

Creative Making: Experience and Physical Computing Portfolio

Creative Work – LaunchPad and sound visualiser

Phase 1 - Background, inspiration and research

I found that music is probably my second biggest interest after computing so I wanted to do a music based project. In this section, Im just going to go over all the background research done for preparing myself for my own piece of work.

The first interesting project I looked at was this popular youtube video where a person had made a launchpad out of coke cans to recreate the sounds of a piano using an Arduino mega and a python script with the PyAudio library. The hardware was made up of lots of transistors so when the coke can is touched it activates the transistors which through the python script plays a .wav file that has the specific piano key sound attached. This opened up my mind to possibly doing a music based project and found extremely cool and creative.

<https://youtu.be/Ttm62RBdOuo>

The next video I found was a person making a Arduino MIDI controller using a DIY MIDI casing with twelve push buttons and digital controls that when pressed the serial connection converts the the movement into MIDI instructions on the software to play a MIDI note. I thought this was an amazing project that really showed the type of great music projects that could be made with an Arduino but I thought this

project had a lot of software and physical hardware needed so I simply just took it as inspiration.

<https://youtu.be/TdUmoSTvW14>

This video is what I watch after which is a DIY Novation launchpad which this project is fairly similar to the first, its a simply launchpad that a recreation of the infamous novation launchpad. I decided that I wanted to create a project similar to this.

<https://youtu.be/EzsMiBHFF0E>

I then came across a Arduino music visualiser tutorial that basically just converts the sounds from music played into a mini LED light show. I thought this would be a great additional to the project that I wanted to do.

<https://youtu.be/Af74A0Tx-wA>

I went and did some in depth research into my favourite electronic based albums due to wanting to understand the great connection between electronics and music even further and since I want to include a music visualiser, I wanted to expand on the visual ambience that electronic music can create.



Aphex Twin Selected Ambient Works 85-92

Selected Ambient Works 85-92



Aphex Twin Recording

Selected Ambient Works 85–92 is the debut studio album by British electronic musician Richard D. James as known as Aphex Twin. Richard began his interest in music from a young age where he would produce music using a ZX sampler and began reassembling and modifying his own synthesisers which would produce unheard of sounds at the time which would then birth a new world of music known as the IDM genre. He began recording his work through the years of 1985 to 1992. During this time he would then succeed as a techno DJ while studying an electronics course in London in 1991 (later dropping out). The reason why Selected ambient works was such an iconic electronic album was the fact it was created entirely with sounds that he made himself with different equipment instead of sampling like the 90's electronic scene mainly consisted of. This album went onto inspiring many musicians from Radiohead to Björk to Kanye West. In terms of the visualisation of the album, it creates a rollercoaster effect of waves and emotions, from dark & horror like tracks e.g. 'come to daddy' and 'windowlicker' to amazing piano pieces e.g. 'avr14th', what made the album so great is that it combined all the electronic genres and sounds together creating a completely new expanded experience and feelings.



J Dilla - Donuts

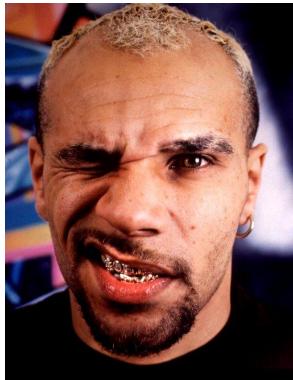


Grand Wizard Theodore

Donuts is the second studio album by the American hip-hop producer J Dilla, released on February 7th 2006. Hip Hop as a genre has always had a huge connection with experimenting with electronics with the start of the hip hop movement coming from DJ Kool Herc who would play two copies of the same record on two turntables in alternation, and at the point where a track featured a break. This technique was further used to manually loop a purely percussive break, leading to what was later called a break beat. This would later go on to create the art of turntablism which this art form would then influence the invention of the direct drive turn table Technics SL-1100 created by Shuichi Obata an engineer who worked at the company now known as Panasonic, in 1972. Donuts is an instrumental Hip-Hop album that was made while J Dilla was in hospital, and released on the day of his 32nd birthday and three days before his death. What makes Donuts such an amazing album was unlike most hip hop albums that used a lot of samples and instruments with jam packed vocals, it introduced the idea of extremely short and minimalist sampled sounds in Hip hop. The album also starts with an outro and ends with an intro and the ending of the final track is an infinite loop which signifies the donut concept of the name of the album. The sweet and blissful and minimal jazz samples on this album created a nostalgic and memorable effect for J Dilla's Ironic final project.



Goldie - Timeless



Goldie



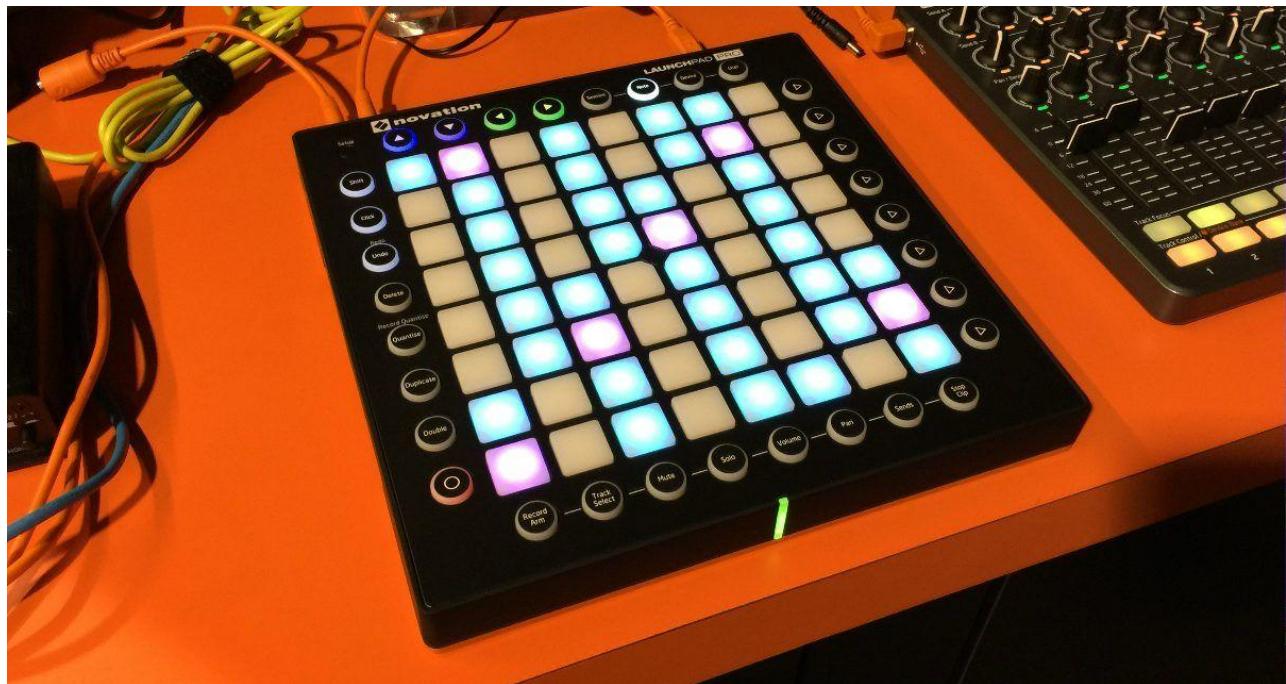
Jungle and drum'n'bass history

The last album I looked into was *Timeless* by Goldie released on July 31st 1995. Goldie is a British DJ and his single 'inner city life' off the album *timeless* became the mainstream hit and representative for the new and fresh electronic UK genre known as 'Jungle'. Jungle music was birthed from the UK rave scene and Reggae sound system culture in 1990s. Goldie's music has been described as ghetto blue ballads 'a yearning reverie of sanctuary from inner-city pressure. Rupert Howe from Muzik stated about Goldie's *Timeless* single "This is a masterpiece of melancholy, with all the dark/light, bass/melody contrasts in jungle thrown into kaleidoscopic relief. The spectral strings move disturbingly in and out of focus, the low frequencies seem to open up underneath you, and the eerie mutations of Diane Charlemagne's vocals float in the ether, utterly lost in space. Emotionally, it's all over the place - joyful one minute, intense enough to suck the daylight out of you the next. Anything to make you feel more alive." Goldies music and jungle music in general, expresses the hardship from England's working class culture as well as the busy inner city life simply through electronic music and gives off a dark & gritty effect through the fast tempo and deep base lines.

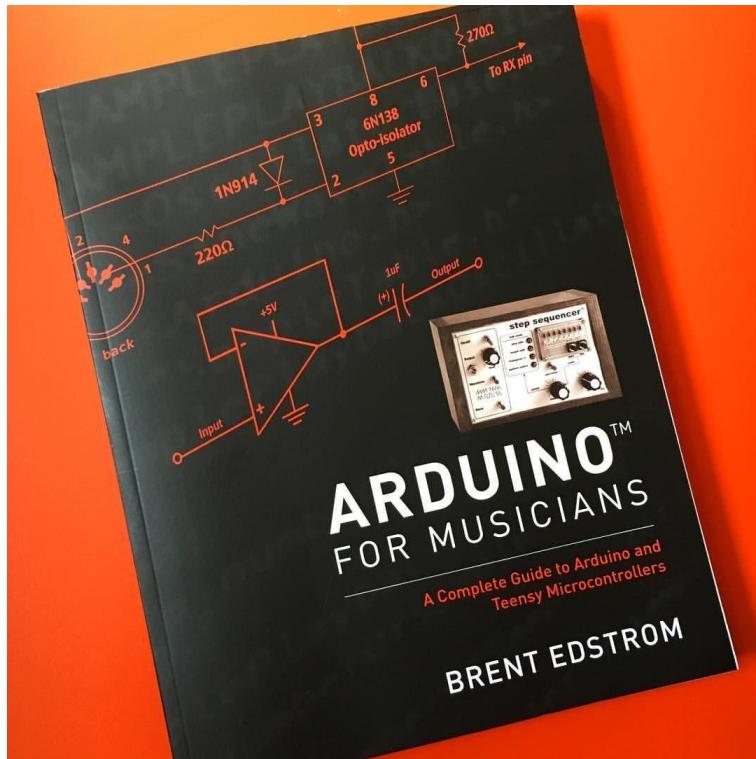
Since I want my project to be a similar to the Novation LaunchPad, I did some background research into that device as well. The Novation Launchpad was originally released in 2009 with 8x8 grid that could be used to trigger sounds, loops, effects and other parameters, it also could be used with the Ableton software for live performances and in its first year of production as mainly used for Ableton users to gain manual control over their Live Sets. The launchpad is famouly known now as a performance instrument where many people will cover popular electronic songs on

youtube with it, but this wasn't until Youtube user and French artist 'Madeon' uploaded his video titled 'Pop culture (live mashup)' on July 11th 2011 which he arranged samples from 39 songs and created one of the best mashups with the use of the Novation Launchpad and the video began a viral sensation. Now launchpad light shows became a normal artistic creation and performances are made on youtube till this day.

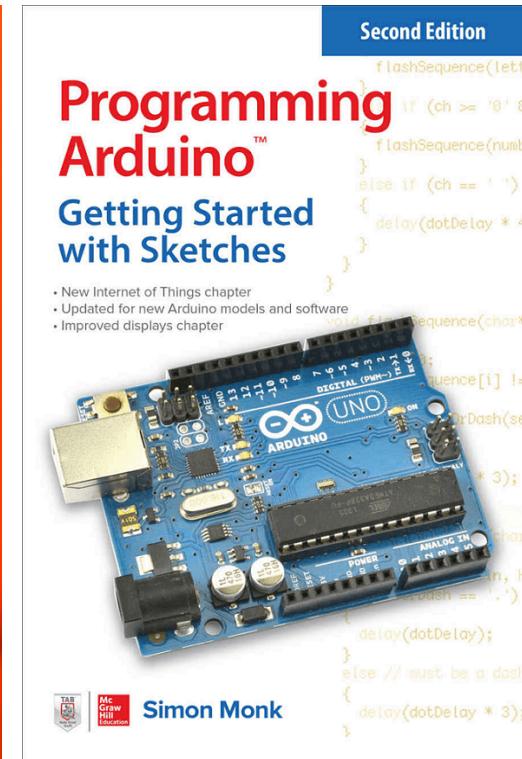
<https://youtu.be/ITx3G6h2xyA>



Novation Launchpad Pro



Arduino for musicians



Programming Arduino

I also looked at some books to also gain some knowledge on the topic. I looked at Arduino for musicians by Brent Edstrom and published in 2016, the book went over a bunch of creative and limitless projects and opportunities for musicians who want experiments with Arduino's, it also goes over different concepts that include circuitry and programming, its super informative and accessible for musicians and other people who just enjoy music technology. The last book I looked at is the programming Arduino by Simon Monk in 2016 simply to refresh my memory on the updated Arduino features, the book just goes over the how to program the Arduino with significant amount sketches and examples.

Phase 2 - Proposal and planning

Due to personal circumstances surrounding covid, I knew that I wasn't physically going to be able to make my project at this point in time but I've as much effort in to thoroughly planning and building an idea of what my project will consist of, so I could physically make it in the near future.

Proposal - A launchpad device combined with a sound visualiser using the Processing software. Visualiser imagery and launchpad sounds will be dedicated to the album Untrue by burial.

Burial's 2005 album untrue is known as one of the most groundbreaking and game changing albums for the electronic music scene. Untrue is loved by many non-electronic music fans because it's an album that has an aura of isolation and abandonment that feels so visual and that anyone can relate to. The album has a large roaster of themes relating to inner city London life in the early 2000's, with the huge UK rave scene being completely dead, the economy being in shambles, and the emotional turmoil that came with this. The concept of hauntology is one of the backbones to this album expressing the bleak modern urban life that capitalism has provided for us. The album has very unique ways of sampling such as taking sounds from the video game metal gear solid and taking smalls snippets from RnB songs that had disheartening lyric and pitch shifting it until it was unrecognisable with a distant spectral quality giving the album a sense of abandonment and lostness. This album went onto influence many electronic artist like How to Dress Well and James Blake. The reason I choose this album to be dedicated to my project is because of how visually compelling the album is, burial in a one of interview stated how connected to South London the album is. I thought this would be a good subject for the visual project.

Wire: One of the greatest things about your music is the sense of place, and it's so specific to South London. When I first heard it, I lived in South London and as I listened to the LP walking around, it was a perfect fit.

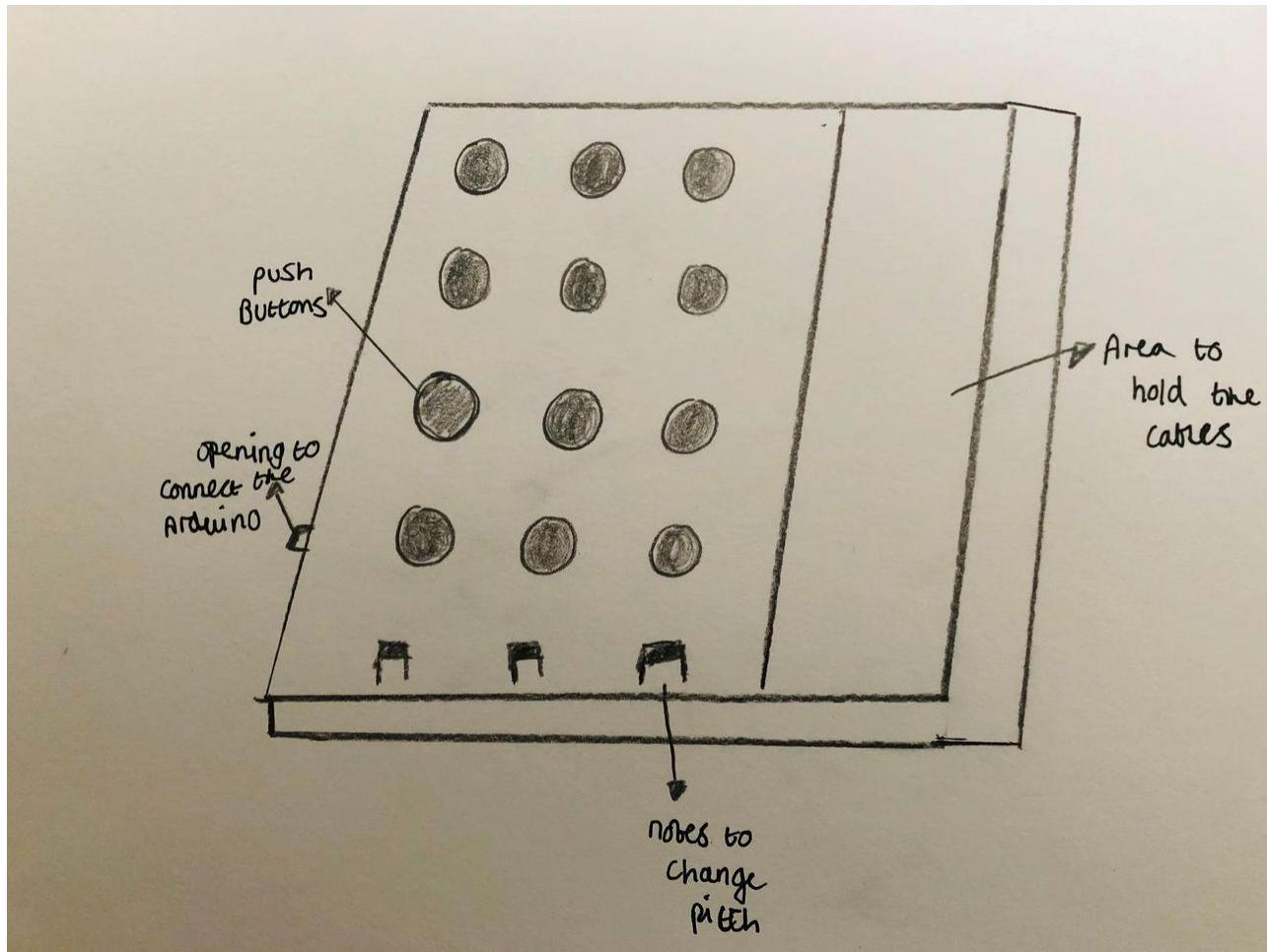
Burial: Thanks for saying that. I spend a lot of time wandering around London, I always have. Sometimes it's because I've got somewhere to go, sometimes it's because I haven't got anywhere to go. So I'd be wandering endlessly, getting in places. Being on your own listening to headphones is not a million miles away from being in a club surrounded by people, you let it in, you're more open to it. Sometimes you get that feeling like a ghost touched your heart, like someone walks with you. In London, there's a kind of atmosphere that everyone knows about but if you talk about it, it just sort of disappears. London's part of me, I'm proud of it but it can be dark, sometimes recently I don't even recognize it.

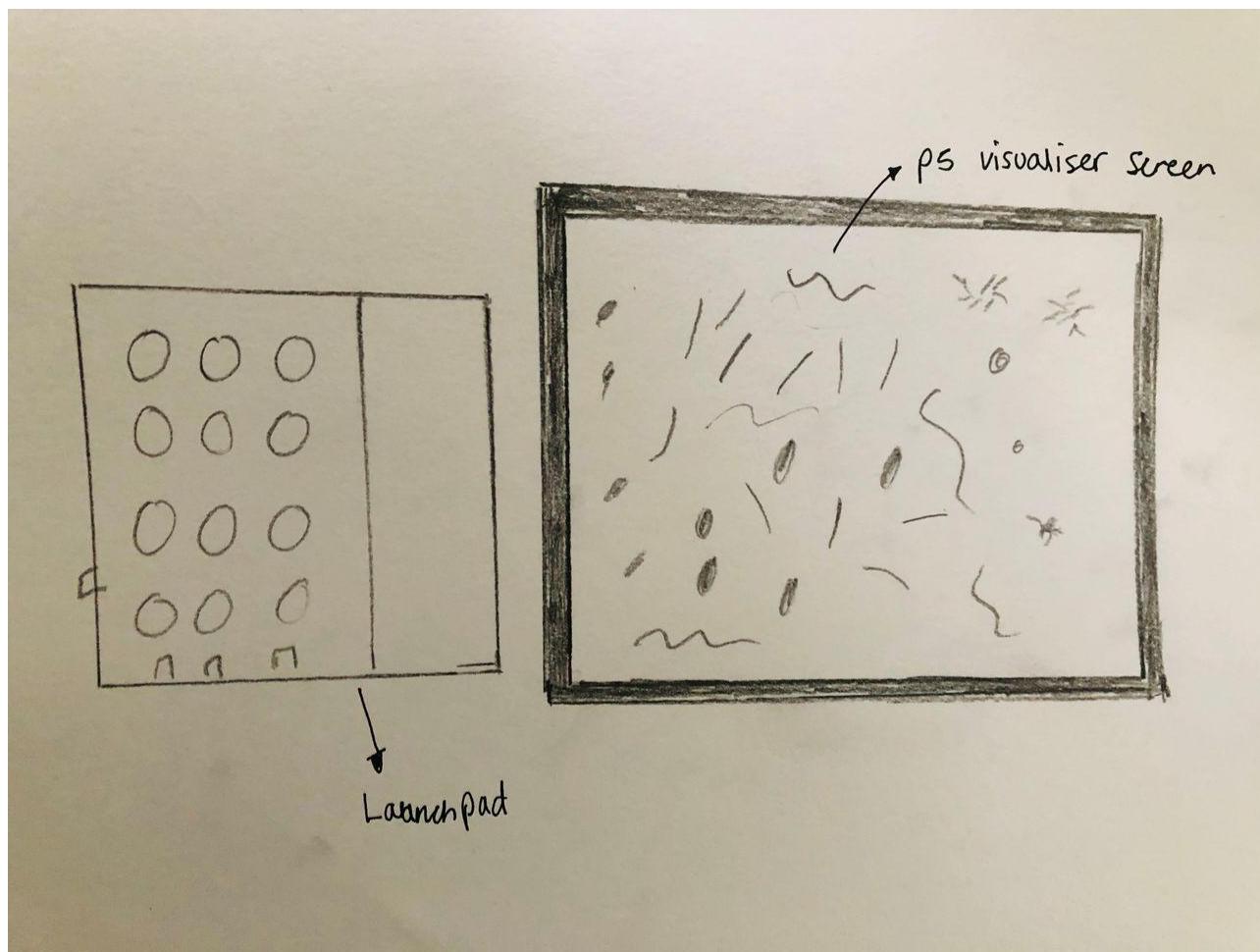
Wire: Your music is very visual. I suppose that's partly the influence of films? You've talked about that sound from 'Alien' being one of your favourite sounds.

Burial: The motion tracker, yeah, and the dropship, the sentry guns. My big brother would play that sound to me when I was little, and tell me the stories from the film. He recorded it on a tape. He would tell me about that motion tracker sound, and 'Alien' and 'Aliens' are some of the scariest films. But he would only show me the bit where they were loading up the weapons, but he'd say, 'you're too young, I won't show you the rest, but I'll tell you about it'. I love the sound of the motion tracker, you can feel the fear of the empty spaces ahead, it's like sonar. I like Blade Runner but I'm only obsessed with one scene in it, the bit where he's sitting at those cafes in the rain. I love rain, like being out in it. Sometimes you just go out in the cold, there's a light in the rain, and you've got this little haven, and you're hanging round like a moth – I love moths too and that's why I love that scene.



Burial - Untrue





Equipment

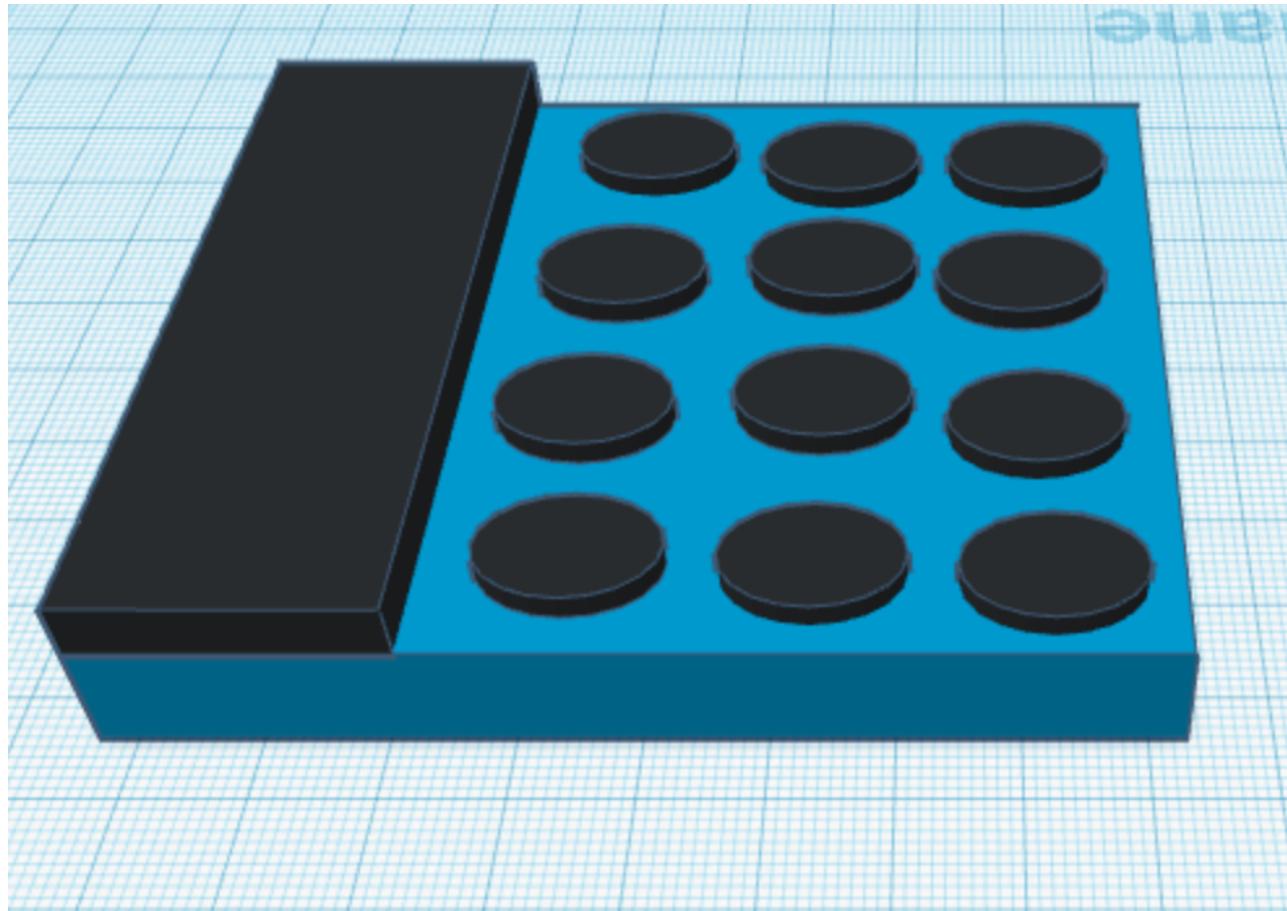
- PCB board
- Males headers
- Shift Register
- Push buttons
- Potentiometer

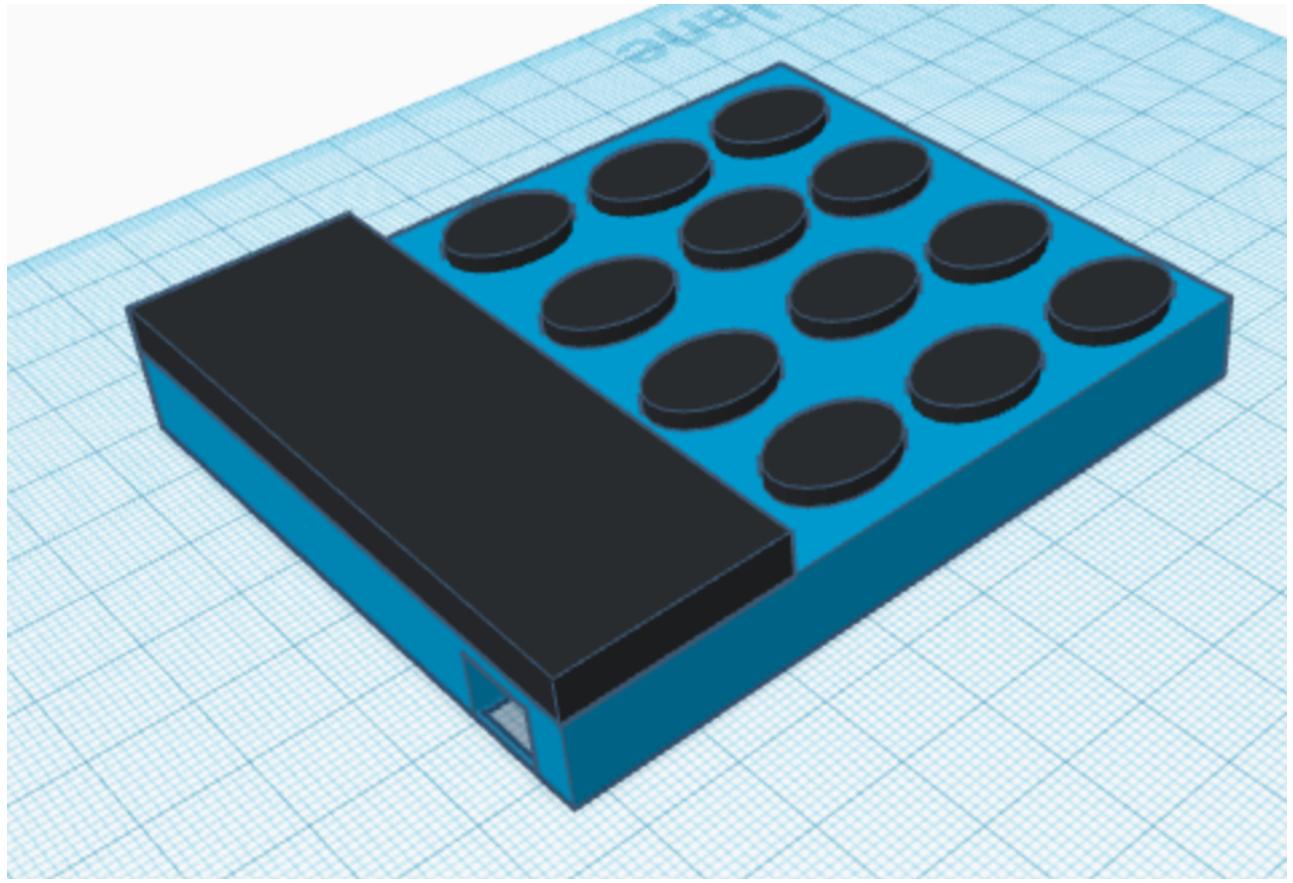
I was going to use a Potentiometer to control the audio on the launchpad by decided that was not a necessary feature.

Phase 3 - Casing development (TinkerCAD)

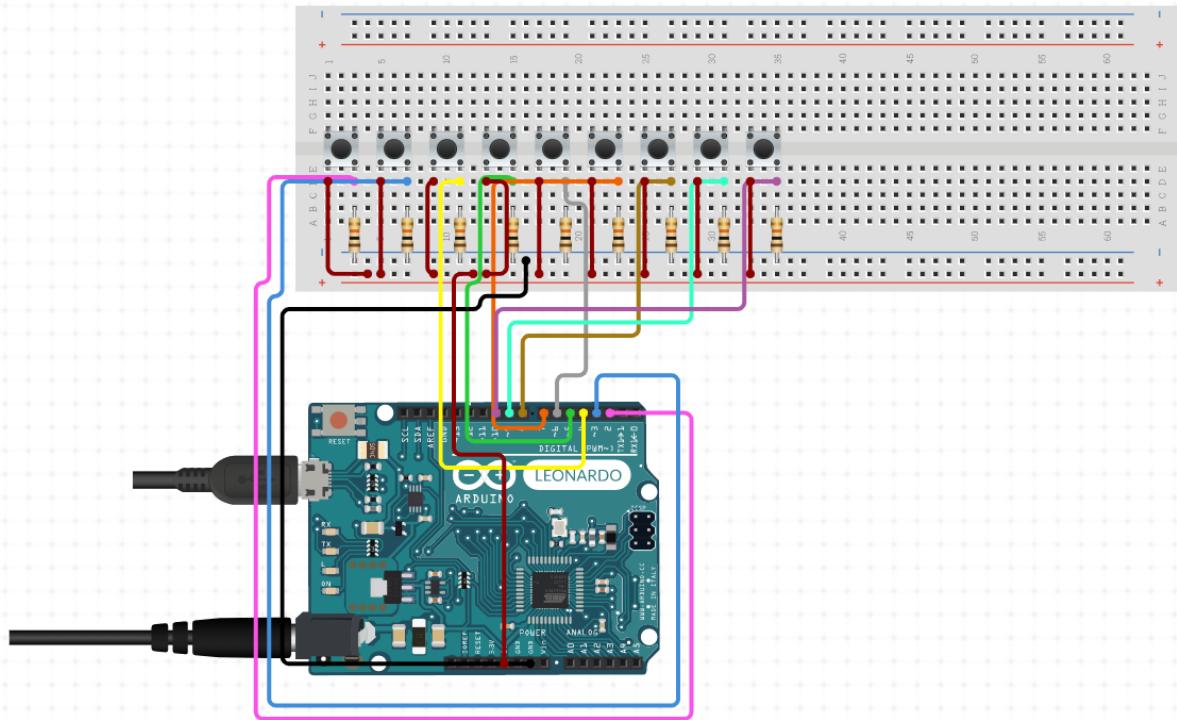
I designed a simple launchpad casing on TinkerCAD with 12 buttons, area for the board and a opening for the usb connection.

TinkerCAD - [https://www.tinkercad.com/things/22CGD0dyBnY-shardai-launchpad-casing/edit?
sharecode=OAqkZGBzsZtgcv9lcKNvrfp0BeMAUmdjbaJPitgkfYI](https://www.tinkercad.com/things/22CGD0dyBnY-shardai-launchpad-casing/edit?sharecode=OAqkZGBzsZtgcv9lcKNvrfp0BeMAUmdjbaJPitgkfYI)





Phase 4 - The project development



Again I didn't have an Arduino so I could actually test code but below is a piece of code written by a programmer named Ben Saltman who made a similar project. This is something similar to what I personal what to produce.

```
/pin values must be altered to match the
//pins you plug headers into.
```

```
int columnOne = 2;
int columnTwo = 3;
int columnThree = 6;
int columnFour = 7;
int rowOne = 10;
int rowTwo = 9;
int rowThree = 12;
```

```
float loopPotent = 0;
float loopCurrent = 0;

int samplePotent = 0;
boolean sampleFlag = 0;

int switchData = A4;
int switchLatch = A0;
int switchClock = A5;

//Data to be shifted into shiftRegister
byte shiftData = B00000000;

//Byte masks
byte oneLightMask = B01000000;
byte twoLightMask = B01010000;
byte threeLightMask = B01010010;

byte sampleOneMask = B10000000;
byte sampleTwoMask = B00000001;

//Initializing button states
boolean button1Previous = false;
boolean button1Current = false;

boolean button2Previous = false;
boolean button2Current = false;
```

```
boolean button3Previous = false;
boolean button3Current = false;

boolean button4Previous = false;
boolean button4Current = false;

boolean button5Previous = false;
boolean button5Current = false;

boolean button6Previous = false;
boolean button6Current = false;

boolean button7Previous = false;
boolean button7Current = false;

boolean button8Previous = false;
boolean button8Current = false;

boolean button9Previous = false;
boolean button9Current = false;

boolean button10Previous = false;
boolean button10Current = false;

boolean button11Previous = false;
boolean button11Current = false;

boolean button12Previous = false;
boolean button12Current = false;
```

```
void setup() {  
    // put your setup code here, to run once:  
    pinMode(2,OUTPUT);  
    pinMode(3,OUTPUT);  
    pinMode(6,OUTPUT);  
    pinMode(7,OUTPUT);  
  
    pinMode(10, INPUT);  
    pinMode(12,INPUT);  
    pinMode(9,INPUT);  
  
    pinMode(A1, INPUT);  
    pinMode(A2, INPUT);  
  
    pinMode(A4,OUTPUT);  
    pinMode(A5, OUTPUT);  
    pinMode(A0, OUTPUT);  
  
    Serial.begin(9600);  
}  
  
void loop() {  
    //Cycles through all columns and for each column reads all rows  
    //Serial communicates the current state of each button.  
    //Column one Powered  
    digitalWrite(columnOne,HIGH);
```

```
if(digitalRead(rowOne) == HIGH){
    button1Current = true;
}
else{
    button1Current = false;
}

if((button1Previous == false) && (button1Current == true)){
    Serial.println("button1");
}

if(digitalRead(rowTwo) == HIGH){
    button2Current = true;
}
else{
    button2Current = false;
}

if((button2Previous == false) && (button2Current == true)){
    Serial.println("button2");
}

if(digitalRead(rowThree) == HIGH){
    button3Current = true;
}
else{
    button3Current = false;
}

if((button3Previous == false) && (button3Current == true))
{
    Serial.println("button3");
}
```

```
//Column One unpowered
digitalWrite(columnOne,LOW);

//Column Two powered
digitalWrite(columnTwo,HIGH);
if(digitalRead(rowOne) == HIGH){
    button4Current = true;
}
else{
    button4Current = false;
}
if((button4Previous == false) && (button4Current == true)){
    Serial.println("button4");
}

if(digitalRead(rowTwo) == HIGH){
    button5Current = true;
}
else{
    button5Current = false;
}
if((button5Previous == false) && (button5Current == true)){
    Serial.println("button5");
}

if(digitalRead(rowThree) == HIGH){
    button6Current = true;
}
else{
    button6Current = false;
```

```
}

    if((button6Previous == false) && (button6Current == true))
{
    Serial.println("button6");
}

//Column Two unpowered
digitalWrite(columnTwo,LOW);

//Column Three Powered
digitalWrite(columnThree,HIGH);
if(digitalRead(rowOne) == HIGH){
    button7Current = true;
}
else{
    button7Current = false;
}
if((button7Previous == false) && (button7Current == true)){
    Serial.println("button7");
}

if(digitalRead(rowTwo) == HIGH){
    button8Current = true;
}
else{
    button8Current = false;
}
if((button8Previous == false) && (button8Current == true)){
    Serial.println("button8");
}
if(digitalRead(rowThree) == HIGH){
```

```
    button9Current = true;
}
else{
    button9Current = false;
}
if((button9Previous == false) && (button9Current == true))
{
    Serial.println("button9");
}

//Column Three unpowered
digitalWrite(columnThree,LOW);

//Column four powered
digitalWrite(columnFour,HIGH);
if(digitalRead(rowOne) == HIGH){
    button10Current = true;
}
else{
    button10Current = false;
}
if((button10Previous == false) && (button10Current == true))
{
    Serial.println("button10");
}

if(digitalRead(rowTwo) == HIGH){
    button11Current = true;
}
else{
    button11Current = false;
```

```
        }

    if((button11Previous == false) && (button11Current == true))
{
    Serial.println("button11");
}

    if(digitalRead(rowThree) == HIGH){
        button12Current = true;
    }
    else{
        button12Current = false;
    }

    if((button12Previous == false) && (button12Current == true)){
        Serial.println("button12");
    }

//Column Four unpowered
digitalWrite(columnFour,LOW);

//Takes in the current value of each Potentiometer
loopPotent = analogRead(A1);
samplePotent = analogRead(A2);

//Sets the flag to current sample set based on potentiometer
readings

//Serial communicates the value
if((samplePotent > 550) && (sampleFlag == 0)){
    Serial.println("sampleChange");
    sampleFlag = 1;
}

if((samplePotent < 500) && (sampleFlag == 1)){
    Serial.println("sampleChange");
```

```
    sampleFlag = 0;
}

//Serial prints the number of loops based on potentiometer reading
if(loopPotent > loopCurrent + 25 || loopPotent < loopCurrent - 25){
    loopCurrent = loopPotent;
    Serial.print("l");
    Serial.println(map(loopCurrent, 0, 1023,1,25));
}

//Alters the shiftData byte to be passed into the shiftRegister
//By utilizing bitmasks
if(sampleFlag == 0){
    shiftData = shiftData | sampleOneMask;
}
if(sampleFlag == 1){
    shiftData = shiftData | sampleTwoMask;
}
if(loopCurrent < 341){
    shiftData = shiftData | oneLightMask;
}
else if(loopCurrent < 682){
    shiftData = shiftData | twoLightMask;
}
else{
    shiftData = shiftData | threeLightMask;
}
```

```
//Passes byte to shift register
digitalWrite(switchLatch, LOW);

shiftOut(switchData,switchClock,MSBFIRST, shiftData);

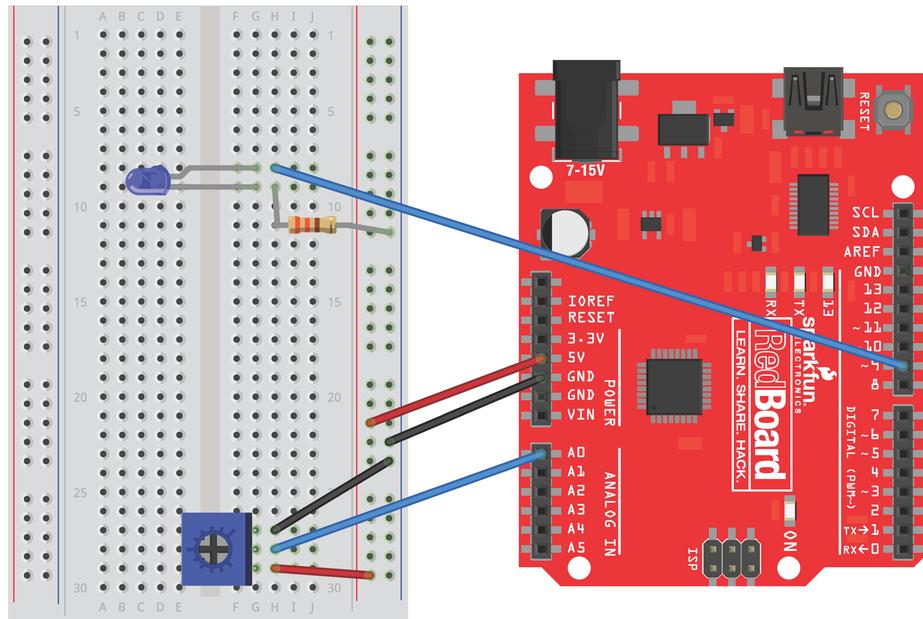
digitalWrite(switchLatch, HIGH);

//resets shiftData
shiftData = B00000000;
// Sets the previous state of each button to its current.
button1Previous = button1Current;
button2Previous = button2Current;
button3Previous = button3Current;
button4Previous = button4Current;
button5Previous = button5Current;
button6Previous = button6Current;

button7Previous = button7Current;
button8Previous = button8Current;
button9Previous = button9Current;
button10Previous = button10Current;
button11Previous = button11Current;
button12Previous = button12Current;

}
```

I tried to figure the way to connect an arduino to p5.js so you could interact with one another and below is the resources I got it from.

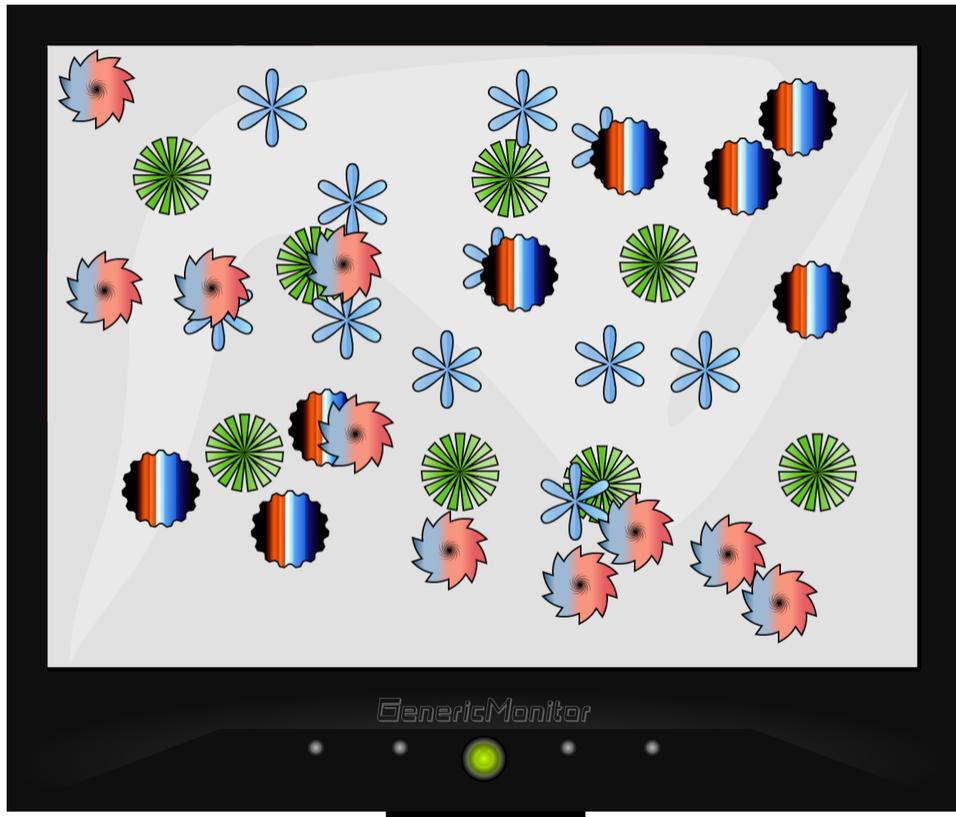


fritzing

<https://medium.com/@yyyyyyuan/tutorial-serial-communication-with-arduino-and-p5-js-cd39b3ac10ce>

 Tutorial: Serial Communication with Arduino and p5.js • medium.com

Below I included a sketchpad sketch of what I wanted the visualiser to look like, so basically when I click on the launchpad buttons a certain shape appears of the screen in the related ways of the burial album concept. I originally was going to complete the visual side of the project in processing but decided that p5.js would be a better fit.



Below are two videos that I looked at for inspiration when thinking about the visualisation part of the project. The first video is just a coding train going over how to make sound visualisation in p5.js and the second video is a random person demonstrating their Arduino Launchpad with a processing sound visualiser which is very similar to what I wanted to execute.

<https://youtu.be/2O3nm0Nvbi4>

<https://youtu.be/ejOXtTidpFM>

The ideal plan for this project part was to essentially to press the launchpad buttons and small snippets of the burial album untrue would play and certain geometric objects would appear of the screen moving with the music, similar to the example above.

Since I knew that I wasn't able to be physically make my project, I couldn't sit down and produce p5.js and Arduino connected code that would be able to interact with one another but instead i just adapted a quick sound visualiser on p5.js do give idea about what the code could look like. The audio used is the sound arch angel by burial.

```
let parts;
let radius;
let t;
let a;
let mapMouseX;
let mapMouseY;
let audio;

let colors = ["green", "black", "blue",
"white"] ;

function preload() {
    audio = loadSound("Burial.mp3");
}

function setup() {
```

```
createCanvas(windowWidth, windowHeight);
a = new p5.Amplitude();
t = new p5.FFT();
audio.loop();

}

function draw() {
background(colors[0]);

translate(windowWidth / 2, windowHeight / 2);

level = a.getLevel();
t.analyze();

var bass = t.getEnergy(150, 150);
var treble = t.getEnergy(150, 250);
var mid = t.getEnergy("mid");

var mapMid = map(mid, 0, 255, -100, 200);
var scaleMid = map(mid, 0, 255, 1, 1.5);

var mapTreble = map(treble, 0, 255, 200, 350);
var scaleTreble = map(treble, 0, 255, 0, 1);
```

```
var mapbass = map(bass, 0, 255, 50, 200);
var scalebass = map(bass, 0, 255, 0.05, 1.2);

mapMouseX = map(mouseX, 0, width, 1, 50);
mapMouseXbass = map(mouseX, 0, width, 1, 5);
mapMouseY = map(mouseY, 0, height, 2, 6);

parts = 20;
radius = 100;

for (i = 0; i < parts; i += 0.1) {

    rotate(TWO_PI / (parts / 2));

    noFill();

    push();
    stroke(colors[1]);
    rotate(frameCount * 0.002);
    strokeWeight(0.5);
    polygon(mapbass + i, mapbass - i, mapMouseXbas
s * i, 3);
    pop();

    push();
    stroke(colors[2]);
    strokeWeight(0.2);
```

```
        polygon(mapMid + i / 2, mapMid - i * 2, mapMouseX * i, 7);
        pop();

        push();
        stroke(colors[3]);
        strokeWeight(0.6);
        scale(mouseX * 0.0005);
        rotate((mouseX * 0.002));
        polygon(mapTreble + i / 2, mapTreble - i / 2,
mapMouseY * i / 2, 3);
        pop();

    }

}

function toggleAudio() {
    if (audio.isPlaying()) {
        audio.pause();
    } else {
        audio.play();
    }
}

function windowResized() {
```

```
resizeCanvas(windowWidth, windowHeight);  
}  
  
function polygon(x, y, radius, npoints) {  
    var angle = TWO_PI / npoints;  
    beginShape();  
    for (var a = 0; a < TWO_PI; a += angle) {  
        var sx = x + cos(a) * radius;  
        var sy = y + sin(a) * radius;  
        vertex(sx, sy);  
    }  
    endShape(CLOSE);  
}
```

Phase 6 - Final thoughts

To conclude though I haven't had the ability to create and properly execute my project due to covid related circumstances, I'm hoping that in the near future I can get my hands on the equipment and tools to do physically complete it. I've tried to conceptually note what I wanted to be executed as throughly i could, so I hope this documentation gives a clear idea as to what the outcomes of my project are. Again i'm sorry but i'm not too sure if this was what was expected by i've tried to complete the project to my best knowledge.