac.

8. Play and record FX samples realtime into Logic project/song

The final step is to set up a new audio track in Logic that is set to record the audio from SoundPlant (via Soundflower).

PROBLEMS ENCOUNTERED

Although the build process was fairly straightforward, there were a few problems encountered along the way.

One of main issues was establishing a solid connection between the keys and the circuit. I overcame this by playing around with the angle that the key made contact with the base so that a solid connection could be established. Even so, the keys still need to be pressed quite firmly in order to make a clean connection.

Another problem was that the alligator clips kept coming loose from their connection points due to the fact that the makey makey board was loosely placed behind the triggers. The solution to this was to build a separate housing unit specifically for the makey makey circuit board behind

the triggers. By doing this I was able to prevent the board from moving, and also secure all of the wires to prevent them being pulled loose. It also had the added bonus of making the unit more aesthetically pleasing.

As mentioned in the build process, a big problem that I encountered was getting the sound samples to play directly into Logic so that they could be recorded in real time. Initially I had hoped that SoundPlant would allow for a direct connection, but unfortunately it didn't and therefore I had to bridge the gap using another piece of software called Soundflower. By playing around with the inputs and outputs on SoundPlant, Soundflower, and Logic, I was eventually able to make it work. However, it was not straightforward and didn't always work first time. Also, occasionally you would hear the sample sound twice due to the fact that it was playing out of both SoundPlant and Logic. I didn't feel that I was able to come up with a satisfactory solution to make sure that recording into Logic was a simple and foolproof process, which is definitely something that will need to be worked on and improved.

The final problem was that the samples only triggered when the SoundPlant app was the active window/program on the Mac desktop. This created a problem when using Logic as it required the user to start recording in Logic first, and then switch over to the SoundPlant app in order for the samples to be triggered. Although not a huge problem, it runs counterintuitively to how I normally record in Logic, and therefore was something that I kept forgetting to do which meant I kept wondering why the sounds weren't triggering.

USER TESTING

I did some user testing with my 8 year old son, and with a music producer friend, in order to highlight problems and find suggestions for improvement.

Child - Dylan Read

Dylan was involved in the creation of the instrument so it was interesting to see how he handled that process. Perhaps unsurprisingly, the Lego part interested him much more than the circuitry aspect. Making the aluminium tape connection points was also a bit too intricate a task for him, and required an adult to do most of it.

During the actual testing of the instrument, Dylan did not always press the keys hard enough, which meant that they didn't always trigger a sound. To counter this he tried pressing them much harder which sometimes meant it would unintentionally trigger the sample multiple times in succession.

Producer - Henry Thomson

Henry is an experienced producer so I wanted to see how he would handle setting the instrument up using the basic instructions and signal flow given to him. As expected the area he struggled most with was routing the audio from SoundPlant into Logic. After a few Google searches he was able to get it to work and could record the audio samples directly into Logic.

I asked Henry a series of questions regarding the instrument and asked him to score the instrument:

Questions	Score (1 = Lowest, 5 = Highest)
How easy was the instrument to set up?	3
How easy was the instrument to use?	4
How fun was the instrument to use?	5
How would you rate the appearance?	5
Would you buy this as a product?	3
Would you use this in your studio?	4
Would you make your own samples?	2

Henry remarked that he loved the idea behind the idea, and really liked the use of Lego as a material. He also really liked the concept of having a dedicated instrument for FX samples and he felt it was something he would use. His main criticism was that, in its current format, it was too complicated to record into Logic, and because of this he would probably end up just dragging samples into his projects as it would be quicker and less hassle that trying to make sure all the audio was routed correctly.

On observation, Henry also struggled with switching between Logic and SoundPlant when recording, and even after I explained that SoundPlant needed to be the active window in order to trigger the sounds, he kept forgetting to switch out of Logic when recording. This is clearly a problem that needs addressing.

Finally, Henry commented that he was unlikely to make his own samples due to the fact that there are already so many samples readily available to him, and he didn't have time to create his own. This is a valid point, and highlights that there is a balance to be struck between creativity and productivity.

REFLECTION ON RESULTS

At the beginning I said I wanted my instrument to achieve three aims. Have these aims been achieved?

1. Be useful to the modern producer / Something that I would use in my own home studio

Both in my own personal testing, and with Henry, the instrument was found to be useful and something that, with development, could find its place in a studio. On reflection the instrument was larger than I had initially imagined. Ideally I would like something small that could sit on my

desk and not take up too much room. If I were to make it again, I would redesign the triggers and Makey Makey board to sit in a much more compact way.

Also, for the instrument to be considered truly useful, it should simplify the process of using FX samples in music creation. However in its current format, the routing is too complicated and temperamental, which creates a barrier to creativity rather than removing it. This is something that needs to be addressed moving forward.

2. Something that could be easily built with my son, and allow for customisation

The build process was certainly the easiest part of the project, and one that I was able to achieve with my son. The choice of both the Makey Makey circuit board and Lego meant that the it was not a complicated build, however in order to achieve some of my other aims, it may be necessary to look at using a different circuit.

The Lego was certainly the right choice of material to use as a base and housing for the instrument. It allowed for more flexibility and customisation than I had initially expected. For example, I was able to house the Makey Makey board and cables using Lego, and I was also able to create custom label blocks that could be switched out when changing sounds on each trigger key.

3. Bring the fun and creativity back into some of the more mundane aspects of producing

This was probably the most successful part of the project. Creating the instrument out of Lego proved to be a lot more fun, and rewarding than I had anticipating. So much so that I kept going back and refining parts of the design. My son came up with a great idea to spell out the letters "FX" on the top of the unit, which added a nice touch to the overall design.

Creating the foley samples using field recordings also proved to be one of the most enjoyable parts of the process. Looking around for objects that you wouldn't normally associate with music, and seeing what sounds they made definitely helped to bring out my creativity. Editing the samples in Logic was also fun as there was almost limitless options in how the sounds could be manipulated, which again fostered a playful and exploratory approach to making the samples.

Finally, aside from the slight frustrations involved in routing the sound into Logic, it definitely did feel more rewarding and fun to play the FX samples into a song in real time. Anticipating the timing and when each trigger needed to be played was challenging in the same way that playing a real instrument is. Also, playing multiple sounds in at once yielded different results than you would get simply by dragging samples into a song.

FUTURE IMPROVEMENTS AND DEVELOPMENT

To develop this instrument further I would like to make the following improvements:

1. Improve the physical design

I'd like to make the overall instrument smaller so that it takes up less space in a studio or on a work desk. I would also improve the key triggers so that they establish a clear connection each time they are pressed. This could be done by using foam pads to increase the connection area.

2. Create a base unit that houses an audio output jack and SD Card Slot

To overcome the problem of routing the audio into Logic I would look at creating a base unit that houses an audio output jack, so that the audio signal could be run directly into an audio interface and recorded into Logic. I would also like the ability to load samples directly into the instrument using an SD card. This would require changing the circuit board to something that could contain both an SD card slot and an audio out port, such as an Arduino board, running IDE software.

The base unit could be sold as part of a kit that would then allow you to build the Lego triggers directly onto the base, so as to still allow for customisation and creativity.

Future Ideas

If I wanted to take this a step further, it could be developed to allow for real time manipulation of samples as they are played. For example you could add volume, expression, and reverb controls so that the samples can be affected allowing for greater customization of the sounds.

You could also further develop it as a stand alone instrument that contained an internal speaker so that users can playback sounds without the need to plug it into a computer. Samples could be loaded and changed using a micro SD card.

Commercial Potential

I think that this idea has potential as a commercially viable product, particularly one that is marketed at children. It could be sold as a customisable kit that you assemble yourself and customise via the lego blocks. The integration of an internal speaker, output jack, and SD card slot would be particularly helpful for the children's market where they may not have access to a computer.

Companies like Nintendo have had recent success with their Labo series of DIY kits aimed at children and created to work with the Nintendo Switch. Labo developer, Mr Sakaguchi said 'I have always enjoyed thinking about interfaces, and I've always wanted to make things that you can interact with.' (Sakaguchi, 2018) I think that this is the type of project that Lego could be interested in collaborating on to develop a Lego branded kit that allows for a range of creative uses, including a sound FX trigger.

Although I do believe this instrument would also be attractive to music producers, there are already other products on the market that allow you to easily trigger samples directly into your DAW, so it may not be as commercially viable due to the competition already available.

COMPARISON TO EXISTING INSTRUMENTS / PRODUCTS

One of my main influences is ROLI, a company that makes instruments that allow musicians to be much more expressive, with more sounds and effects at their fingertips, than they've ever had before. They help to bridge the gap between the digital world of samples and the analogue world of playable instruments. Their hardware allows the user to manipulate sounds and samples in an expressive and tactile way. Roli have created a Blocks system that fit together magnetically, and allow you to manipulate sounds and samples directly into your computer using MIDI. (Lamb, 2019)

The main point of difference between my instrument and Roli blocks, is that the blocks come pre-built and are not customisable, whereas one of the main features of the Lego FX Trigger is the fact that, not only do you build it yourself, but you can customise the way it looks and add your own flair and design to it using the Lego system.

There are also a range of Foley sample packs currently on the market that have been recorded and edited excellently. One of the best packs is called Look Mum No Drums by Francesco Pellegrin. By listening to what was around him and paying attention to what was in front of him. He soon realized anything could be a musical instrument if he listened well. (Pellegrin, 2019) However, these packs all come as standalone samples which require the user to input them into their music in some way. The Lego FX Trigger could make an excellent companion for these sound packs.

SUMMARY

In summary, the project was a success and the all the aims were achieved to varying degrees. There is scope to develop the instrument and make improvements, however even in its current form it remains a fun project that could be built easily and is versatile enough for use in both recreational and professional settings.

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