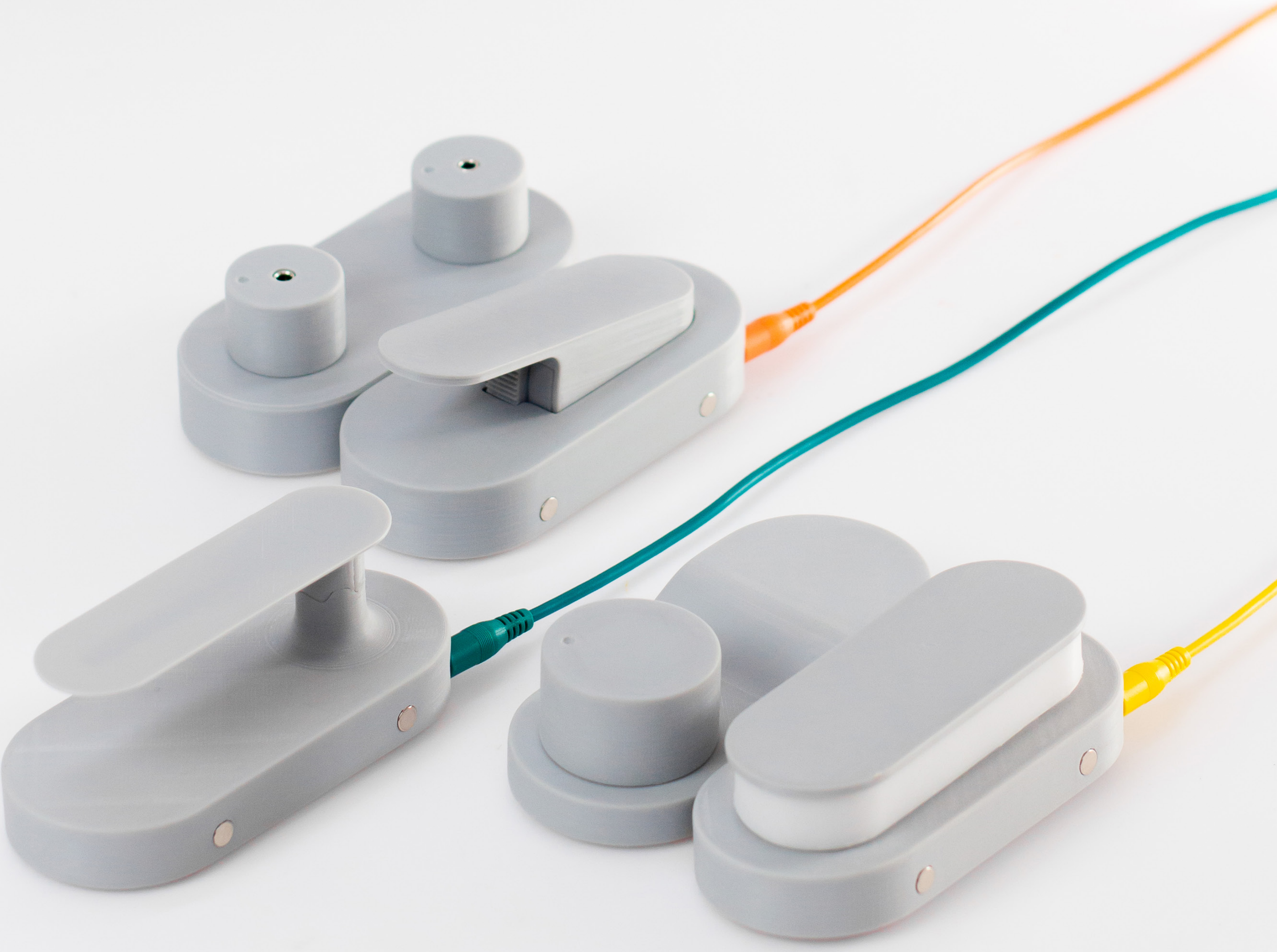
Parameters

Linus Brorsson



LUND UNIVERSITY

Parameters

Linus Brorsson

Degree Project for Master of Fine Arts in Design, Main Field of Study Industrial Design, from Lund University, School of Industrial Design

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Abstract

This project delves into the interplay of physical interfaces of electronic devices and the creative act of making music. Through a literature review, it was understood that there are key UI & UX principles which need to be followed in the development of user-friendly products of this type. In-depth interviews revealed that users find sub-menus challenging, desire a reduction in screen time, and emphasize the importance of an enjoyable user experience.

Market research unveiled a notable rise in the popularity of analog synth gear and an increasing interest among consumers for modular musical equipment. Despite the rising interest in analog synths, the MIDI controller market remains dominantly larger.

Using the insights from the analysis phase, a set of MIDI controllers was designed, using various physical inputs classified into three parameter types: constants, bends, and modulators. The synthesis stage involved extensive coding, breadboarding, and physical prototyping. Following rigorous user testing of these prototypes, iterative refinements were made to enhance usability and functionality.

For the realization of the final product, simplicity was chosen as the guiding principle. This was not just to ensure ease of modification in the future, but also to create a cohesive design language for a range of products. With the integration of AI, image generations provided inspiration for deciding on the shape and detailing. The end product is a modular collection of CV and MIDI controllers, allowing users the flexibility to tailor their setup. Accompanying the final prototypes are a series of renders showcasing various color, material, and finish (CMF) options.

Analysis

INTRODUCTION

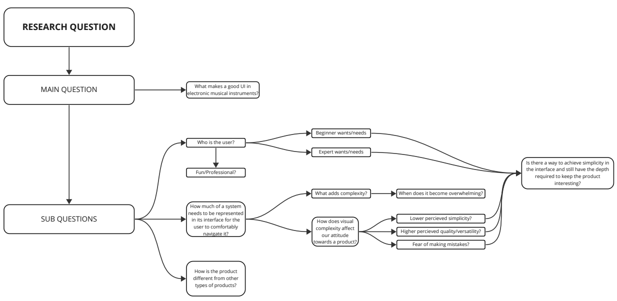
Over the past few decades, the rise of the bedroom producer and digital music production has revolutionized the way music studios are set up. With just a computer, musicians can create and produce high-quality tracks without the need for expensive hardware. However, despite this shift towards software-based production, analog synthesizers have seen a resurgence in popularity over the past decade, with companies like Korg, Roland, Behringer and Arturia making them more accessible to amateurs and semi-professional producers. Synthesizers are often packed with knobs, switches, buttons, and faders that may seem intimidating to beginners and experienced users alike. The research phase of this project investigates the relationship between producers and their gear, as well as how visual complexity in a music device interface affects how users interact with the underlying system.

RESEARCH QUESTION

The research question was phrased as follows:

"What makes a UI in electronic musical intruments good?"

While this question is broad in scope, it can be broken down into smaller components. Please refer to the flowchart below to see how these sub-questions interrelate and how they can be integrated into a cohesive overarching question.



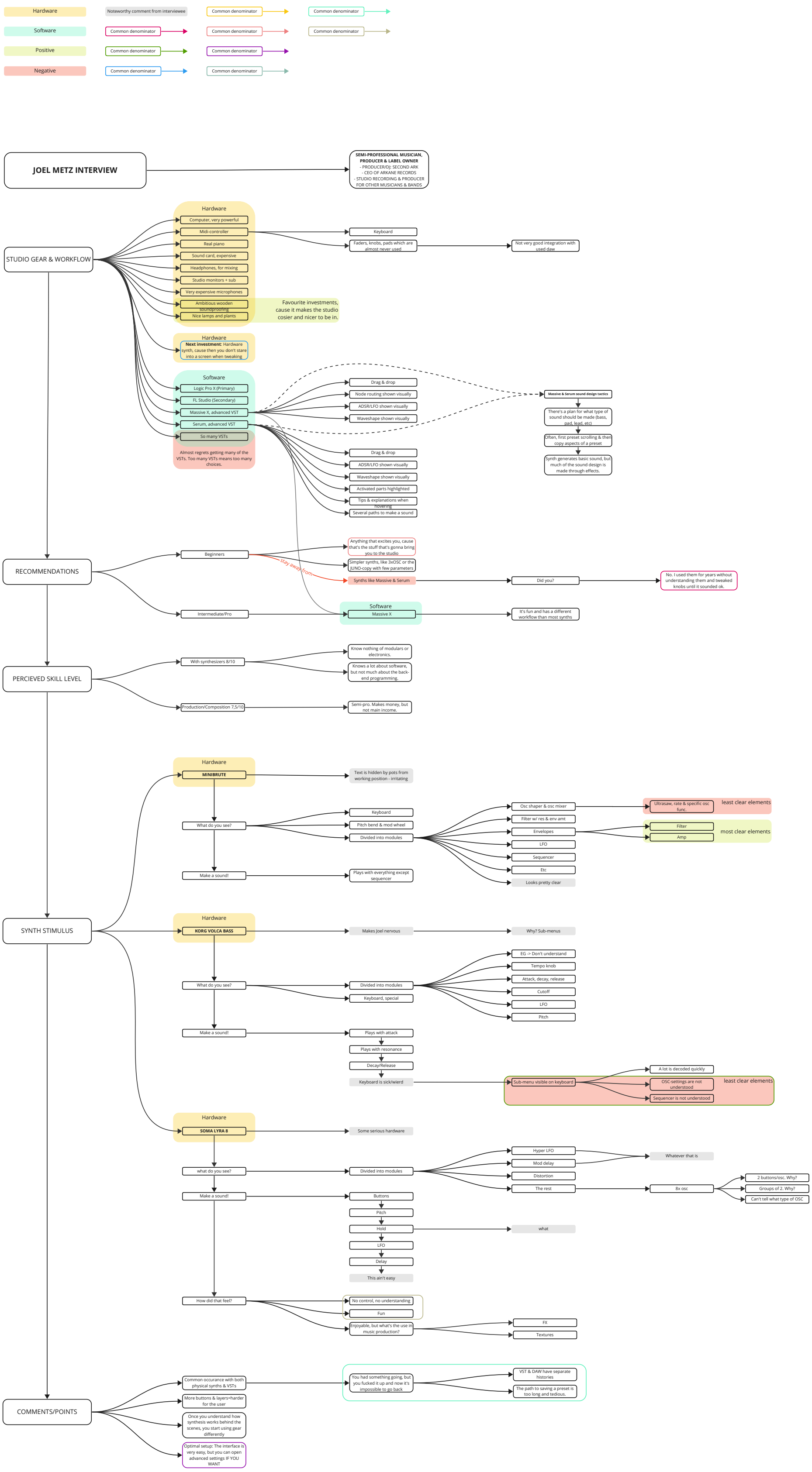
RESEARCH METHODS

Some of the questions have already been investigated by very competent people, findings documented in articles. A selection of three of these articles were read in hopes of better understanding the fundamentals within the field of UI. How visual complexity in Human-Computer Interaction affects how we interact with the system behind an interface, as well as how it affects our attitude towards the product in question. Two of the articles were quite advanced, and although they list UX and cognitive psychology as some of their subjects, the intended audience seemed to be computer scientists with a bigger focus on the technical aspects. Still, some very interesting points was extracted from them that are relevant to this project.

After reviewing the contents of the literature, the research questions stated before were brought into qualitative interviews. Five interviews were conducted one-on-one with people that regularly uses electronic musical instruments. The questions were kept in mind and were often directly answered, but the quality of the conversation held priority over structure. The interviews were also recorded with video and audio, so that the conversational flow wouldn't be interrupted from the interviewer taking notes. The interviewees have varying strategies and philosophies when it comes to creating music, and different setups of musical gear. The interviews took place in the interviewees' respective studios, so that their regular workflow could be observed. A selection of devices from my own synthesiser collection was brought to four of the interviews, so that it could be observed how they interacted with something that they hadn't seen before.

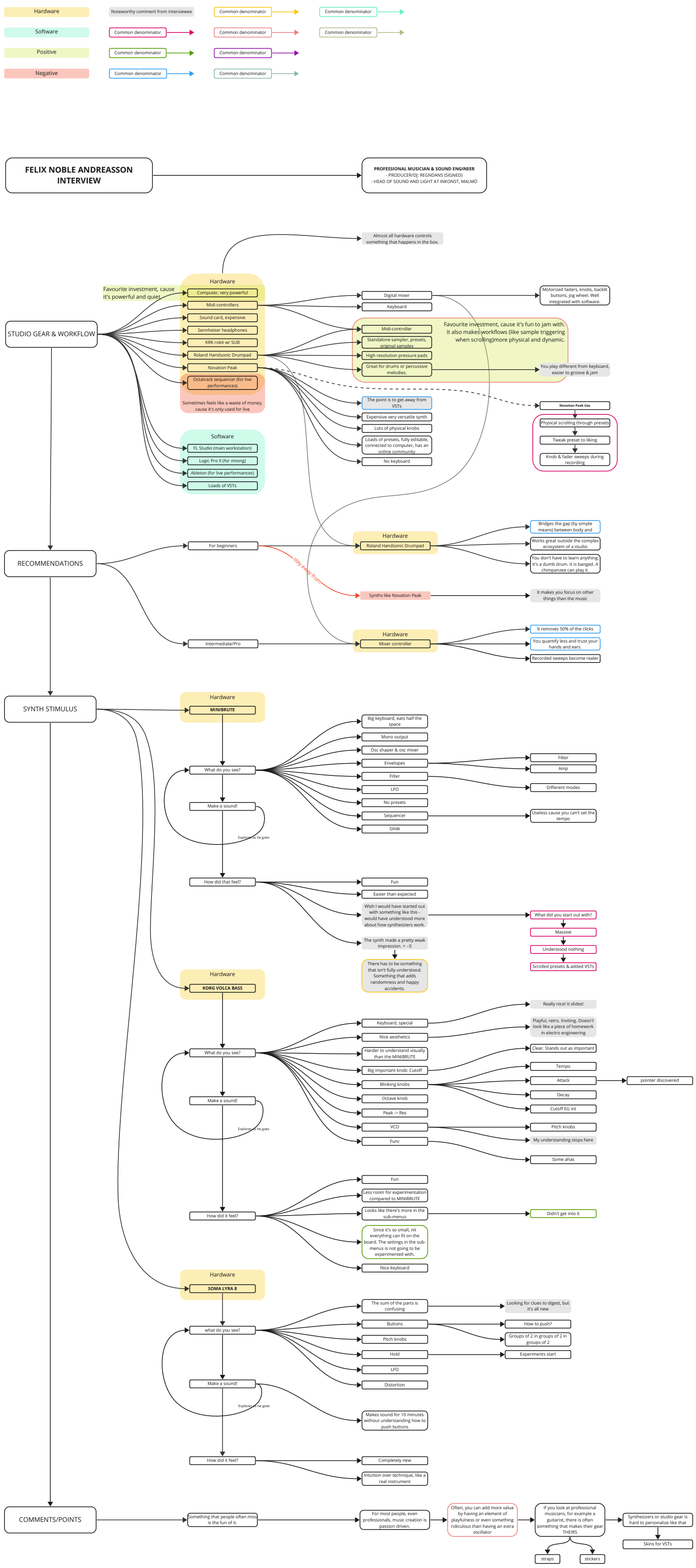
The interviewee was informed beforehand that the entire conversation would be recorded, and that they can pull out of the interview or entire study at any time. Any quotes have been checked with them to make sure it is phrased correctly. All conclusions made in the text or shown in the processed interview section should be viewed as having been made by the author of this text unless stated otherwise.

Interview #1



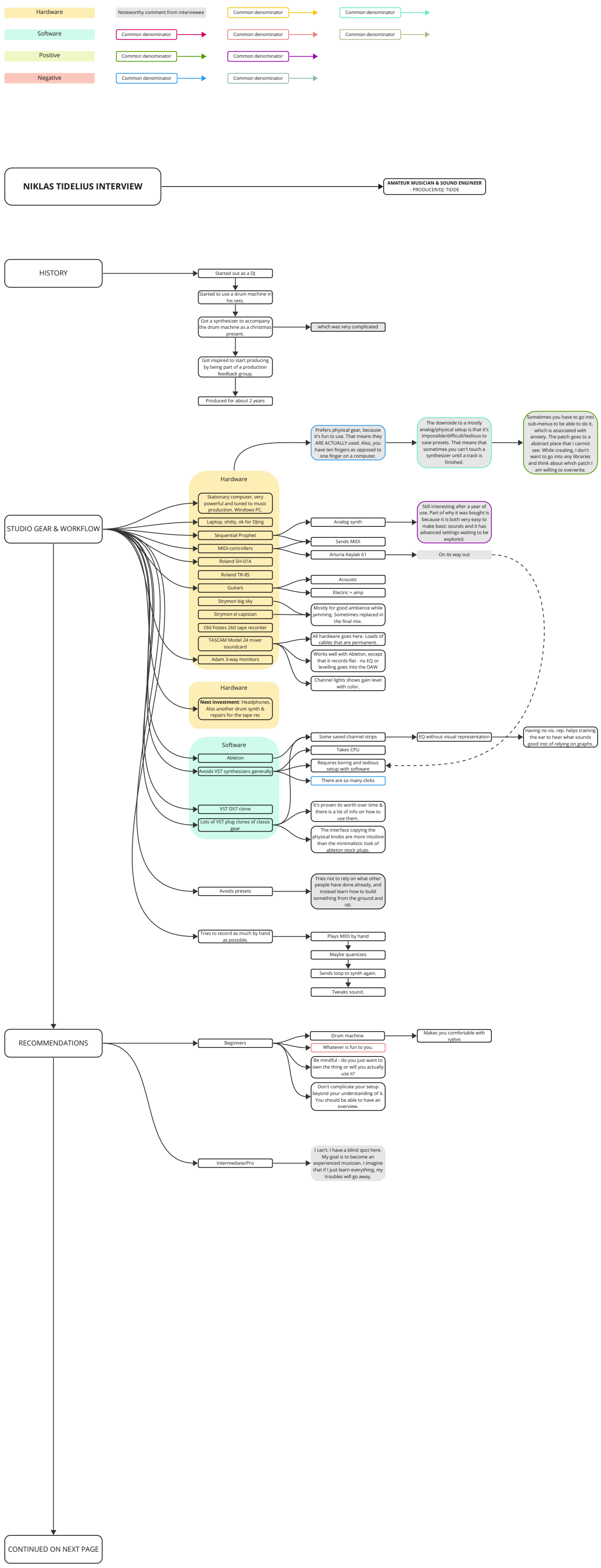
Hardware
Software
Positive
Negative
Noteworthy comment from interviewee
Common denominator
JOEL METZ INTERVIEW
SEMI-PROFESSIONAL MUSICIAN, PRODUCER & LABEL OWNER
- PRODUCER/DJ: SECOND ARK
- CEO OF ARKANE RECORDS
- STUDIO RECORDING & PRODUCER FOR OTHER MUSICIANS & BANDS
STUDIO GEAR & WORKFLOW
Hardware
Computer, very powerful
Midi-controller
Real piano
Sound card, expensive
Headphones, for mixing
Studio monitors + sub
Very expensive microphones
Ambitious wooden soundproofing
Nice lamps and plants
Favourite investments, cause it makes the studio cosier and nicer to be in.
Keyboard
Faders, knobs, pads which are almost never used
Not very good integration with used daw
Hardware
Next investment: Hardware synth, cause then you don't stare into a screen when tweaking
Software
Logic Pro X (Primary)
FL Studio (Secondary)
Massive X, advanced VST
Serum, advanced VST
So many VSTs
Almost regrets getting many of the VSTs. Too many VSTs means too many choices.
Drag & drop
Node routing shown visually
ADSR/LFO shown visually
Waveshape shown visually
Drag & drop
ADSR/LFO shown visually
Waveshape shown visually
Activated parts highlighted
Tips & explanations when hovering
Several paths to make a sound
Massive & Serum sound design tactics
There's a plan for what type of sound should be made (bass, pad, lead, etc)
Often, first preset scrolling & then copy aspects of a preset
Synth generates basic sound, but much of the sound design is made through effects.
RECOMMENDATIONS
Beginners
Anything that excites you, cause that's the stuff that's gonna bring you to the studio
Simpler synths, like 3xOSC or the JUNO-copy with few parameters
stay away from
Synths like Massive & Serum
Did you?
No. I used them for years without understanding them and tweaked knobs until it sounded ok.
Intermediate/Pro
Software
Massive X
It's fun and has a different workflow than most synths
PERCIEVED SKILL LEVEL
With synthesizers 8/10
Know nothing of modulars or electronics.
Knows a lot about software, but not much about the back-end programming.
Production/Composition 7,5/10
Semi-pro. Makes money, but not main income.
SYNTH STIMULUS
Hardware
MINIBRUTE
Text is hidden by pots from working position - irritating
What do you see?
Keyboard
Pitch bend & mod wheel
Divided into modules
Osc shaper & osc mixer
Filter w/ res & env amt
Envelopes
LFO
Sequencer
Etc
Looks pretty clear
Ultrasaw, rate & specific osc func.
least clear elements
Filter
Amp
most clear elements
Make a sound!
Plays with everything except sequencer
Hardware
KORG VOLCA BASS
Makes Joel nervous
Why? Sub-menus
What do you see?
Divided into modules
Keyboard, special
EG -> Don't understand
Tempo knob
Attack, decay, release
Cutoff
LFO
Pitch
Make a sound!
Plays with attack
Plays with resonance
Decay/Release
Keyboard is sick/wierd
Sub-menu visible on keyboard
A lot is decoded quickly
OSC-settings are not understood
Sequencer is not understood
least clear elements
Hardware
SOMA LYRA 8
Some serious hardware
what do you see?
Divided into modules
Hyper LFO
Mod delay
Distortion
The rest
Whatever that is
8x osc
2 buttons/osc. Why?
Groups of 2. Why?
Can't tell what type of OSC
Make a sound!
Buttons
Pitch
Hold
LFO
Delay
This ain't easy
what
How did that feel?
No control, no understanding
Fun
Enjoyable, but what's the use in music production?
FX
Textures
COMMENTS/POINTS
Common occurance with both physical synths & VSTs
You had something going, but you fucked it up and now it's impossible to go back
VST & DAW have separate histories
The path to saving a preset is too long and tedious.
More buttons & layers=harder for the user
Once you understand how synthesis works behind the scenes, you start using gear differently
Optimal setup: The interface is very easy, but you can open advanced settings IF YOU WANT

Interview #2



Hardware
Software
Positive
Negative
Noteworthy comment from interviewee
Common denominator
FELIX NOBLE ANDREASSON INTERVIEW
PROFESSIONAL MUSICIAN & SOUND ENGINEER
- PRODUCER/DJ: REGNDANS (SIGNED)
- HEAD OF SOUND AND LIGHT AT INKONST, MALMÖ
STUDIO GEAR & WORKFLOW
Almost all hardware controls something that happens in the box.
Hardware
Favourite investment, cause it's powerful and quiet
Computer, very powerful
Midi-controllers
Sound card, expensive
Sennheiser headphones
KRK rokit w/ SUB
Roland Handsonic Drumpad
Novation Peak
Octatrack sequencer (for live performances)
Sometimes feels like a waste of money, cause it's only used for live
Digital mixer
Motorized faders, knobs, backlit buttons, jog wheel. Well integrated with software.
Keyboard
Midi-controller
Standalone sampler, presets, original samples
High resolution pressure pads
Great for drums or percussive melodies.
Favourite investment, cause it's fun to jam with. It also makes workflows (like sample triggering when scrolling)more physical and dynamic.
You play different from keyboard, easier to groove & jam
The point is to get away from VSTs
Expensive very versatile synth
Lots of physical knobs
Loads of presets, fully editable, connected to computer, has an online community
No keyboard
Novation Peak Use
Physical scrolling through presets
Tweak preset to liking
Knob & fader sweeps during recording
Software
FL Studio (main workstation)
Logic Pro X (for mixing)
Ableton (for live performances)
Loads of VSTs
RECOMMENDATIONS
For beginners
Hardware
Roland Handsonic Drumpad
Bridges the gap (by simple means) between body and
Works great outside the complex ecosystem of a studio
You don't have to learn anything. It's a dumb drum. It is banged. A chimpanzee can play it.
stay away from
Synths like Novation Peak
It makes you focus on other things than the music
Intermediate/Pro
Hardware
Mixer controller
It removes 50% of the clicks
You quantify less and trust your hands and ears.
Recorded sweeps become realer
SYNTH STIMULUS
Hardware
MINIBRUTE
What do you see?
Big keyboard, eats half the space
Mono output
Osc shaper & osc mixer
Envelopes
Filter
Amp
Filter
Different modes
LFO
No presets
Sequencer
Useless cause you can't set the tempo
Glide
Make a sound!
Explores as he goes
How did that feel?
Fun
Easier than expected
Wish I would have started out with something like this - would have understood more about how synthesizers work.
What did you start out with?
Massive
Understood nothing
Scrolled presets & added VSTs
The synth made a pretty weak impression. + - 0
There has to be something that isn't fully understood. Something that adds randomness and happy accidents.
Hardware
KORG VOLCA BASS
What do you see?
Keyboard, special
Really nice! It slides!
Nice aesthetics
Playful, retro. Inviting. Doesn't look like a piece of homework in electro engineering
Harder to understand visually than the MINIBRUTE
Big important knob: Cutoff
Clear. Stands out as important
Blinking knobs
Tempo
Attack
pointer discovered
Decay
Cutoff EG int
Octave knob
Peak -> Res
VCO
Pitch knobs
My understanding stops here
Func
Some ahas
Make a sound!
Explores as he goes
How did it feel?
Fun
Less room for experimentation compared to MINIBRUTE
Looks like there's more in the sub-menus
Didn't get into it
Since it's so small, nit everything can fit on the board. The settings in the sub-menus is not going to be experimented with.
Nice keyboard
Hardware
SOMA LYRA 8
what do you see?
The sum of the parts is confusing
Looking for clues to digest, but it's all new
Buttons
How to push?
Groups of 2 in groups of 2 in groups of 2
Pitch knobs
Hold
Experiments start
LFO
Distortion
Make a sound!
Explores as he goes
Makes sound for 10 minutes without understanding how to push buttons
How did it feel?
Completely new
Intuition over technique, like a real instrument
COMMENTS/POINTS
Something that people often miss is the fun of it.
For most people, even professionals, music creation is passion driven.
Often, you can add more value by having an element of playfulness or even something ridiculous than having an extra oscillator
If you look at professional musicians, for example a guitarist, there is often something that makes their gear THEIRS
straps
stickers
Synthesizers or studio gear is hard to personalize like that
Skins for VSTs

Interview #3



Hardware
Software
Positive
Negative
Noteworthy comment from interviewee
Common denominator
NIKLAS TIDELIUS INTERVIEW
AMATEUR MUSICIAN & SOUND ENGINEER - PRODUCER/DJ: TIDDE
HISTORY
Started out as a DJ
Started to use a drum machine in his sets.
Got a synthesizer to accompany the drum machine as a christmas present.
which was very complicated
Got inspired to start producing by being part of a production feedback group.
Produced for about 2 years
STUDIO GEAR & WORKFLOW
Hardware
Stationary computer, very powerful and tuned to music production. Windows PC.
Laptop, shitty, ok for DJing
Sequential Prophet
MIDI-controllers
Roland SH-01A
Roland TR-8S
Guitars
Strymon big sky
Strymon el capistan
Old Fostex 260 tape recorder
TASCAM Model 24 mixer soundcard
Adam 3-way monitors
Prefers physical gear, because it's fun to use. That means they ARE ACTUALLY used. Also, you have ten fingers as opposed to one finger on a computer.
The downside to a mostly analog/physical setup is that it's Impossible/difficult/tedious to save presets. That means that sometimes you can't touch a synthesizer until a track is finished.
Sometimes you have to go into sub-menus to be able to do it, which is associated with anxiety. The patch goes to a abstract place that i cannot see. While creating, I don't want to go into any libraries and think about which patch I am willing to overwrite.
Analog synth
Sends MIDI
Arturia Keylab 61
Still interesting after a year of use. Part of why it was bought is because it is both very easy to make basic sounds and it has advanced settings waiting to be explored.
On its way out
Acoustic
Electric + amp
Mostly for good ambience while jamming. Sometimes replaced in the final mix.
All hardware goes here. Loads of cables that are permanent.
Works well with Ableton, except that it records flat - no EQ or levelling goes into the DAW
Channel lights shows gain level with color.
Hardware
Next investment: Headphones. Also another drum synth & repairs for the tape rec
Software
Ableton
Avoids VST synthesizers generally
VST DX7 clone
Lots of VST plug clones of classic gear
Some saved channel strips
EQ without visual representation
Having no vis. rep. helps training the ear to hear what sounds good inst of relying on graphs.
Takes CPU
Requires boring and tedious setup with software
There are so many clicks
It's proven its worth over time & there is a lot of info on how to use them.
The interface copying the physical knobs are more intuitive than the minimalistic look of ableton stock plugs.
Avoids presets
Tries not to rely on what other people have done already, and instead learn how to build something from the ground and up.
Tries to record as much by hand as possible.
Plays MIDI by hand
Maybe quantizes
Sends loop to synth again.
Tweaks sound.
RECOMMENDATIONS
Beginners
Drum machine
Makes you comfortable with rythm
Whatever is fun to you.
Be mindful - do you just want to own the thing or will you actually use it?
Don't complicate your setup beyond your understanding of it. You should be able to have an overview.
Intermediate/Pro
I can't. I have a blind spot here. My goal is to become an experienced musician. I imagine that if I just learn everything, my troubles will go away.
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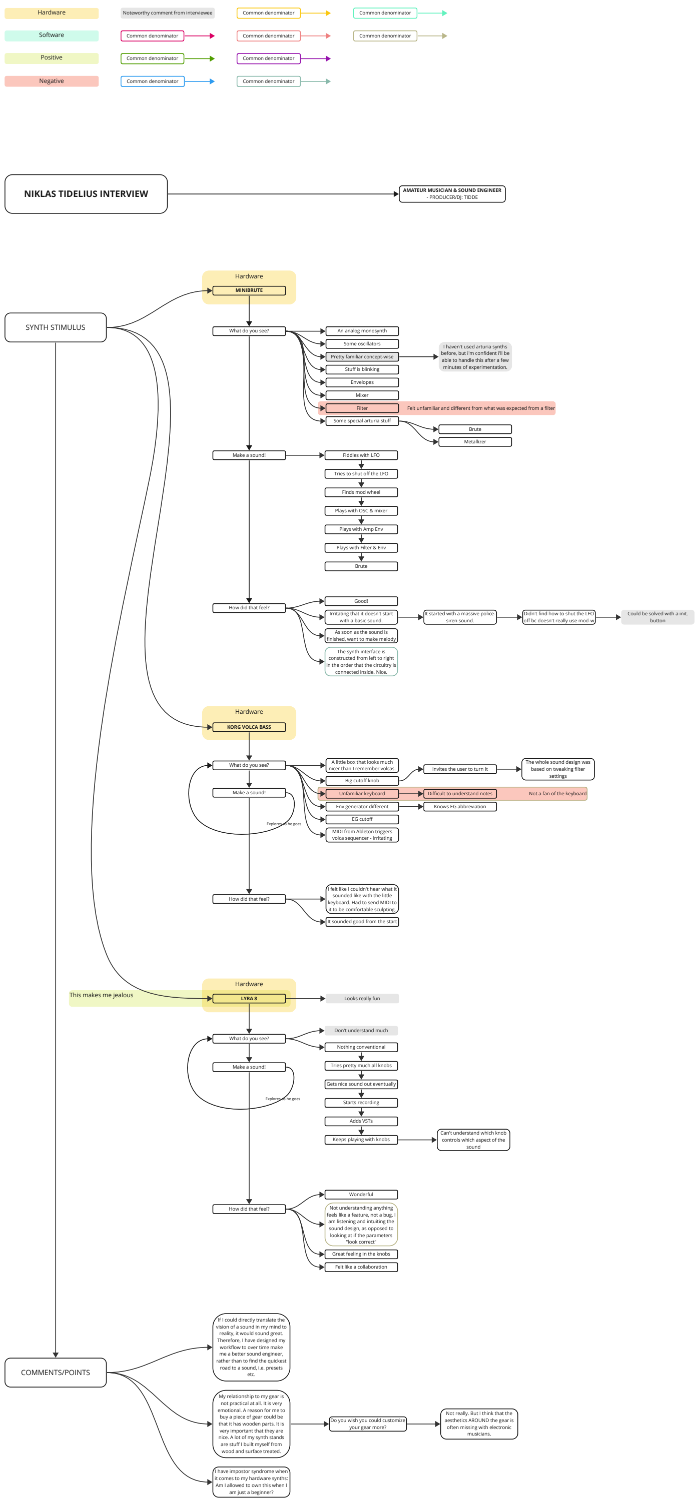
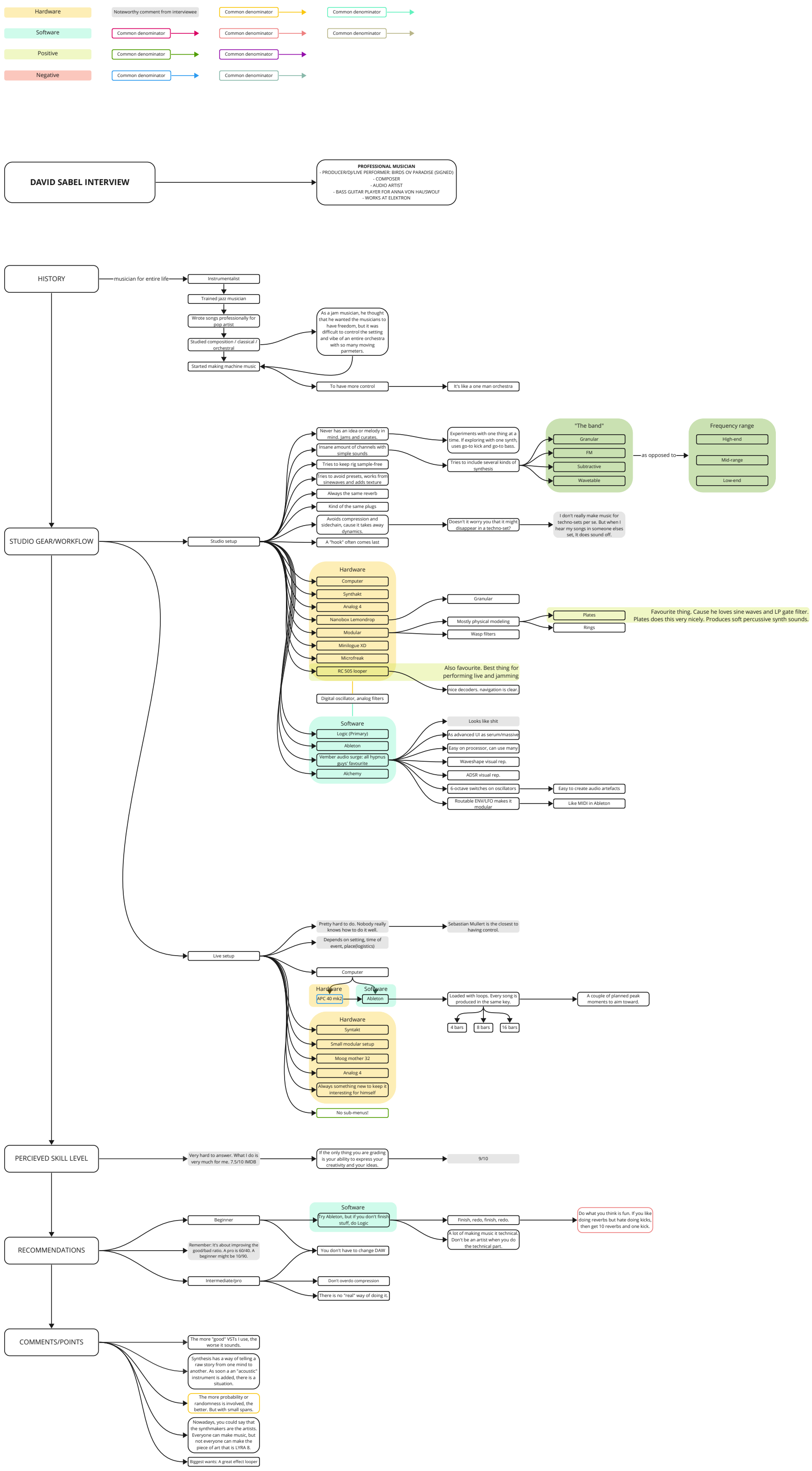
Interview #3

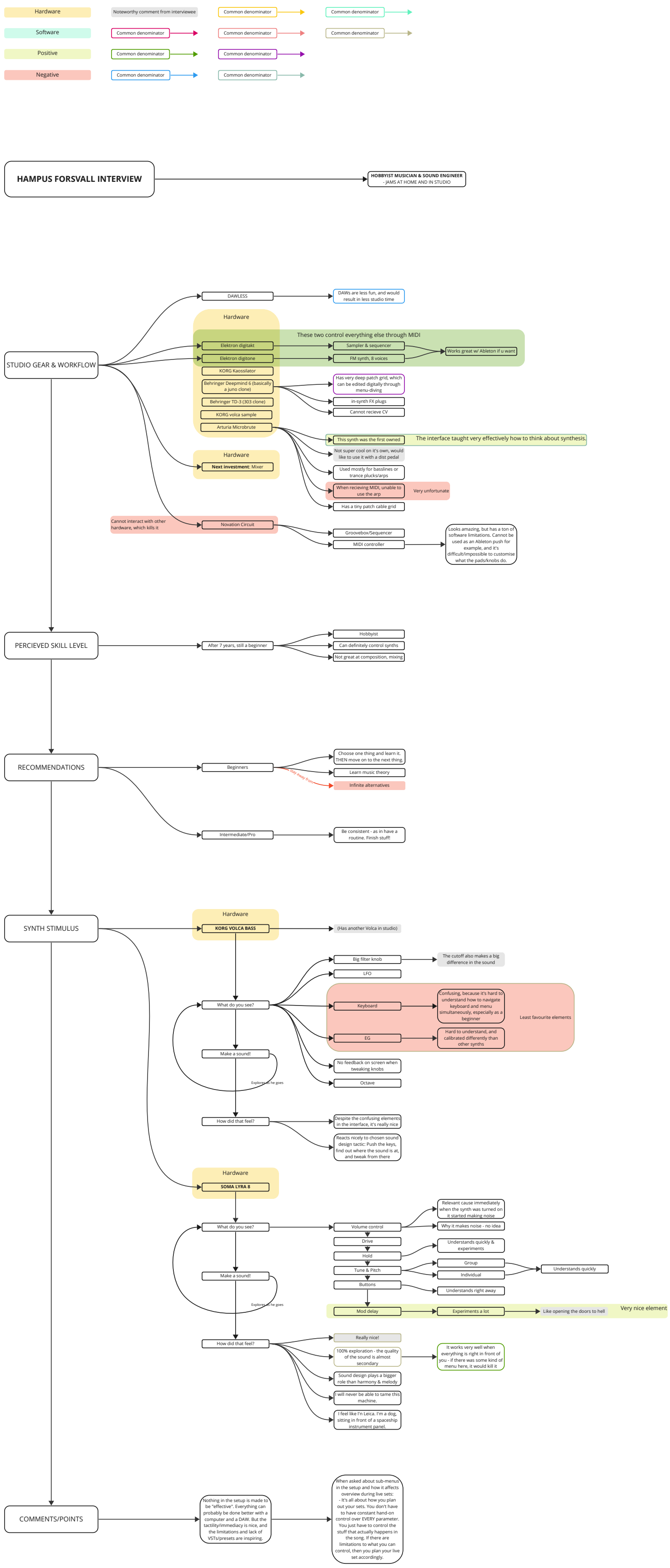

Hardware
Software
Positive
Negative
Noteworthy comment from interviewee
Common denominator
NIKLAS TIDELIUS INTERVIEW
AMATEUR MUSICIAN & SOUND ENGINEER
- PRODUCER/DJ: TIDDE
SYNTH STIMULUS
Hardware
MINIBRUTE
What do you see?
An analog monosynth
Some oscillators
Pretty familiar concept-wise
I haven't used arturia synths before, but i'm confident i'll be able to handle this after a few minutes of experimentation.
Stuff is blinking
Envelopes
Mixer
Filter
Felt unfamiliar and different from what was expected from a filter
Some special arturia stuff
Brute
Metallizer
Make a sound!
Fiddles with LFO
Tries to shut off the LFO
Finds mod wheel
Plays with OSC & mixer
Plays with Amp Env
Plays with Filter & Env
Brute
How did that feel?
Good!
Irritating that it doesn't start with a basic sound.
It started with a massive police-siren sound.
Didn't find how to shut the LFO off bc doesn't really use mod-w
Could be solved with a init. button
As soon as the sound is finished, want to make melody
The synth interface is constructed from left to right in the order that the circuitry is connected inside. Nice.
Hardware
KORG VOLCA BASS
What do you see?
A little box that looks much nicer than I remember volcas.
Big cutoff knob
Invites the user to turn it
The whole sound design was based on tweaking filter settings
Unfamiliar keyboard
Difficult to understand notes
Not a fan of the keyboard
Env generator different
Knows EG abbreviation
EG cutoff
MIDI from Ableton triggers volca sequencer - irritating
Make a sound!
Explores as he goes
How did that feel?
I felt like I couldn't hear what it sounded like with the little keyboard. Had to send MIDI to it to be comfortable sculpting.
It sounded good from the start
Hardware
This makes me jealous
LYRA 8
Looks really fun
What do you see?
Don't understand much
Nothing conventional
Tries pretty much all knobs
Gets nice sound out eventually
Starts recording
Adds VSTs
Keeps playing with knobs
Can't understand which knob controls which aspect of the sound
Make a sound!
Explores as he goes
How did that feel?
Wonderful
Not understanding anything feels like a feature, not a bug. I am listening and intuiting the sound design, as opposed to looking at if the parameters "look correct"
Great feeling in the knobs
Felt like a collaboration
COMMENTS/POINTS
If I could directly translate the vision of a sound in my mind to reality, it would sound great. Therefore, I have designed my workflow to over time make me a better sound engineer, rather than to find the quickest road to a sound, i.e. presets etc.
My relationship to my gear is not practical at all. It is very emotional. A reason for me to buy a piece of gear could be that it has wooden parts. It is very important that they are nice. A lot of my synth stands are stuff I built myself from wood and surface treated.
Do you wish you could customize your gear more?
Not really. But I think that the aesthetics AROUND the gear is often missing with electronic musicians.
I have impostor syndrome when it comes to my hardware synths: Am I allowed to own this when I am just a beginner?

Interview #4



Hardware
Software
Positive
Negative
Noteworthy comment from interviewee
Common denominator
DAVID SABEL INTERVIEW
PROFESSIONAL MUSICIAN
- PRODUCER/DJ/LIVE PERFORMER: BIRDS OV PARADISE (SIGNED)
- COMPOSER
- AUDIO ARTIST
- BASS GUITAR PLAYER FOR ANNA VON HAUSWOLF
- WORKS AT ELEKTRON
HISTORY
musician for entire life
Instrumentalist
Trained jazz musician
Wrote songs professionally for pop artist
Studied composition / classical / orchestral
Started making machine music
As a jam musician, he thought that he wanted the musicians to have freedom, but it was difficult to control the setting and vibe of an entire orchestra with so many moving parmeters.
To have more control
It's like a one man orchestra
STUDIO GEAR/WORKFLOW
Studio setup
Never has an idea or melody in mind. Jams and curates.
Insane amount of channels with simple sounds
Tries to keep rig sample-free
Tries to avoid presets, works from sinewaves and adds texture
Always the same reverb
Kind of the same plugs
Avoids compression and sidechain, cause it takes away dynamics.
A "hook" often comes last
Experiments with one thing at a time. If exploring with one synth, uses go-to kick and go-to bass.
Tries to include several kinds of synthesis
"The band"
Granular
FM
Subtractive
Wavetable
as opposed to
Frequency range
High-end
Mid-range
Low-end
Doesn't it worry you that it might disappear in a techno-set?
I don't really make music for techno-sets per se. But when I hear my songs in someone elses set, It does sound off.
Hardware
Computer
Synthakt
Analog 4
Nanobox Lemondrop
Modular
Minilogue XD
Microfreak
RC 505 looper
Granular
Mostly physical modeling
Wasp filters
Plates
Rings
Favourite thing. Cause he loves sine waves and LP gate filter. Plates does this very nicely. Produces soft percussive synth sounds.
Also favourite. Best thing for performing live and jamming
nice decoders. navigation is clear.
Digital oscillator, analog filters
Software
Logic (Primary)
Ableton
Vember audio surge: all hypnus guys' favourite
Alchemy
Looks like shit
As advanced UI as serum/massive
Easy on processor, can use many
Waveshape visual rep.
ADSR visual rep.
6-octave switches on oscillators
Easy to create audio artefacts
Routable ENV/LFO makes it modular
Like MIDI in Ableton
Live setup
Pretty hard to do. Nobody really knows how to do it well.
Sebastian Mullert is the closest to having control.
Depends on setting, time of event, place(logistics)
Computer
Hardware
APC 40 mk2
Software
Ableton
Loaded with loops. Every song is produced in the same key.
A couple of planned peak moments to aim toward.
4 bars
8 bars
16 bars
Hardware
Syntakt
Small modular setup
Moog mother 32
Analog 4
Always something new to keep it interesting for himself
No sub-menus!
PERCIEVED SKILL LEVEL
Very hard to answer. What I do is very much for me. 7.5/10 IMDB
If the only thing you are grading is your ability to express your creativity and your ideas.
9/10
RECOMMENDATIONS
Beginner
Remember: It's about improving the good/bad ratio. A pro is 60/40. A beginner might be 10/90.
Intermediate/pro
Software
Try Ableton, but if you don't finish stuff, do Logic
You don't have to change DAW
Don't overdo compression
There is no "real" way of doing it.
Finish, redo, finish, redo.
A lot of making music it technical. Don't be an artist when you do the technical part.
Do what you think is fun. If you like doing reverbs but hate doing kicks, then get 10 reverbs and one kick.
COMMENTS/POINTS
The more "good" VSTs I use, the worse it sounds.
Synthesis has a way of telling a raw story from one mind to another. As soon a an "acoustic" instrument is added, there is a situation.
The more probability or randomness is involved, the better. But with small spans.
Nowadays, you could say that the synthmakers are the artists. Everyone can make music, but not everyone can make the piece of art that is LYRA 8.
Biggest wants: A great effect looper

Interview #5



Hardware
Software
Positive
Negative
Noteworthy comment from interviewee
Common denominator
HAMPUS FORSVALL INTERVIEW
HOBBYIST MUSICIAN & SOUND ENGINEER
- JAMS AT HOME AND IN STUDIO
STUDIO GEAR & WORKFLOW
DAWLESS
DAWs are less fun, and would result in less studio time
Hardware
These two control everything else through MIDI
Elektron digitakt
Sampler & sequencer
Elektron digitone
FM synth, 8 voices
Works great w/ Ableton if u want
KORG Kaossilator
Behringer Deepmind 6 (basically a juno clone)
Has very deep patch grid, which can be edited digitally through menu-diving
in-synth FX plugs
Cannot recieve CV
Behringer TD-3 (303 clone)
KORG volca sample
Arturia Microbrute
This synth was the first owned
The interface taught very effectively how to think about synthesis.
Not super cool on it's own, would like to use it with a dist pedal
Used mostly for basslines or trance plucks/arps
When recieving MIDI, unable to use the arp
Very unfortunate
Has a tiny patch cable grid
Hardware
Next investment: Mixer
Cannot interact with other hardware, which kills it
Novation Circuit
Groovebox/Sequencer
MIDI controller
Looks amazing, but has a ton of software limitations. Cannot be used as an Ableton push for example, and it's difficult/impossible to customise what the pads/knobs do.
PERCIEVED SKILL LEVEL
After 7 years, still a beginner
Hobbyist
Can definitely control synths
Not great at composition, mixing
RECOMMENDATIONS
Beginners
Choose one thing and learn it. THEN move on to the next thing.
Learn music theory
stay away from
Infinite alternatives
Intermediate/Pro
Be consistent - as in have a routine. Finish stuff!
SYNTH STIMULUS
Hardware
KORG VOLCA BASS
(Has another Volca in studio)
What do you see?
Big filter knob
The cutoff also makes a big difference in the sound
LFO
Keyboard
Confusing, because it's hard to understand how to navigate keyboard and menu simultaneously, especially as a beginner
EG
Hard to understand, and calibrated differently than other synths
Least favourite elements
No feedback on screen when tweaking knobs
Octave
Make a sound!
Explores as he goes
How did that feel?
Despite the confusing elements in the interface, it's really nice
Reacts nicely to chosen sound design tactic: Push the keys, find out where the sound is at, and tweak from there
Hardware
SOMA LYRA 8
What do you see?
Volume control
Relevant cause immediately when the synth was turned on it started making noise
Why it makes noise - no idea
Drive
Hold
Understands quickly & experiments
Tune & Pitch
Group
Individual
Understands quickly
Buttons
Understands right away
Mod delay
Experiments a lot
Like opening the doors to hell
Very nice element
Make a sound!
Explores as he goes
How did that feel?
Really nice!
100% exploration - the quality of the sound is almost secondary
It works very well when everything is right in front of you - if there was some kind of menu here, it would kill it
Sound design plays a bigger role than harmony & melody
I will never be able to tame this machine.
I feel like I'n Leica. I'm a dog, sitting in front of a spaceship instrument panel.
COMMENTS/POINTS
Nothing in the setup is made to be "effective". Everything can probably be done better with a computer and a DAW. But the tactility/immediacy is nice, and the limitations and lack of VSTs/presets are inspiring.
When asked about sub-menus in the setup and how it affects overview during live sets:
- It's all about how you plan out your sets. You don't have to have constant hand-on control over EVERY parameter. You just have to control the stuff that actually happens in the song. If there are limitations to what you can control, then you plan your live set accordingly.

INTERVIEW FINDINGS

With the interviews mapped out like this, it was easy to get an overview and find common denominators.

Common Denominator 1 (Joel Metz & Felix Noble Andreasson):
— As a beginner, starting out with a complex synthesizer and not taking the time to learn how it works. Using it by scrolling through presets, tweaking knobs, and adding effects without a deep understanding of the underlying functionality.

Common Denominator 2 (Everyone):
— It's generally difficult to understand how to get into sub-menus, and as soon as you go out of them, you often lose the visual representation of what was just edited. This results in less experimentation and editing of the settings hidden inside the sub-menus.

Common Denominator 3 (Everyone):
— Producers prefer physical buttons, knobs, and faders to minimize screen time and reduce the need for using a computer mouse to manipulate VST parameters. Sometimes, a piece of gear's only function is to decrease clicks or screen time and make things more physical.

Common Denominator 4 (Joel Metz & Niklas Tidelius):
— Difficulty in saving presets or undoing steps can lead to fear of making mistakes, resulting in less experimentation with sound parameters.

Common Denominator 5 (Everyone):
— The enjoyment factor and fun of using gear is an important consideration, as music production is a passion-driven activity.

Common Denominator 6 (Joel Metz, Niklas Tidelius, & Hampus Forsvall):
— A simple interface that sounds good from the outset is appreciated, but advanced settings and complex sound design options should be available for those who wish to explore them.

Common Denominator 7 (Niklas Tidelius & Hampus Forsvall):
— An interface that matches the sound circuit and sequencing can teach users about how synthesis works and enhance understanding.

Common Denominator 8 (Felix Noble Andreasson & David Sabel):
— Happy accidents, slight modulation, and machine-generated ideas are appreciated for creating interesting and unique sounds. Pursuing perfection and full control can lead to artificial-sounding results.

Common Denominator 9 (Joel Metz, Niklas Tidelius, & Hampus Forsvall):
— Full experimentation with little comprehension or full control over gear is acceptable, but an interface that looks familiar yet behaves differently is not appreciated.

INTERVIEWS CONCLUDED

Points 2, 3 and 5 were mentioned by all interviewees, stretching across genre and production strategy. This makes them extra important, and they were the main guides through the design process. It seems that within a digital workflow, it can feel like you are programming music - not playing it. There is a tactility in physical instruments that is lacking in the digital world. This may detach you from the creative experience, especially if you come from an instrumentalist background.

There was also some confirmation of UI fundamentals in the interviews. It was stated that more buttons and layers in a piece of music equipment makes it harder for the user, which corresponds with Hick's law (The time it takes to make a decision increases logarithmically as the number of choices increase), mentioned by Bakaev and Razumnikova (2021) In their article "What Makes a UI Simple? Difficulty and Complexity in Tasks Engaging Visual-Spatial Working Memory".

When trying out new equipment, contextually larger knobs were percieved as being of greater importance. This corresponds with Fitt's law (The time it takes to travel to a target within an interface is dependent on the ratio of distance/size) - mentioned by Bakaev and Razumnikova (2021). In some of the interviews, the optimal setup for a synthesiser was suggested as having a very basic and simple interface, but having the option to open advanced settings if you want to. This corresponds with something stated in the last article - that objects out of reach doesn't seem to add much to cognitive load (Grgic, Still and Still, 2016).

This is interesting, as all interviewees expressed a dislike for sub- menus hidden behind special buttons. Perhaps sub menus are simply something that you don't interact with during performance - only during preparation.

A powerful argument made by one of the interviewees is that a lot of electronic musical instruments misses the fun part. For most people, even for professionals, music production is passion driven - something that they got into because they enjoyed it. Often, you can add more value to a piece of equipment by including an element of playfulness than by including an extra oscillator.

MARKET ANALYSIS

As mentioned before, analog synthesizers have experienced a resurgence in popularity over the past decade, driven by a renewed interest in the sounds and hands-on experience they offer. This revival has led to a growing market for both new and vintage analog synthesizers. The analog synthesizer market's value is likely in the range of tens to low hundreds of millions of dollars, but this is only an estimate. The market size for analog synthesizers is generally considered to be a smaller market compared to digital synthesizers and other music production equipment, which made it necessary to consider MIDI controllers and CV controllers as an end result for this project.

MIDI controllers, which are like remote controls for synthesizers and audio effects, have been an essential part of the music production and performance industry since the 1980s. They are used by musicians, producers, DJs, and performers to control various aspects of their digital audio workstations, synthesizers, and other virtual instruments. The market for MIDI controllers has grown alongside the increasing popularity of electronic music and advancements in digital music technology. In September 2021, the global market for MIDI controllers was estimated to be worth several hundred million dollars.

CURRENTLY AVAILABLE PRODUCTS & ONGOING STARTUPS

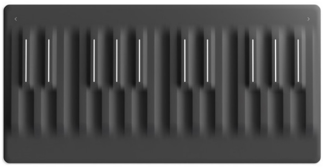
TEENAGE ENGINEERING OP-1 & OP-Z

The OP-1 and OP-Z are very innovative when it comes to functionality and have a lot of thought put in to the physical shape and aesthetics. They are both great for sequencing and synthesis alike, and posess a portability that is otherwise very uncommon in the synth world.

SOMA LABS LYRA 8

The Lyra 8 is an analog, semi-modular synthesizer with a very unconventional approach to synthesis. It has 8 voices, with individual keys and individual tuning. It favors experimentation instead of trying to achieve a sound design goal in a controlled way.

ROLI Seaboard



The Seaboard is a new take on a classic keyboard. The notes are positioned as a regular keyboard, but instead of having individual keys, the whole board is a single, flexible, touch sensitive surface. This allows the user to seamlessly slide between notes and change velocity mid note.

BIRDKIDS OFFGRID

An innovative MIDI controller which lets you control parameters through shaking, tilting or using a joystick. It also has a bunch of assignable buttons. This unit is marketed as a portable, pocket-sized product that favors the user holding it in their hands and bringing it along for travels.

ARTIPHON ORBA

ORBA is a hand-held synthesizer, sequencer and MIDI controller. Like the offgrid, it favors the user picking it up into their hands. You can control sound by sliding your fingers across the surface, tapping it or shaking the unit. It includes haptic feedback by vibrating according to the users touch.

SOMI-1

SOMI-1 is a MIDI controller that reacts to the body movements of the user by attaching sensors to feet and hands. This way, you dont just dance to the music - the music also reacts to your dancing. The user group for this product is different from most MIDI controllers, as it’s not very useful in a traditional music production studio. Instead, it sets out to bridge the gap between music and dancing in a way that might appeal more to live act art performers or experimental musicians.

MIDI-sprout

MIDI-sprout translates biorythms from plants into MIDI signals. This experimental piece of music gear combines biology, technology and artistic value in a way that encourages the user to interact more with the natural world.

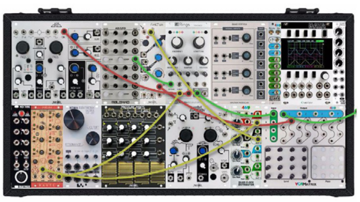
Monogram CC

Monogram CC was originally developed for photo editing, but its usefulness for musicians and producers quickly became evident. It is a modular system of MIDI controllers, allowing the user to choose the kinds of buttons, switches, knobs or faders they want to use. The individual units connect from the sides by magnets, and you can set up your grid in any way you like.

Expressive E Touché

Touché features a big plate that you can press, tap or slide sideways or back and forth to manipulate many different MIDI signals with one object. It offers a simple way to add expression to music in studio- or live situations.

MODULAR RACKS

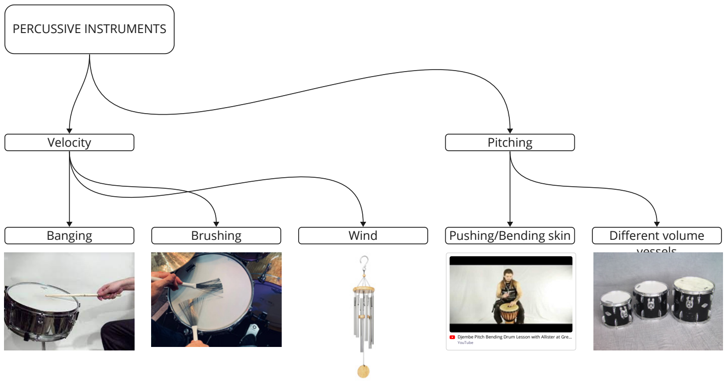


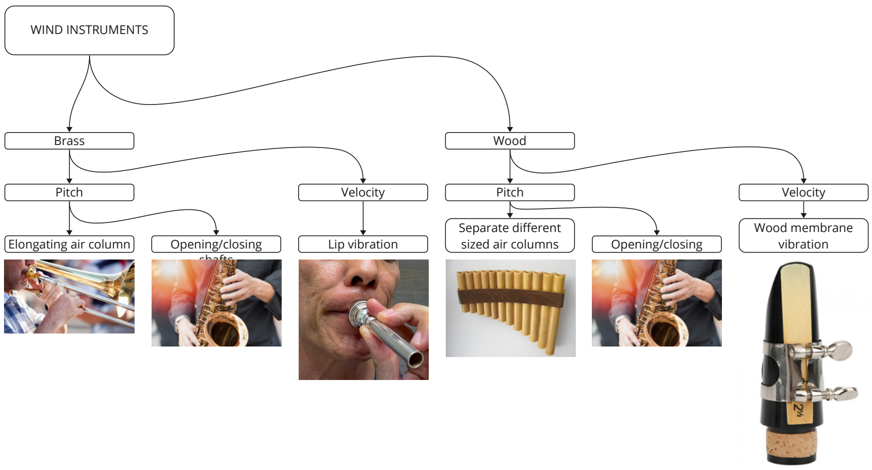
Commonly referred to as Euroracks, these systems are one of the driving forces of the trend towards modularity that can be seen in both analog and digital synthesis. Euroracks allow the user to choose a specific oscillator, filter, sequencer etc separately, instead of buying a complete synthesizer. This opens up for the possibility for more complex patching and flexible sound designs. A large community of coders and electronic tinkerers also fuel this ongoing development of modularity.

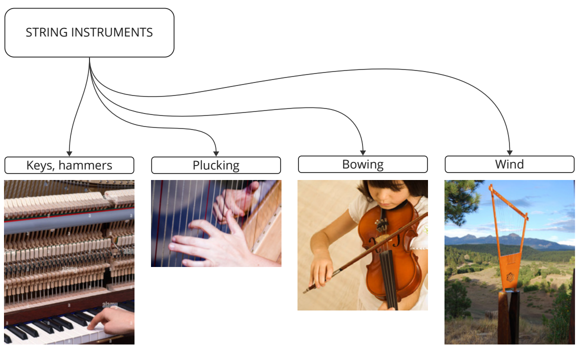
Similar to these analog systems, Ableton Live (currently the most popular DAW by far) makes it very easy and convenient for the user to connect parameters to each other, randomise values or connect midi controllers to any parameter.

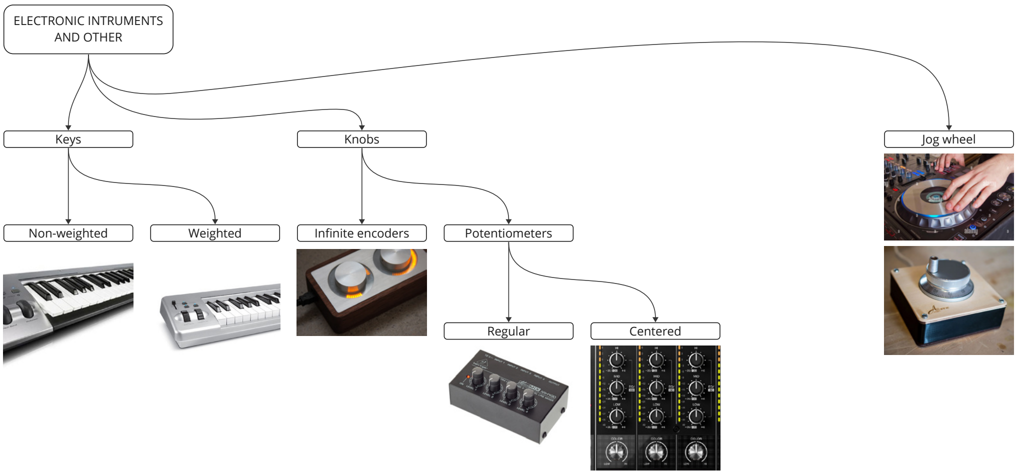
INSTRUMENT ANATOMY / PHYSICAL INPUT TYPES

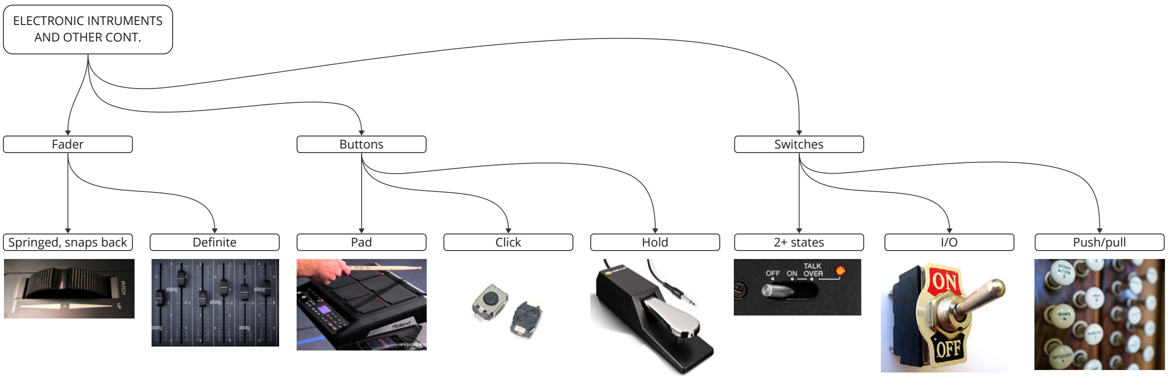
Musical instruments and electronic audio devices all rely in some way on human interaction to activate them. On the following pages, I have tried to map out different types of physical inputs that are used to produce and manipulate sound. There are also some other interesting mechanisms unrelated to music included at the end.

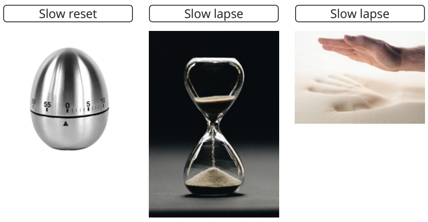







ELECTRONIC INTRUMENTS AND OTHER
Keys
Knobs
Jog wheel
Non-weighted
Weighted
Infinite encoders
Potentiometers
Regular
Centered


ELECTRONIC INTRUMENTS AND OTHER CONT.
Fader
Buttons
Switches
Springed, snaps back
Definite
Pad
Click
Hold
2+ states
I/O
Push/pull
TALK
OFF ON OVER
ON
OFF


Slow reset
Slow lapse
Slow lapse

Brief

Based on the findings from the research, I defined my brief. It is designed to assess the common denominators from the interviews. I want the outcome to be useful in a home- or professional studio environment. Ideally, the result will be a tabletop solution and fit into the already existing eco-system of synthesizers, MIDI controllers and other related audio equipment. I want to avoid getting too close to an art project like the MIDI-sprout or SOMI-1.

BRIEF ABSTRACT

"Design a useful, creative, electronic audio device, simple enough for beginners, and versatile enough to be interesting during long time use, which brings the creative process of making electronic music closer to the body."

TARGET AUDIENCE

Music producers or musicians in a music studio or on stage.

PROPOSED METHOD

Conduct rigorous and continuous user testing to find out to which extent it is effective to use different UI optimisation methods for the specific product type. Balance the interface based on findings.

PROPOSED OUTCOME

— Physical product to minimise screen time

— Interface simple enough for beginners

— Function versatile enough to be interesting for intermediate and expert users

— Include element of playfulness

— Compatible with related gear

Synthesis

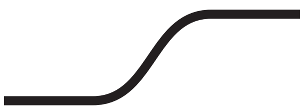
PROJECT SCOPE

Many design ideas could spring from the issues presented in the research. I could build a unique and interesting synthesizer, or one with an interface optimized for a certain user group, but I doubt that I would get very far in the process during the given timeframe of the project. After processing the interviews and taking a look at what the gaps in the market are, it seemed more suitable to make a MIDI controller. A midi signal can be applied to almost anything - digital or analog - which makes it much more versatile. It's generally cheaper for the consumer as well, since it doesn't house the components that makes the sound.

PARAMETER TYPES

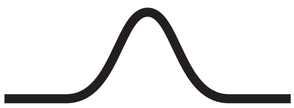
Previously, various types of physical inputs were addressed. Now, we'll focus on parameter types. This way to look at things is not industry standard, but rather a personal method I use to categorize and understand things. Consider an on/off switch. When you flip the switch, it alternates between on and off states. Now, envision an on/off button. Though the physical action of pressing the button differs from flipping the switch, the outcome is the same. Both flipping the switch and pressing the button represent physical inputs, while the on/off functionality serves as the parameter.

The on/off parameter is binary, but we want to deal primarily with dynamics. That's where human touch and expression comes in to play. There are three types of parameters that I am interested in:



CONSTANTS

Remains where you leave it. An example would be a volume knob or fader.



BENDS

When you let go, it resets back to its origin state. An example would be an egg clock or a pitch bend on a synth.

MODULATIONS

Adds constant motion. An example would be a clock pendulum or an LFO.

If you combine and stack these parameter types on top of each other, you can produce very complex and versatile signals.

EARLY IDEAS

The first ideas came from one of the points that showed up in the interviews. The difficulty of saving presets or back-stepping gives rise to a fear of making mistakes, which in its turn makes you interact with some parameters less. One way of inviting for more interaction would be to use snapback knobs.

In its standard state, it acts as a bend. You would turn the knob to tweak a setting, and when you let go of the knob, it resets. However, if you press the knob down, it kind of switches gears and acts like a constant. When you let go, it stays where you left it

This idea never made it to the prototyping stage for a number of reasons. It seemed there's a risk you just confuse the user. You might start doing the opposite mistake - having knobs snap back when you really wanted them to stay where you left them. How would you differentiate between regular knobs and snapback knobs? Also, the design process for this would largely be about mechanics, the switching of gears, the physical resistance in the snapback. That didn't really appeal to me. Although, as will become obvious later, things got very technical anyway.

The idea that i moved forward with is to change the physical input that controls a synthesiser. Instead of turning a knob, you could have something that is pressure sensitive and tactile to make the signal more dynamic. Depending on what type of parameter you are playing around with, the type of physical input is gonna be a little different.

I had a lot of different input ideas:

PHYSICALLY BENDING ROD OR PLATE THAT CREATES A BEND PARAMETER

Very simple. Pressing or bending is a type of action that a lot of people know from bending rulers in school and breaking sticks in the woods. Thickness of the rod or plate plays a big role on the physical resistance.

SPRINGED BOARD BEND WITH GEARS THAT LEAD TO POTENTIOMETER

A springed board that revolves around an axis and resets when you let go. Gears lead to a potentiometer. By changing the sizes of the gears, you can make a small movement in the board to make a big movement in the potentiometer.

INFLATABLE BEND

Balloon that you push or squeeze. An air pressure meter inside the balloon controls the signal.

JOG WHEEL BEND

The faster you spin the wheel, the more the signal is raised. If you spin the jog wheel backwards, it lowers the signal. When the jog wheel stops spinning, the signal resets.

SLOW RESET BEND

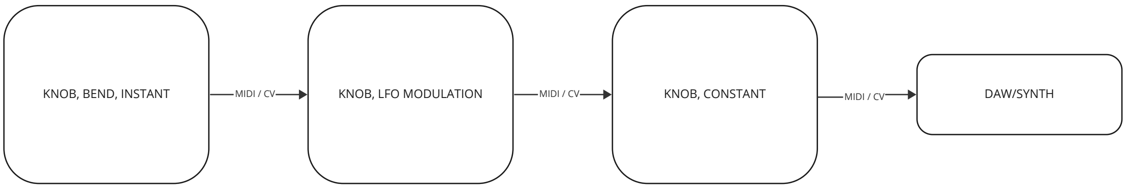
Wind up a parameter and let it reset in a few minutes like an egg timer.

I started building some of these ideas, and ordered some components that would help me realise them. Then, I could evaluate which of the input types were the best, and refine their designs.

CONCEPTUAL FUNCTION MODELS

As I started building the testers for the different physical inputs, I liked the idea of having them as separate units which, when connected, work together.

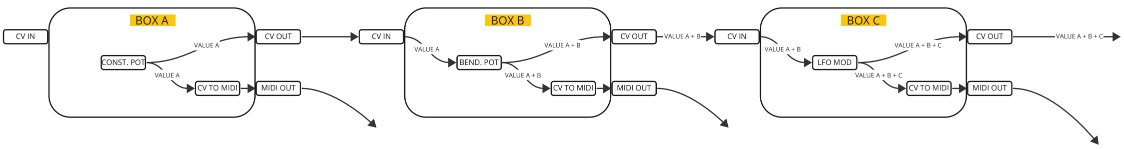
The figure to the left illustrates how i imagined the system to work. Each individual unit produces a signal. It sends the signal to the next unit. That unit generates its own signal, and adds the two together. The signal travels through all the units in the chain of different parameter types in that same fashion until it reaches the final unit. The final unit sends the sum of the whole chain to a synthesizer or a DAW.



In the figure below you can see the same system, a little more fleshed out. In this figure, MIDI and CV is separated into different outputs and inputs. MIDI and CV (Control Voltage) are the main two ways that synthesizers and other pieces of music equipment communicate with each other. CV is analog, and MIDI is digital. The system needs both to be able to cover as much compatibility ground as possible.

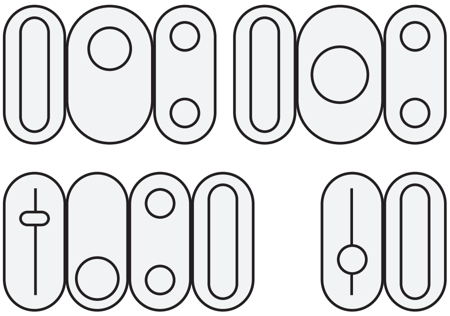
The input on the units should be CV, because it's compatible with analog synthesizers and euroracks. CV, being an unbroken continuum of electrical current, also has higher resolution than MIDI, which makes it a better languange for the units to communicate with each other. The CV signal should not be compressed to MIDI until it has to, which is at the last unit in the chain.

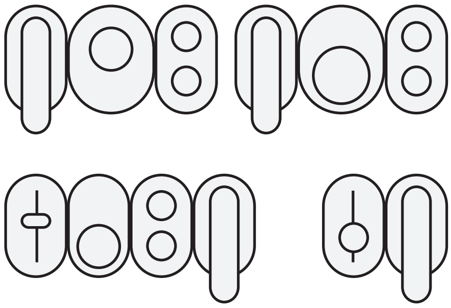
With the Arduinos used for prototyping in this project, the signal unfortunately has to be compressed down to a resolution of 4096 in every unit for it to work properly, but we'll get to that later.

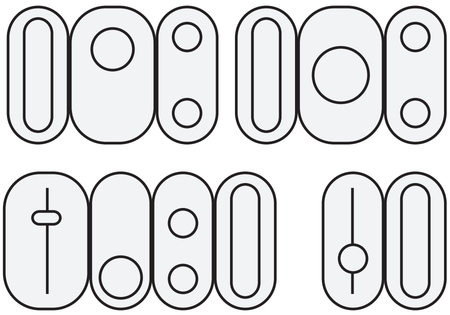


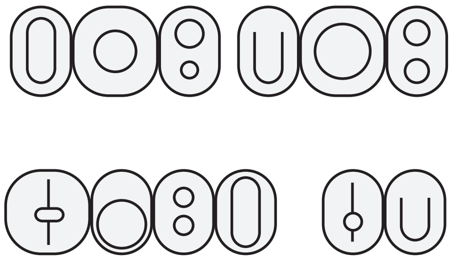
GRIDDING

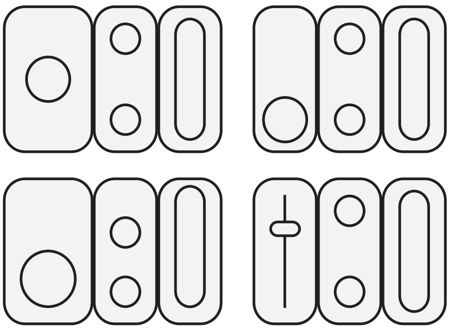
Below is some ideation exploring different widths and button setups. Which radii and other measurements could be shared? Do they need to be the same size or can they be different? What is a practical and aesthetically pleasing footprint?

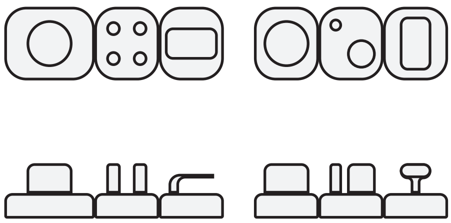


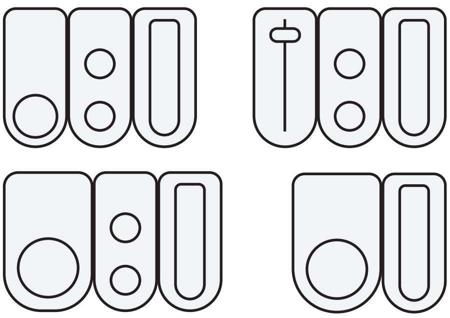


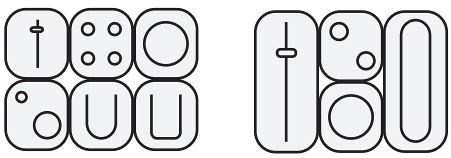






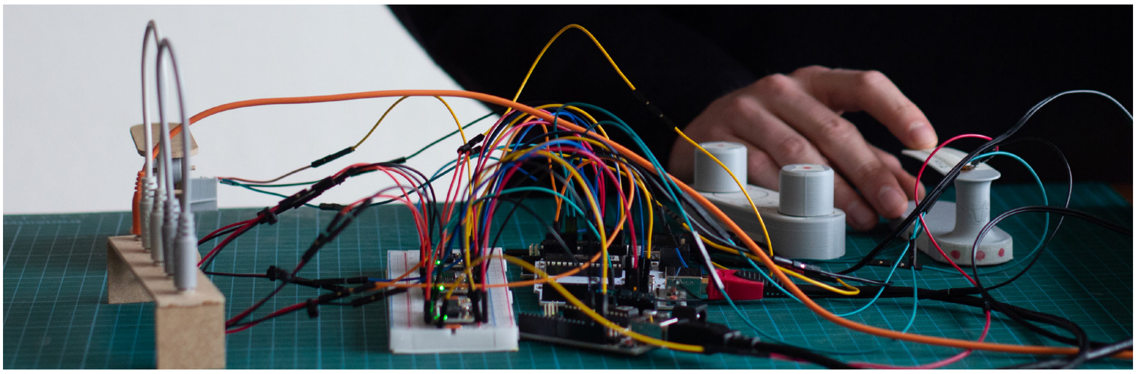




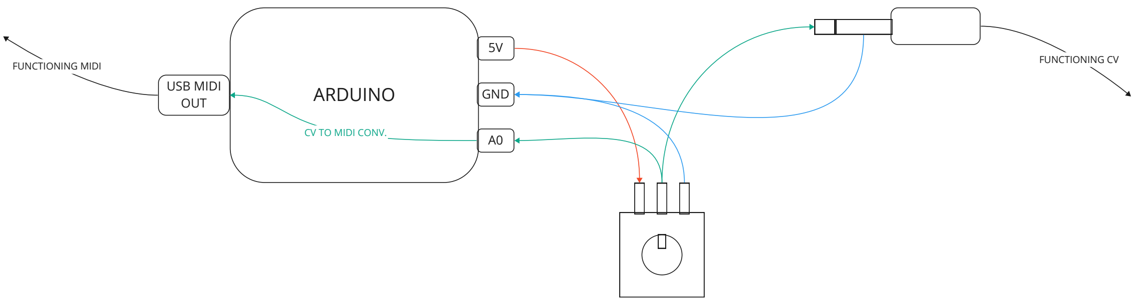


CODING & BREADBOARDING

Figuring out the electronics and making the code do what I want it to has been the biggest challenge of the project. Most of the skills I had to learn was found in the book "Arduino for musicians" by Brent Edstrom. Bouncing my ideas and problems with knowledgeable friends has been a great resource, and a major tool that i used to help with the code throughout the project was Open AI ChatGPT.



The Arduino UNO was used for the majority of the prototyping phase. It's very versatile and works great for testing out ideas and concepts. The first time I managed to use the arduino to actually interact with a synthesizer was by connecting it like below. The "functioning CV" was plugged in to the filter cutoff of an Arturia Minibrute. By turning the potentiometer knob, I could raise or lower the cutoff level. The output CV was simultaneously measured by the arduino and displayed as a MIDI number on a serial monitor on my laptop computer.



The code simply reads the value fed back by the potentiometer and converts it to a number between 0 and 127, which is the resolution of a MIDI channel. There is a problem with this setup when we add additional units, though. The arduino UNO is unable to output varying voltage through code. The reason that this setup works is because we are outputting CV directly from the potentiometer.

The next unit in the chain is gonna be able to measure the voltage in the green line. It is also gonna be able to produce it's own voltage using the same setup. But it cannot add the two voltages together and output them as one. To do that, we need a DAC (Ditigal to Analog Converter). Then, we can output any voltage that we want using code.

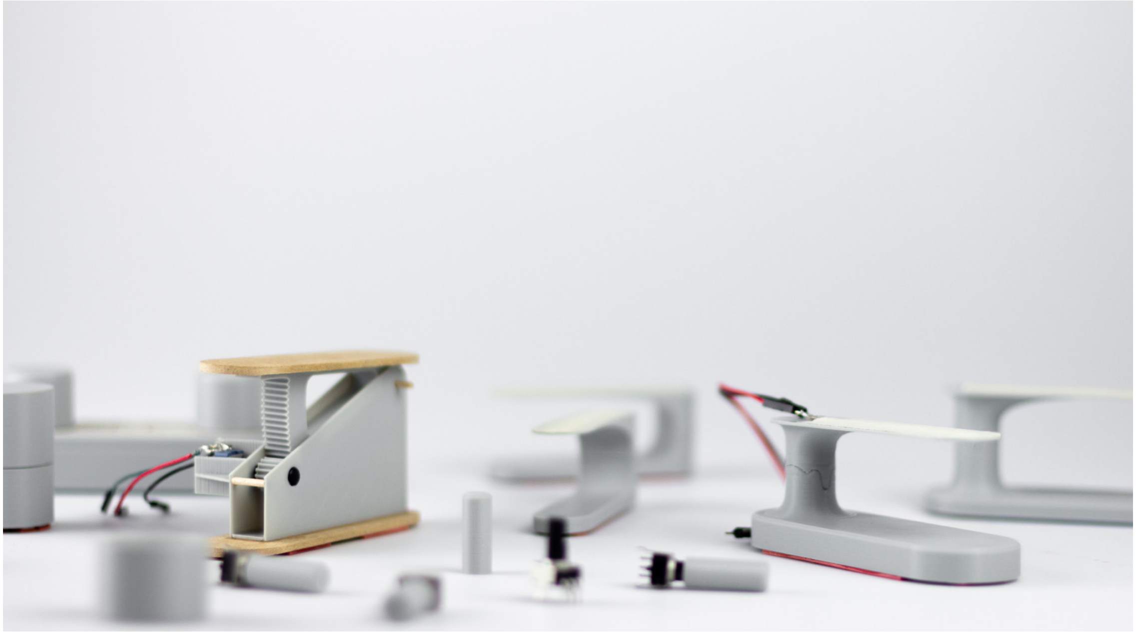
With DACs hooked up, I managed to get a chain of three Arduinos to successfully send the signal down the chain and output it to an analog synthesizer.

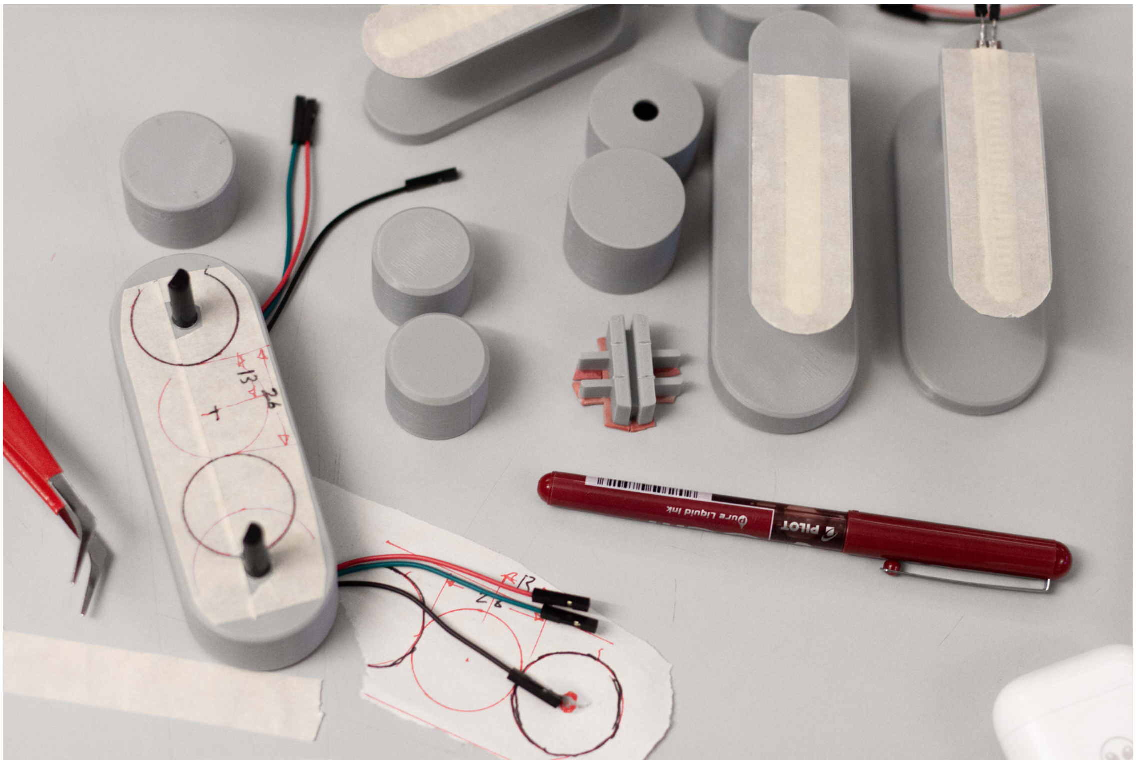
The next step was to built something with the interesting components that i bought.

EARLY PHYSICAL MODELS

The iterative models are attempts to house the physical inputs and their respective mechanical parts in the simplest way possible. As a result, they are pretty straight forward and easy to understand. This is something that I tried to keep throughout the development.

During the user testing and feedback meetings, they gradally started to look more and more similar in their footprint and general expression.





Evaluation

COMPANY DISCUSSIONS

Mid process, I paid visits to OP and Elektron in Gothenburg for feedback. The discussions were very helpful to the project, and it was very valuable to get the perspective from both a synth manufacturer and a design agency.

USER TESTING

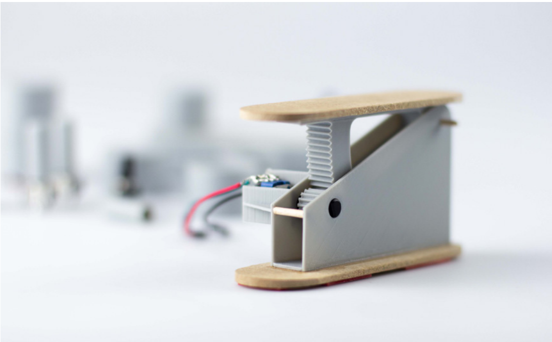
Although the electronics and coding was a big challenge, the resulting functioning prototypes really made it possible to have impactful user testing sessions. Relationships between shape and function could be observed and discussed.

In total, there were four user testing sessions, involving five people. Three of them were interviewed in the beginning of the project, and the remaining two were new to the project.

I have been documenting this as if the prototyping came first and the user testing second, but in reality it all happened simultaneously. Some peoaple got to test very early prototypes, whereas others got to test them nearing completion. All testing was conducted with CV sent to analog synthesizers, as functioning MIDI was one of the last things added to the units.

Units involved in the testing:

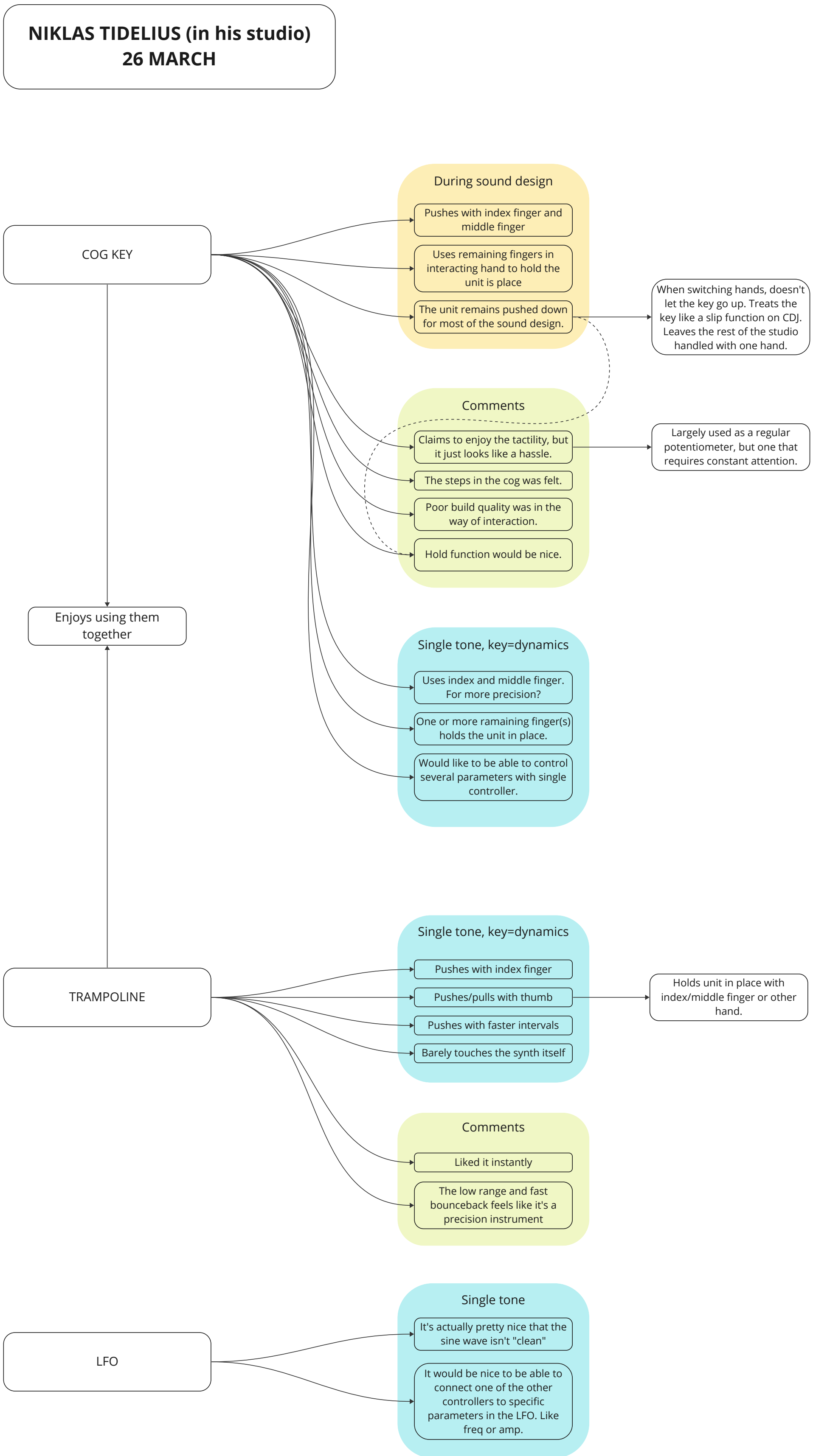
BENDING SPRINGED & HINGED BOARD



PHYSICALLY BENDING BOARD W/ FLEX SENSOR

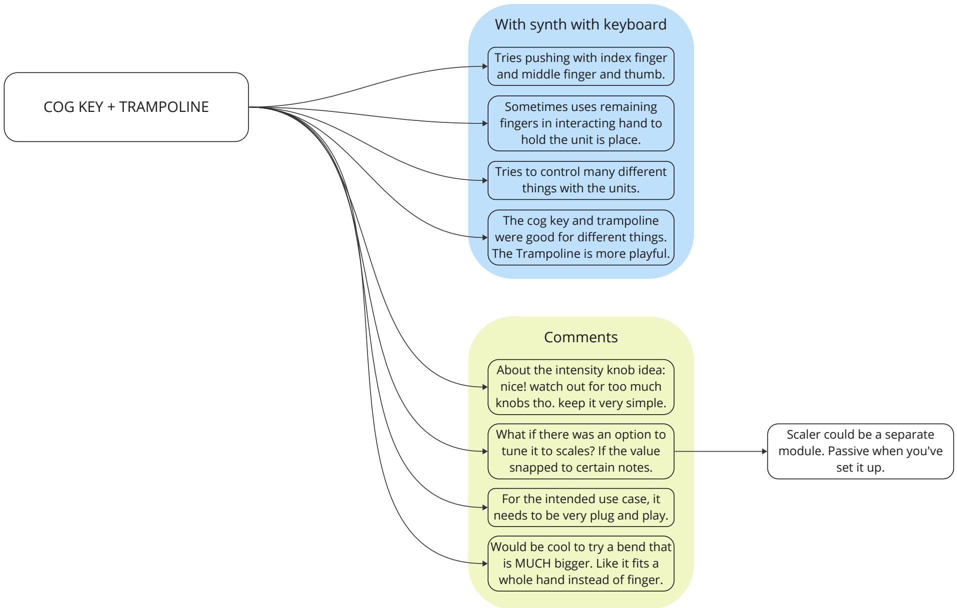
MODULATING LFO WITH KNOBS FOR AMPLITUDE & FREQUENCY

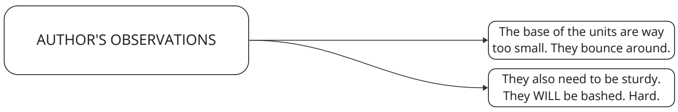
User test #1


NIKLAS TIDELIUS (in his studio)
26 MARCH
COG KEY
During sound design
Pushes with index finger and middle finger
Uses remaining fingers in interacting hand to hold the unit is place
The unit remains pushed down for most of the sound design.
When switching hands, doesn't let the key go up. Treats the key like a slip function on CDJ. Leaves the rest of the studio handled with one hand.
Comments
Claims to enjoy the tactility, but it just looks like a hassle.
Largely used as a regular potentiometer, but one that requires constant attention.
The steps in the cog was felt.
Poor build quality was in the way of interaction.
Hold function would be nice.
Enjoys using them together
Single tone, key=dynamics
Uses index and middle finger. For more precision?
One or more ramaining finger(s) holds the unit in place.
Would like to be able to control several parameters with single controller.
TRAMPOLINE
Single tone, key=dynamics
Pushes with index finger
Pushes/pulls with thumb
Holds unit in place with index/middle finger or other hand.
Pushes with faster intervals
Barely touches the synth itself
Comments
Liked it instantly
The low range and fast bounceback feels like it's a precision instrument
LFO
Single tone
It's actually pretty nice that the sine wave isn't "clean"
It would be nice to be able to connect one of the other controllers to specific parameters in the LFO. Like freq or amp.

User test #2

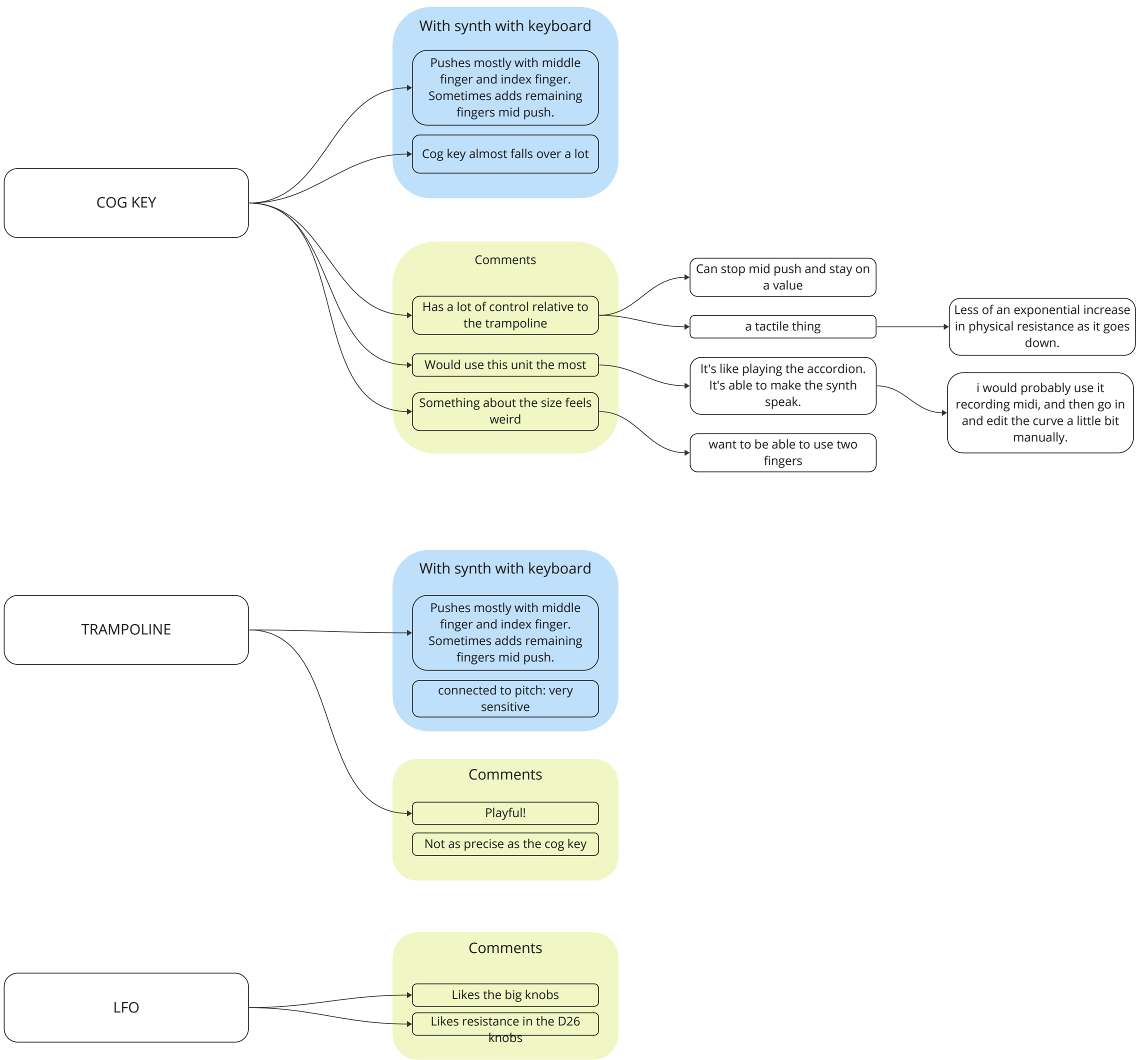
**HAMPUS FORSVALL & JOHN G (in Hampus' home studio)
1 APRIL**





User test #3

JOEL METZ (in his studio)
7 APRIL



User test #4

ARVID WENDEL (at IKDC)
15 APRIL

- COG KEY
  - With synth with keyboard
    - Uses thumb or sometimes palm to push
  - Comments
    - Feels like it suits FX
    - A little slower than the trampoline.
    - Would like to be able to set it to stay at a value
    - Function instantly understood, but it takes a while to grasp how hard you can press it or what you can do in terms of precision, speed etc.

- TRAMPOLINE
  - With synth with keyboard
    - Uses middle and index finger, or sometimes thumb to push
    - Picks it up and presses it with his hand
    - This is the favourite and most frequently used unit
  - Comments
    - Feels very rythmic, instant, melodic.
    - How it sounds and how it looks works very well together.
    - Function instantly understood

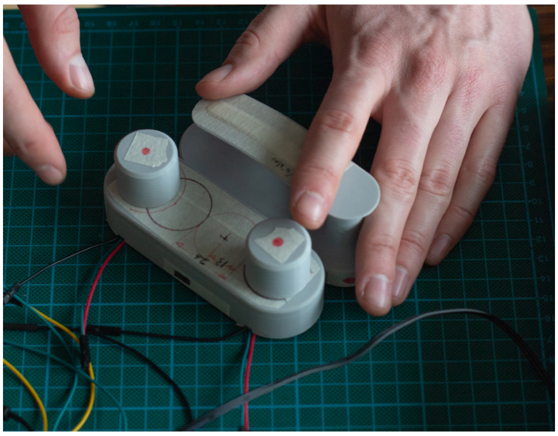
- LFO
  - With synth with keyboard
    - interacts a lot with LFO to create rythms.
      - appears to want to interact with LFO more, but is held back by shitty programming.
    - Hard to understand what's happening

- OVERALL DISCUSSION
  - Nice to have them spread around the table, not clasped together. Most of the time, modular setups or synth studio setups are very aligned. but it's also nice to have it set up kind of like a drum set.
    - If you have them in groups of two or three, you could just quickly turn them around and play it from the side if you want.
  - Would like to try and stick them to the table with velcro.
  - Very instagram friendly.

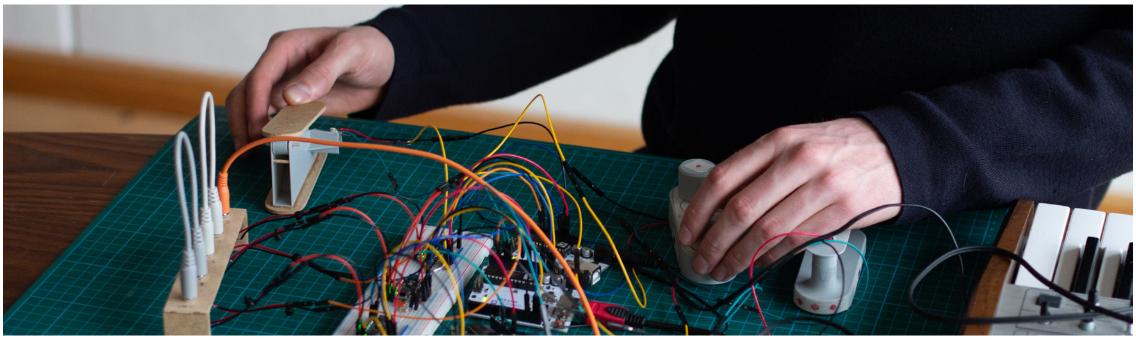
CONCLUSIONS FROM FEEDBACK SESSIONS AND USER TESTINGS

The shapes of the units were direct results of their function, which seem to work very well. Except for the LFO, which is a bit complicated, the units were quickly understood by everyone that I spoke to.

Magnets as a way of anchoring the units are really nice. In the best case, the units would automatically connect through the magnet anchoring as you group them. Even with a magnet anchoring connection, the units still need to have a 3.5 input and output as well in case the user wants to separate the units to fit a table. The units should be able to input or output signals to or from external gear, which the 3.5 jacks makes possible. Also, everyone won't use the units as you intend them to. Not having the magnet connection being the only option opens up for experimentation.

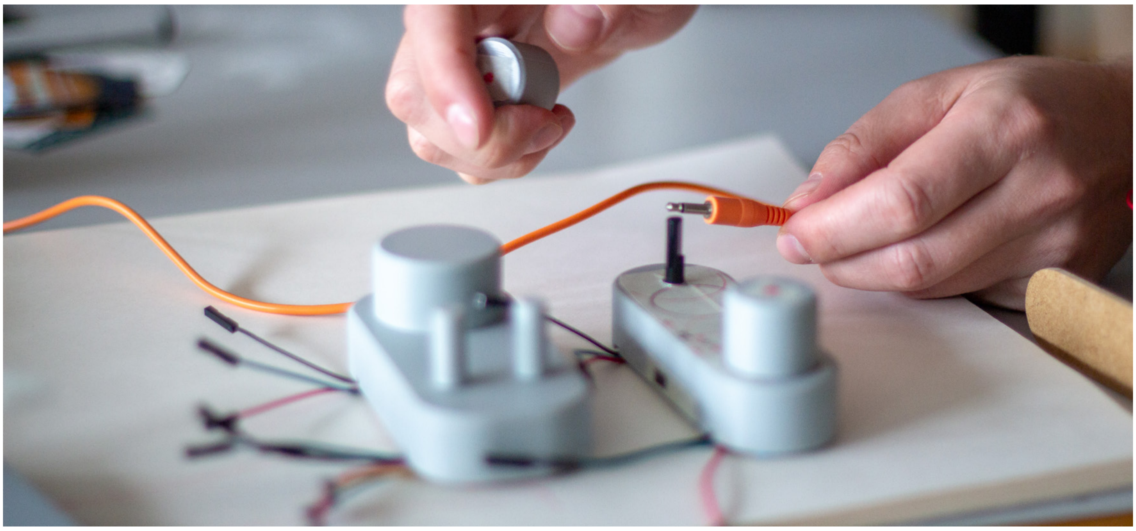


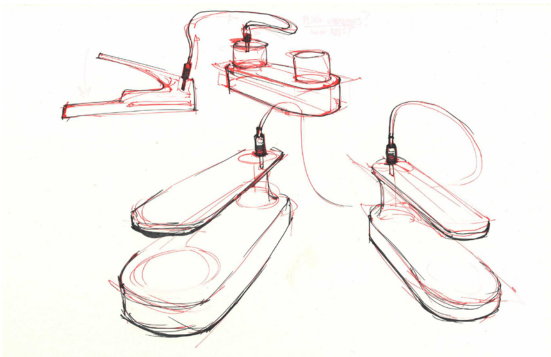
With 3.5 jack inputs and outputs, you can split the chain of units where you want. Let the user decide which units are important and how to arrange them.

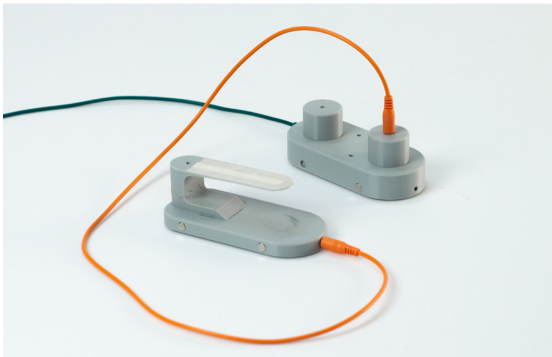


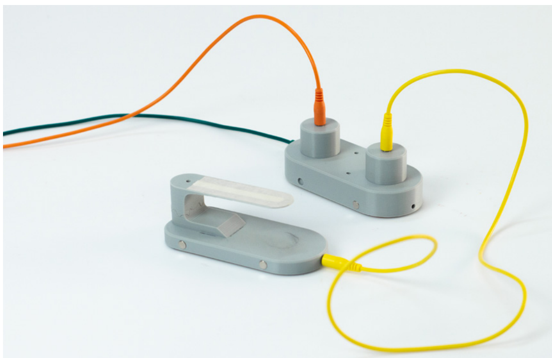
Continuing on customisation, it is a good idea to have a few setting knobs even though you want to keep the units very clean. Some things that came up regarding the bend units is an intensity knob to control how much the push affects the signal. It would also be great it there was a way to physically freeze the pressure board at a specific value.

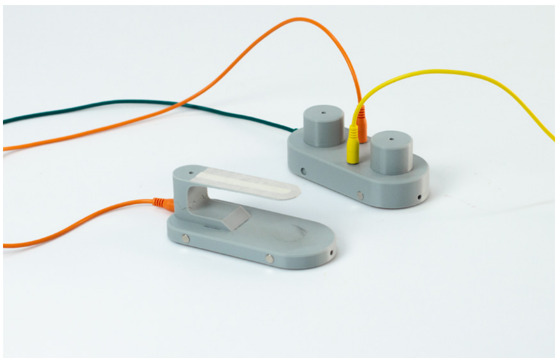
The LFO has two parameters that are unaffected by input from other units. What if the amplitude and frequency knob took input? This made me ideate with wire connections. What makes sense and what can actually be built?

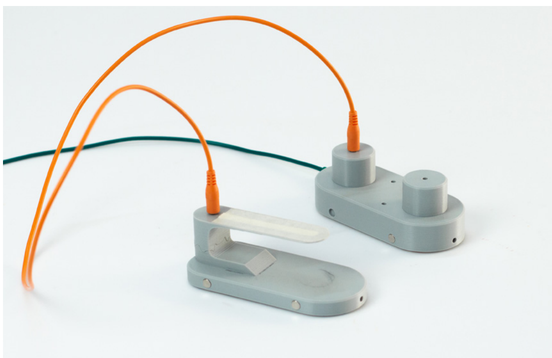


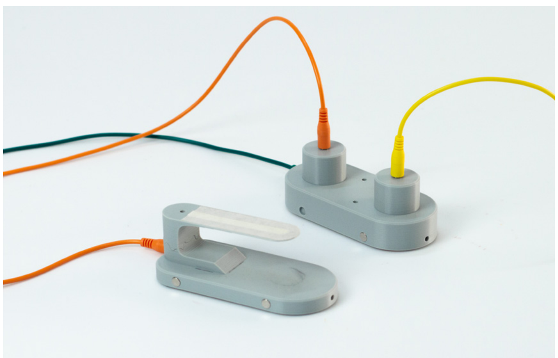




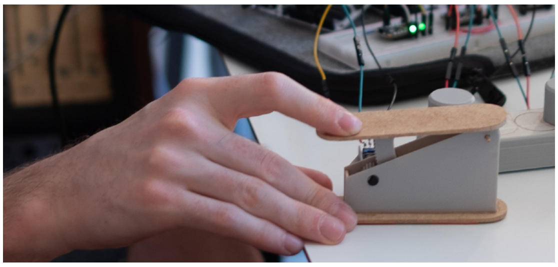


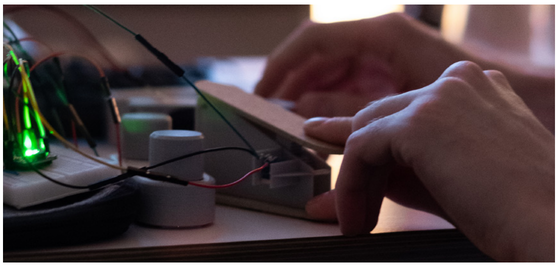






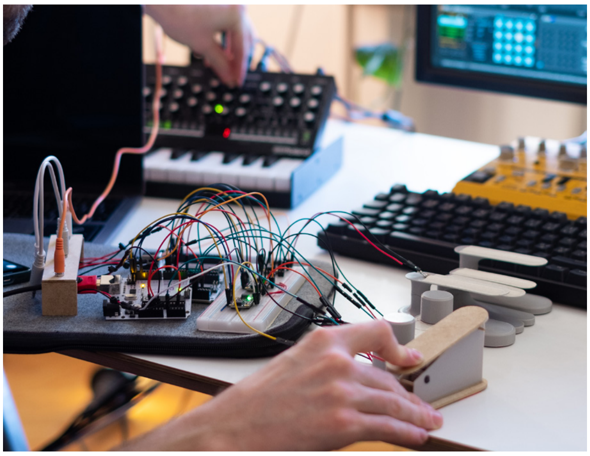
The base of the units are way too small. They bounce around and fall over when you use them. One or more extra fingers are frequently used to hold the unit in place.





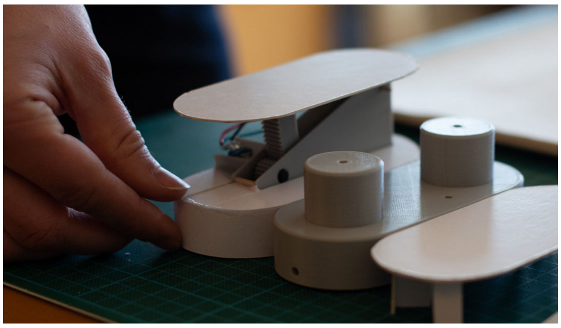
They also gradually slide forward on the table. In the picture below, the unit has been pushed into a place where it is getting harder to use it.

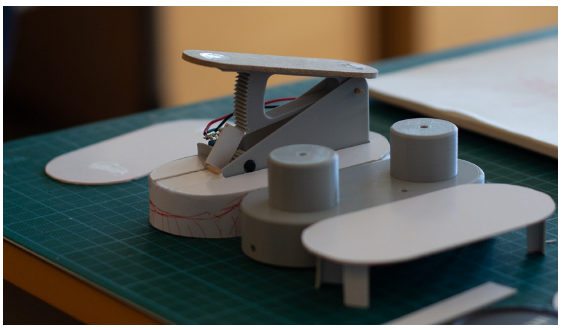
Lastly, during discussions about what function goes where, I raised the question wether or not there should be a constant parameter unit at all. The answer was yes. During most of the user testing sessions, the absence of a big constant knob or fader was a pretty big issue. While doing sound design, the bend units were pushed down for long periods of time. Then, it just acts like a constant knob that needs attention.

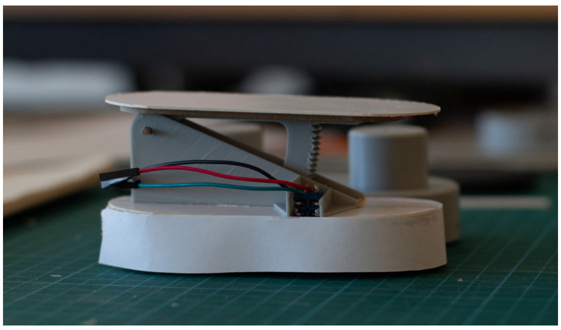


Realisation

As I was developing the individual tabletop units, I had been trying to fit all of the units into the same box. It was a struggle to fit everything into the same height or width with the inner components varying so much. Though it's nice to have the same footprint, it actually looked quite boring for the units to have the same height.

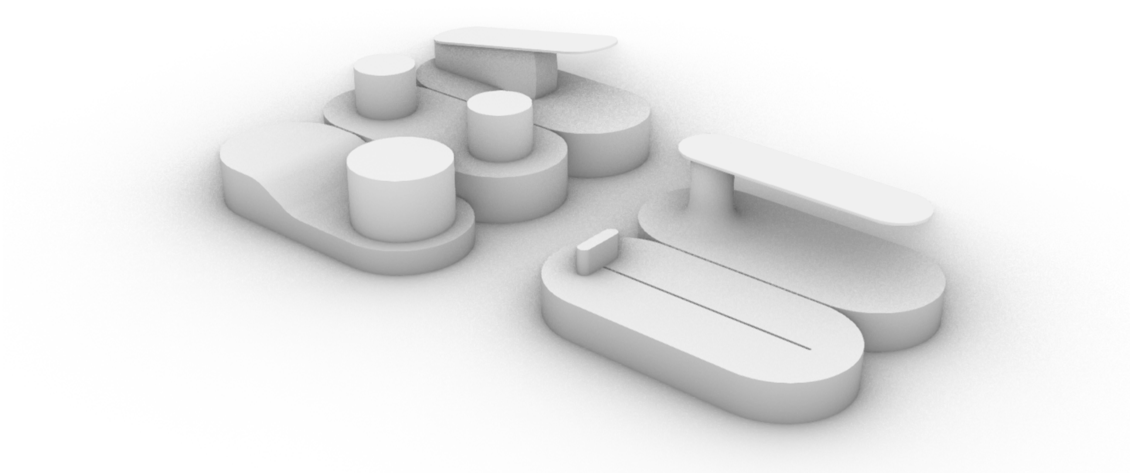






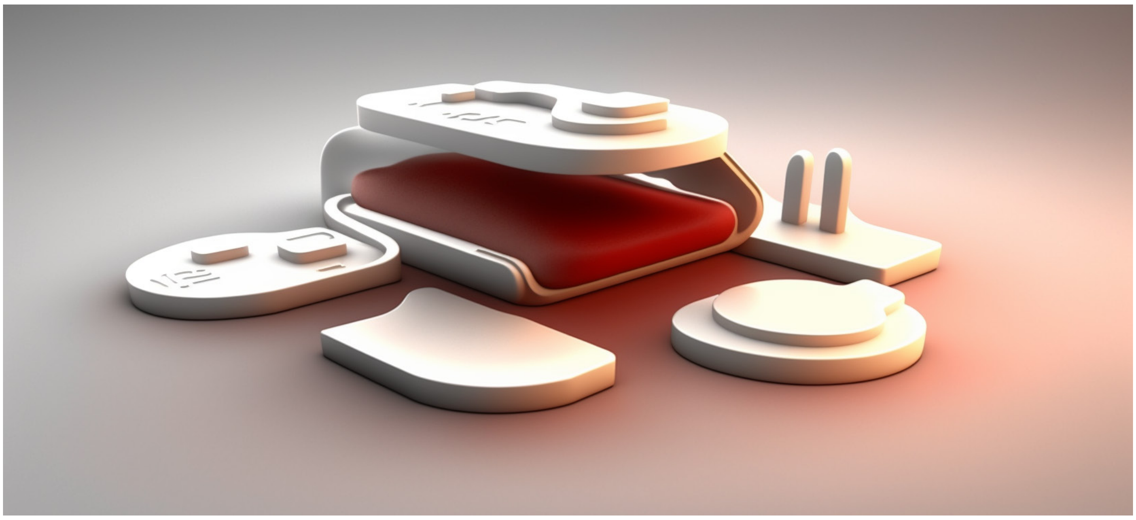
During the realisation phase, the collection of units were given some topographic variation to make it more interesting for the eye. The variation in size is also a good way to design for future changes or additions to the collection. In a future unit, it might be impossible to fit everything in a box the size of the already existing units.

I eventually decided to keep the pill-shaped footprint that showed up in the early models and leave room for different heights. A simple geometric form language would be easy to expand upon. To speed up the ideation process for detailing, I gave a simple, white rendering of the basic shapes(seen below) to Midjourney - an AI image generator.

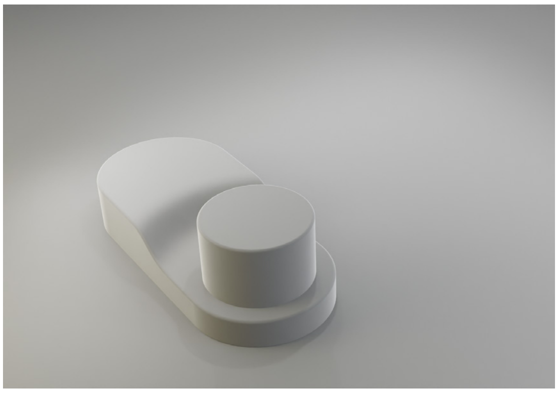
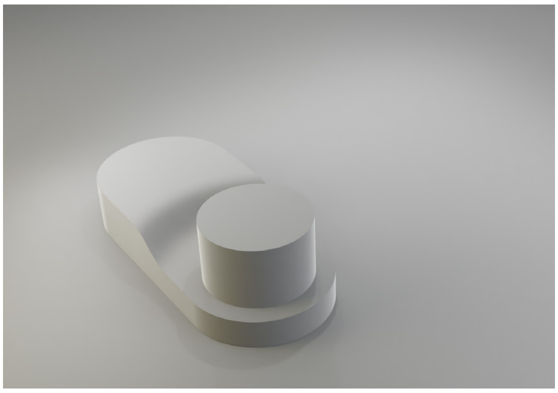
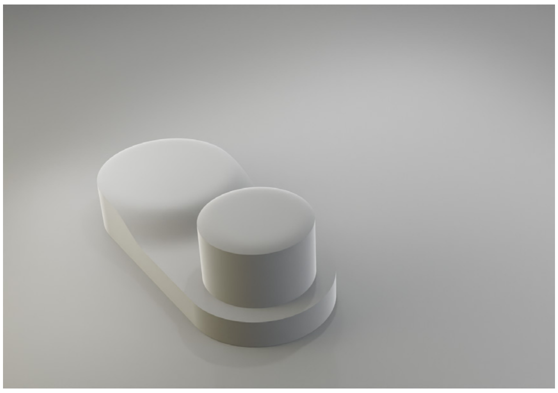
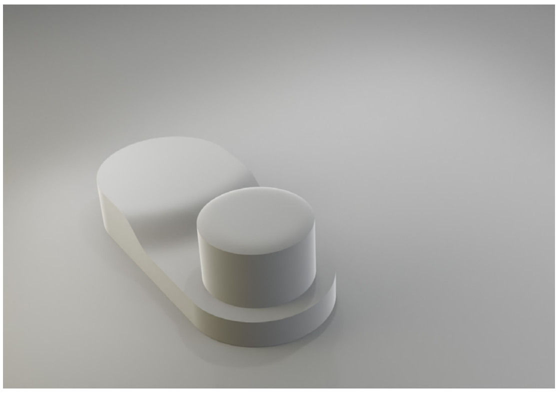
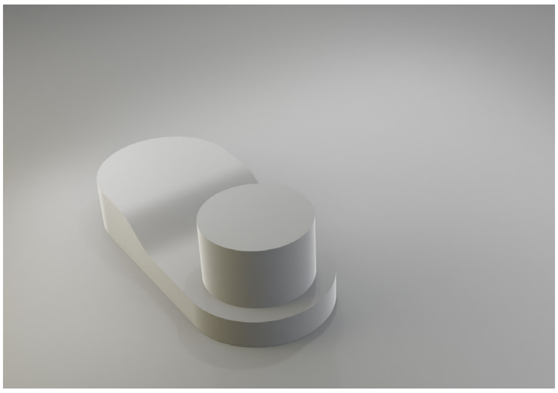
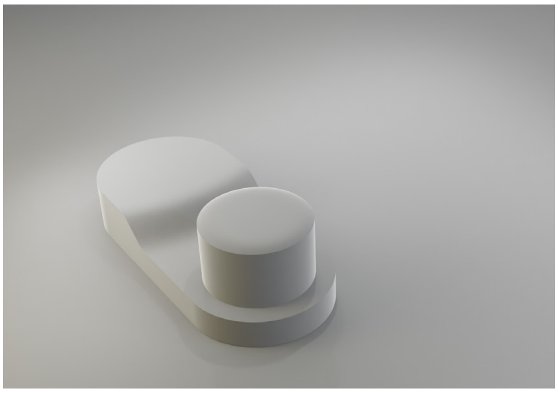
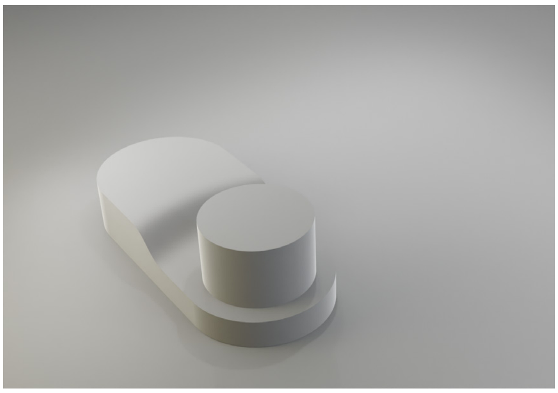
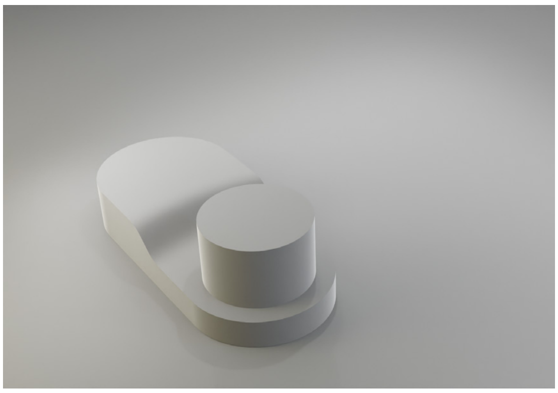


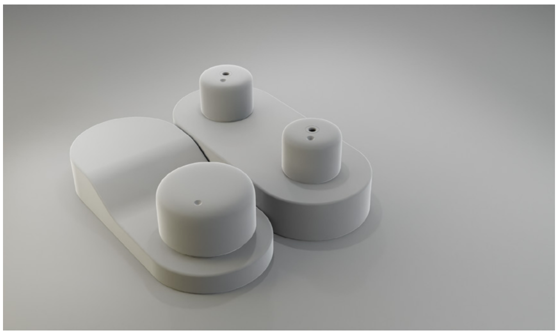
Some interesting things came out that I deemed worth exploring. Small circles as indicators on knobs. Smooth edges. Matte, off-white surfaces. A splitline on the knob, changing materials on the turning piece.

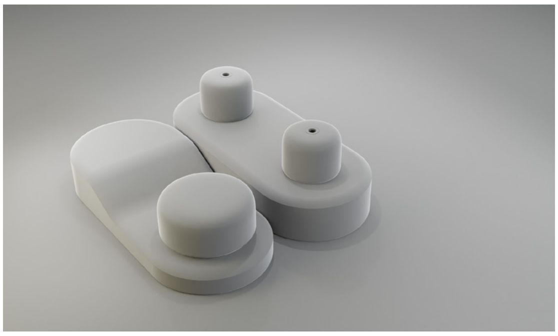
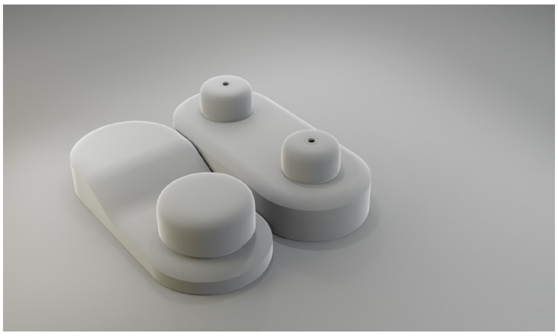
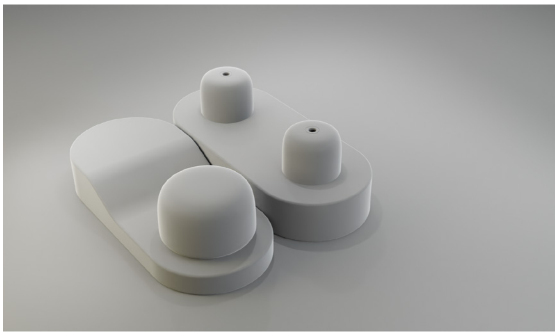
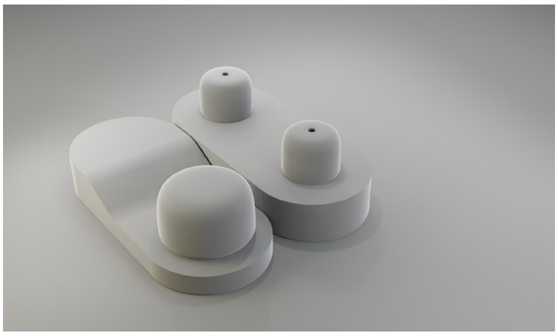
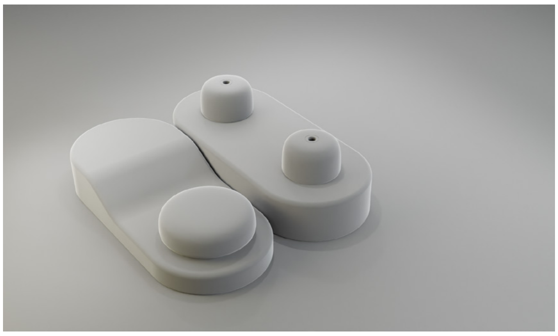
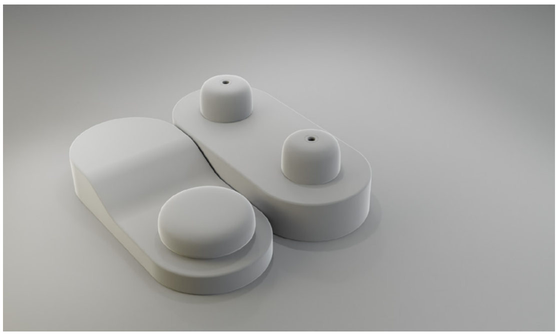
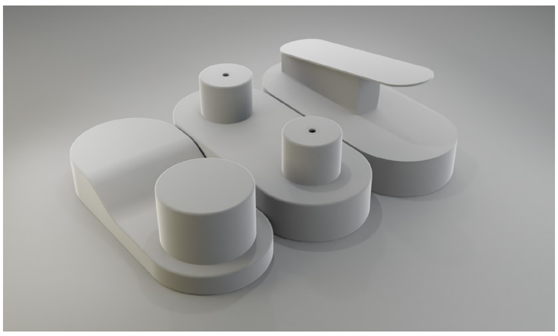
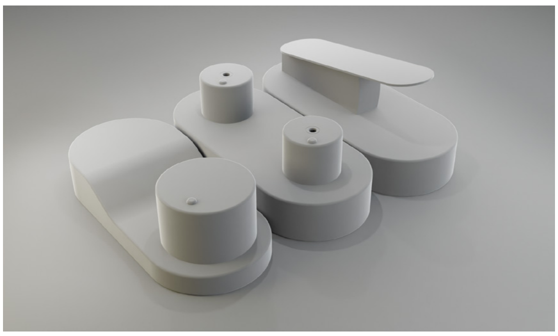
Topographic variations and curvy transitions between faces. Asymmetric button distribution. Large parts of planar surfaces left untouched. Knobs off-center. The colors shown in the images would look fantastic if LEDs were added to the units in future editions.

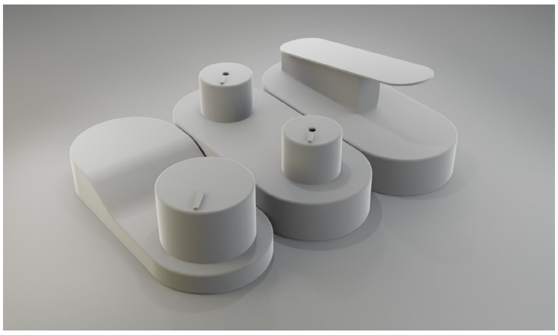
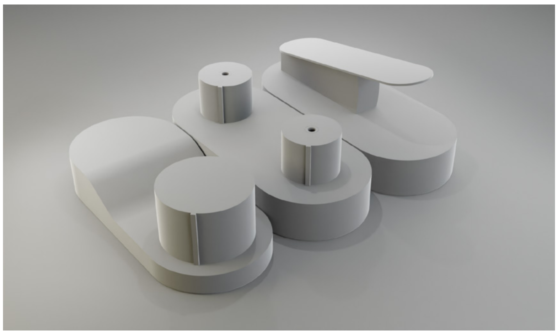
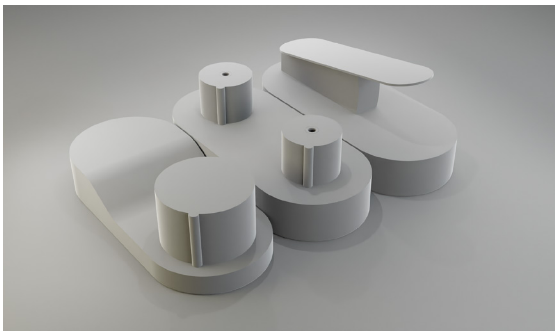
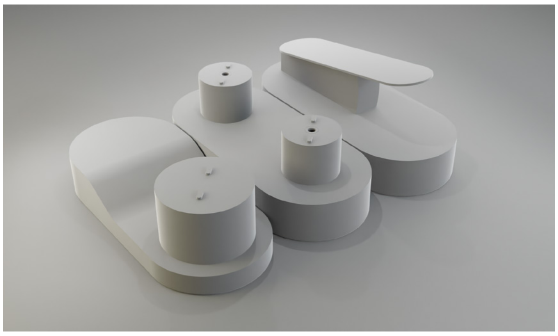
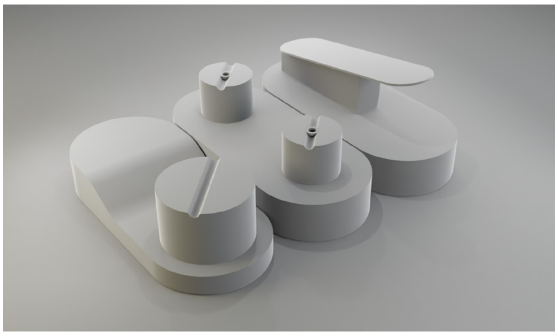
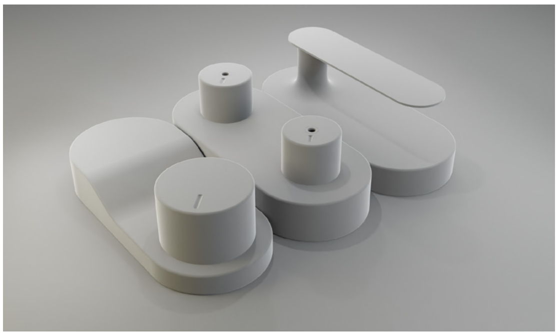
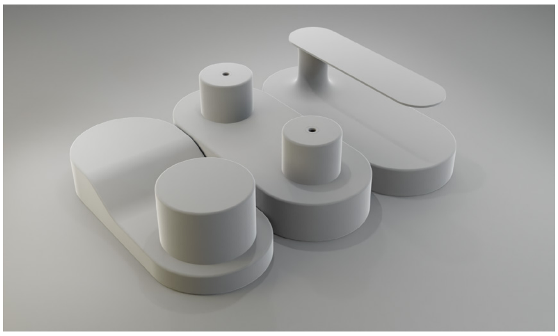
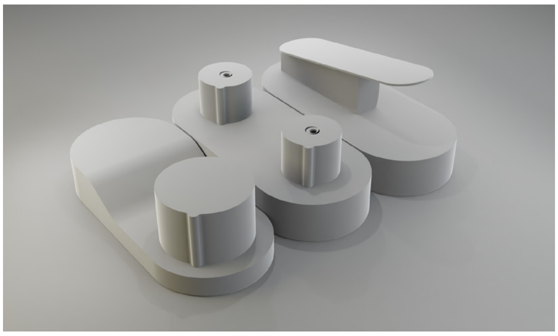
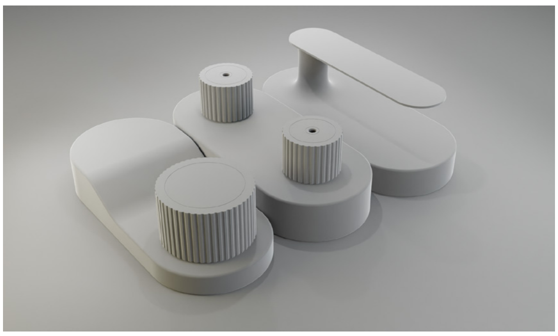
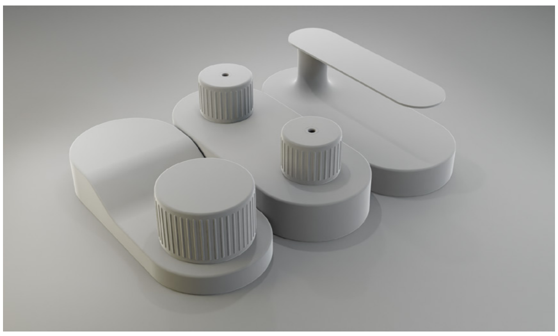


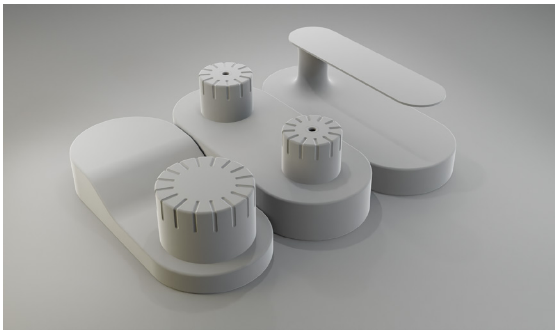
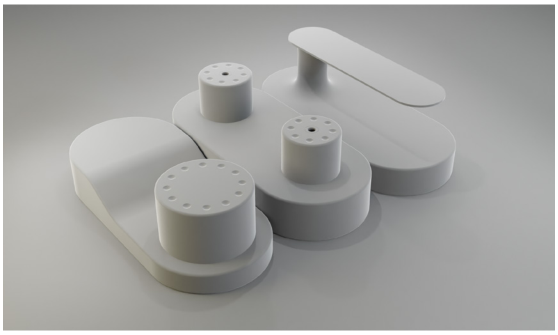
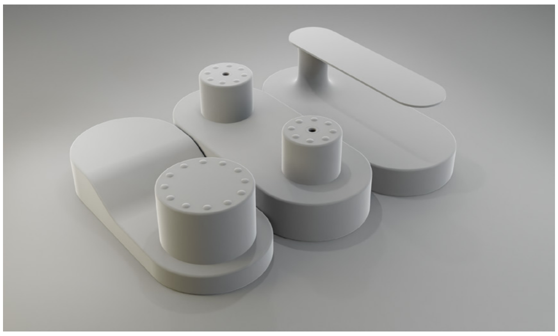
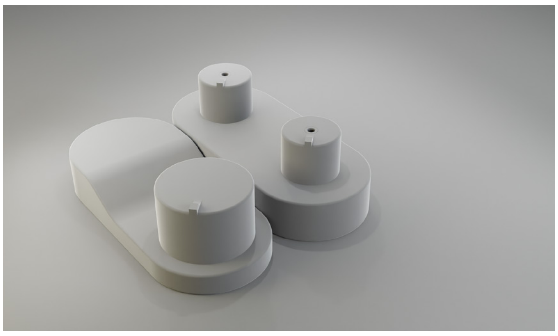
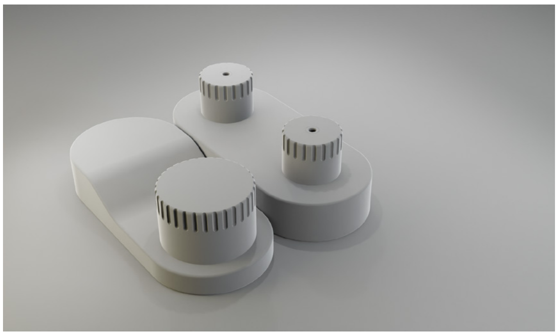
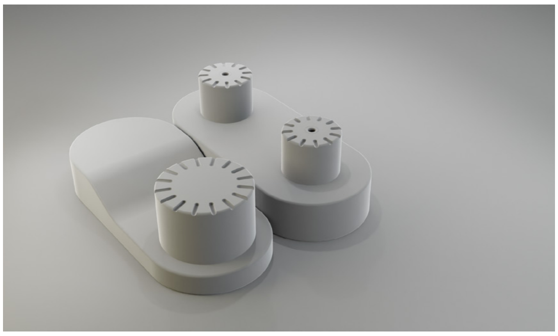
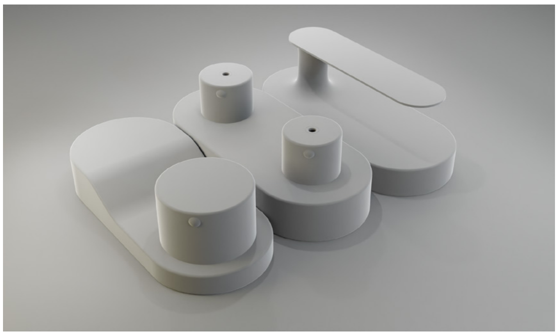
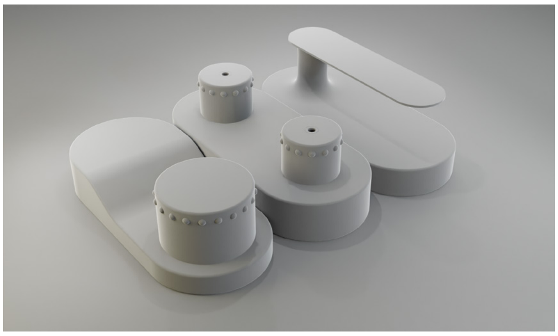
Some of the ideas from the Midjourney generated images was then tried out. I modelled up some different detailing of both the body and the knobs of the units.



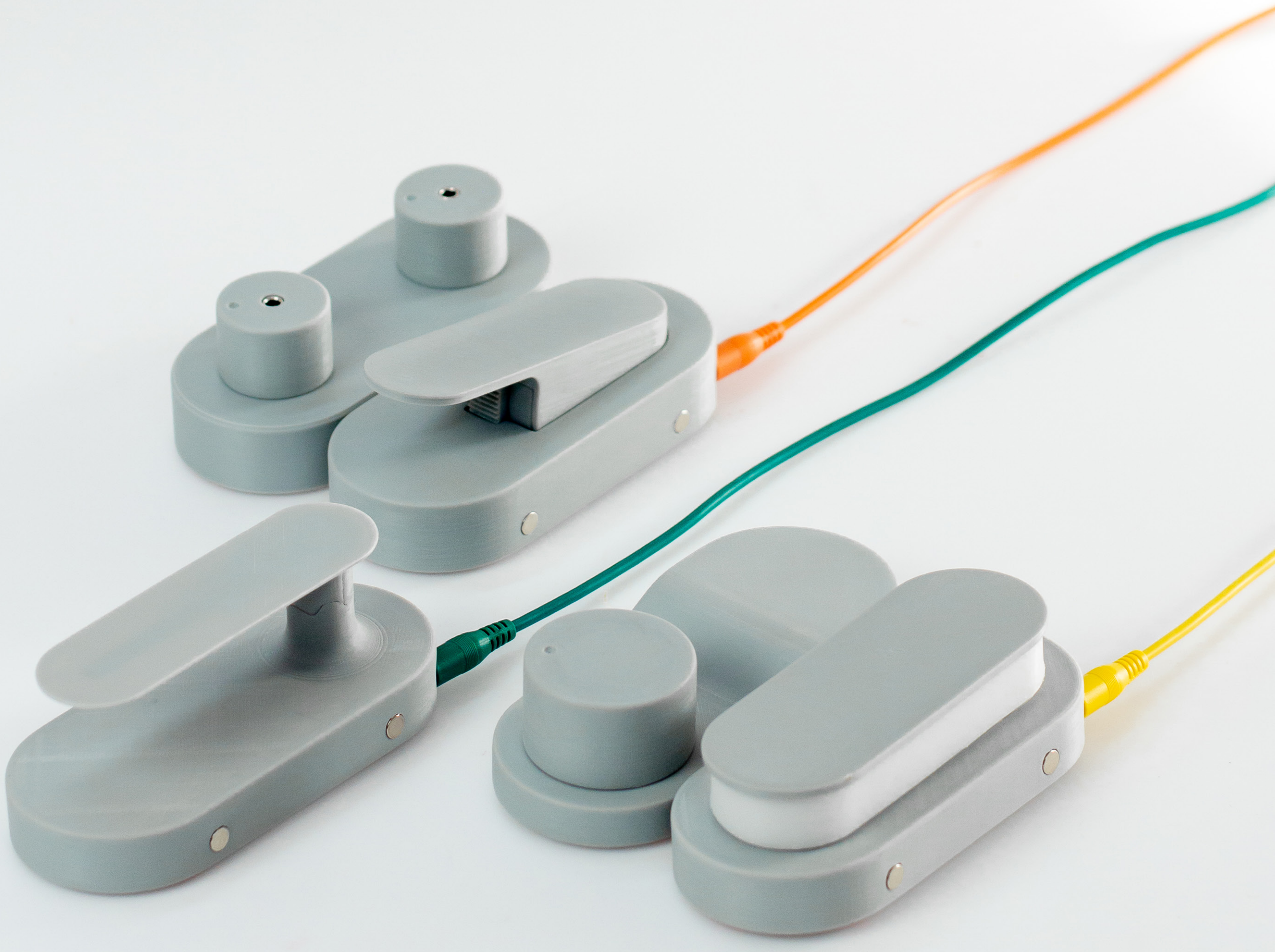











Trying these variations felt neccessary. In the end though, almost none of it made it through to the final design. As the units are seen grouped together, less complex shapes and minimalistic detailing looks a lot cleaner. The more cluttered a setup is, the harder it is to navigate - especially when performing a piece of music on stage in front of people. My hopes are that the simplicity in the design will make it easier and more convenient for the user.

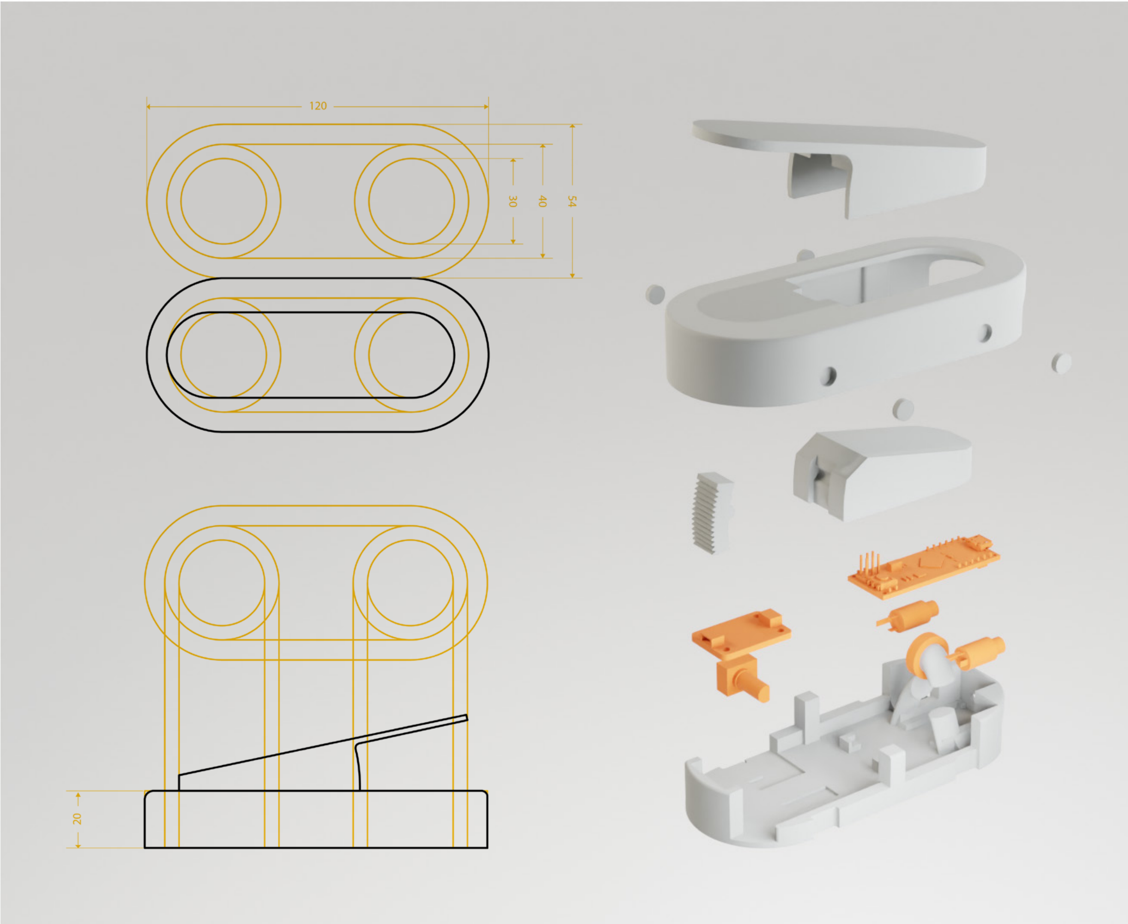
Result

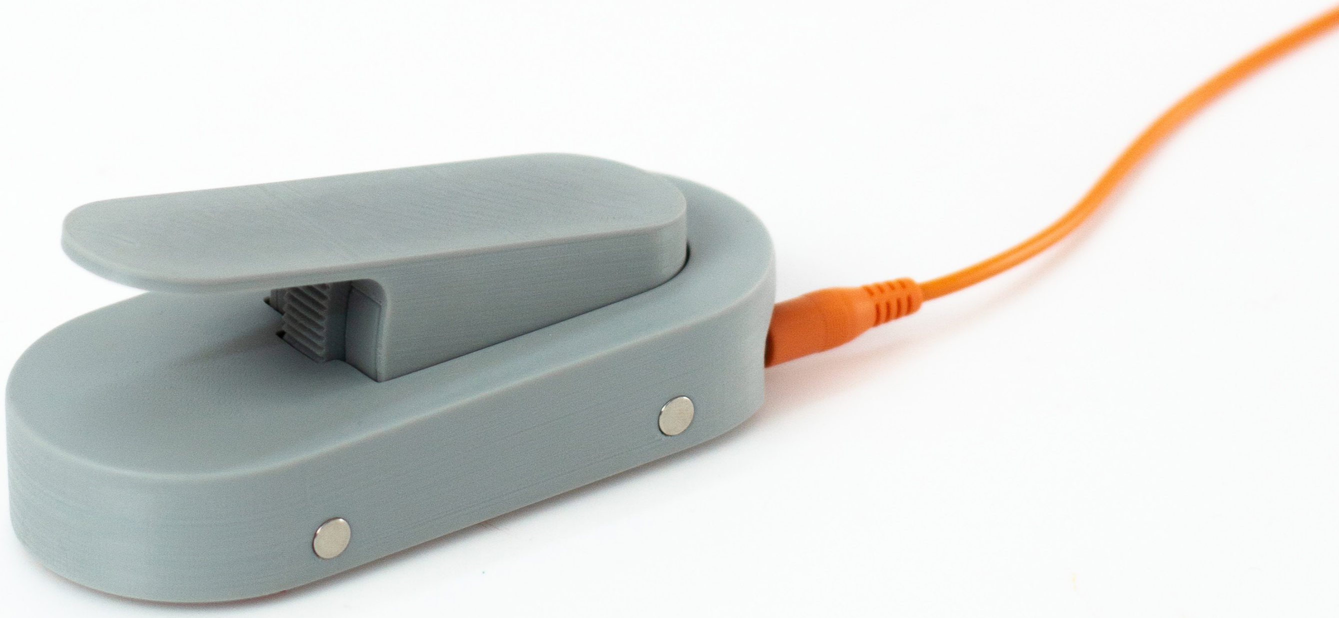
The result is this set of controllers. They send both MIDI for digital systems, and CV for analog machines. They work individually, but they work even better together. They are great for playing around with dynamics - the intensity of a sound - but you can assign them to anything. It's up to the user to decide how to use them. It's also up to the user to decide which input type they like the best and how to combine the units to best fit their needs.



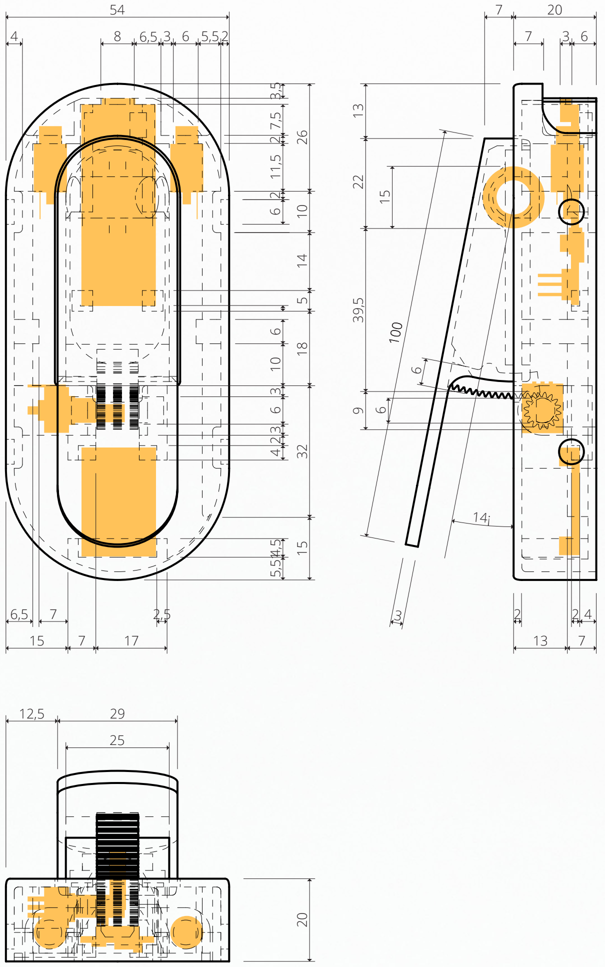
PRESSURE BOARD #1

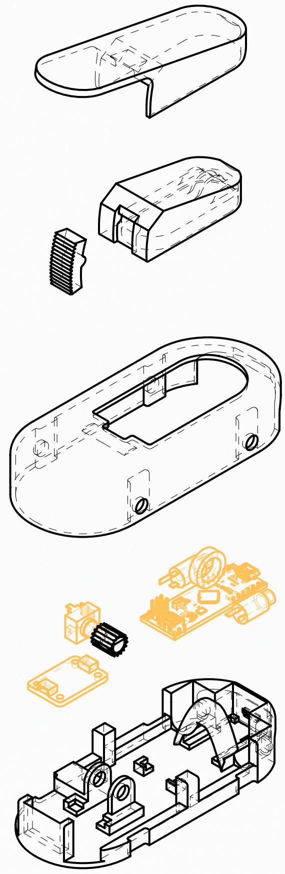
This bender unit is great for precision. The pressure board is connected to a potentiometer through gears, and there is a spring underneath that provides some physical resistance and resets the board when you stop interacting with it. The potentiometer moves smoothly, and slows down the movement time by some milliseconds. Because of this, it's easy to stay in one position and only partly push the board down.

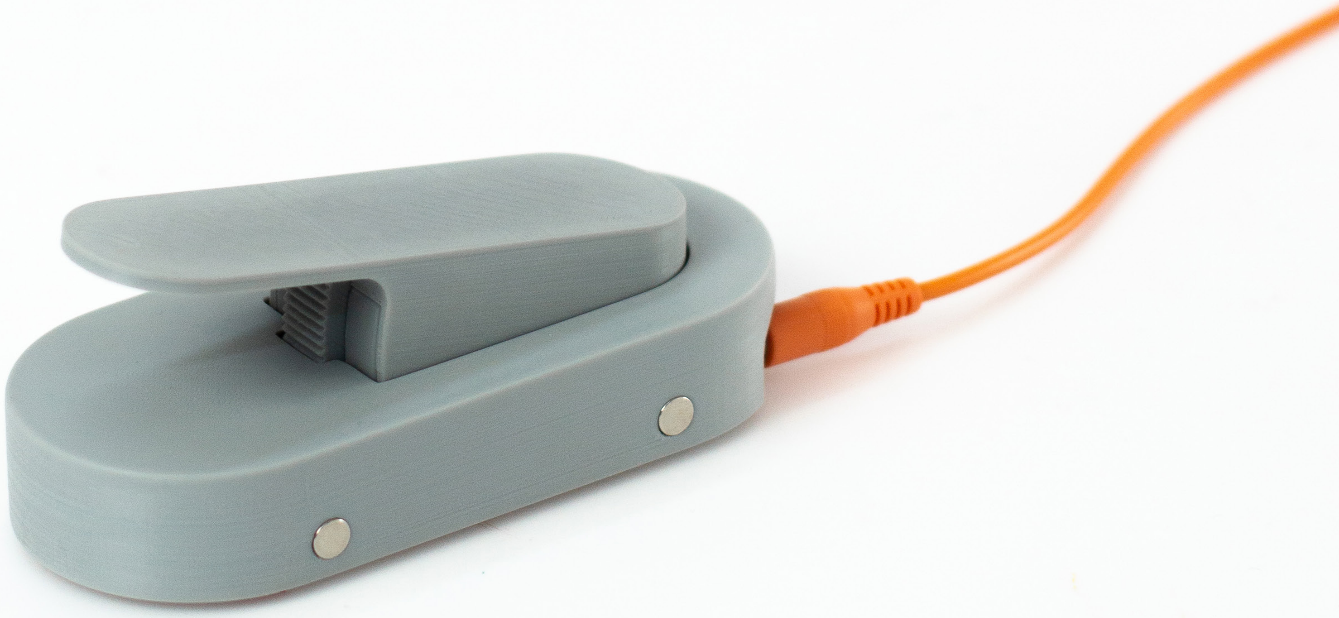




TECHNICAL DRAWING (mm)

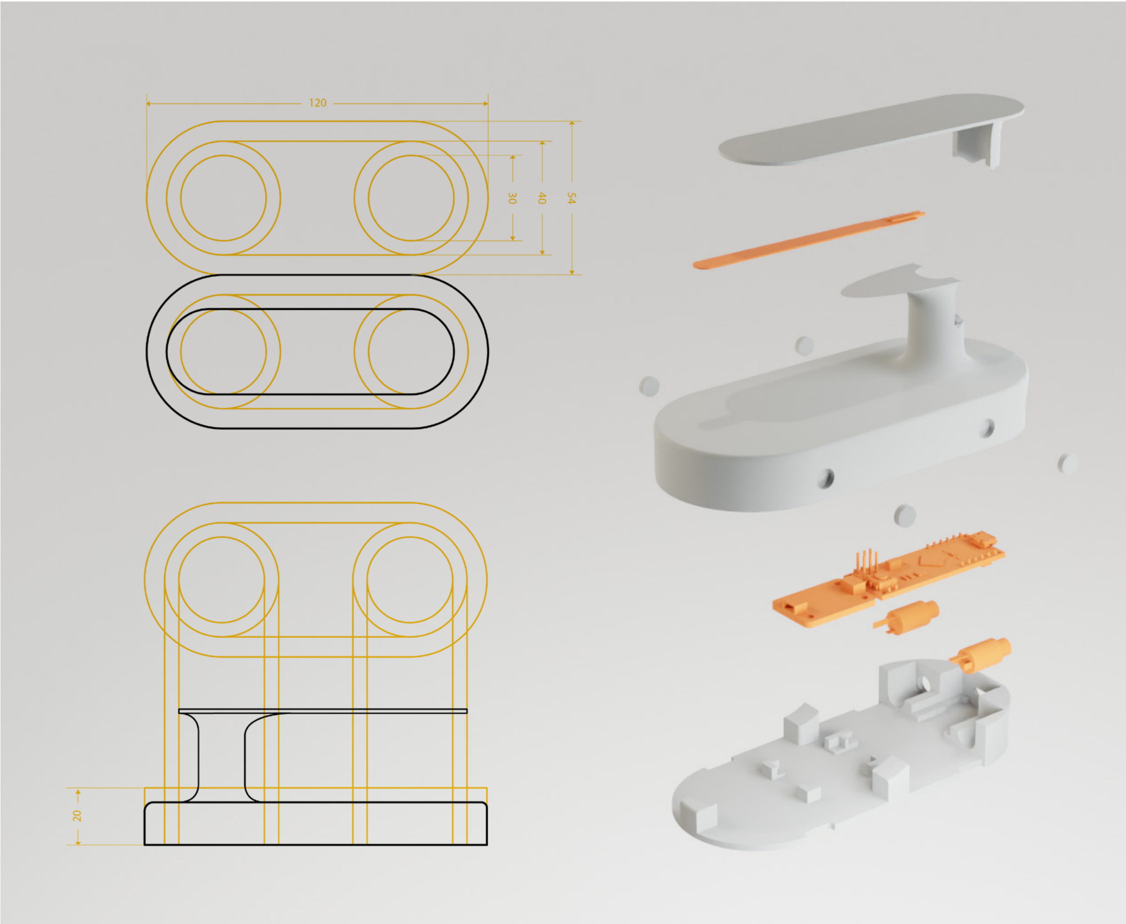


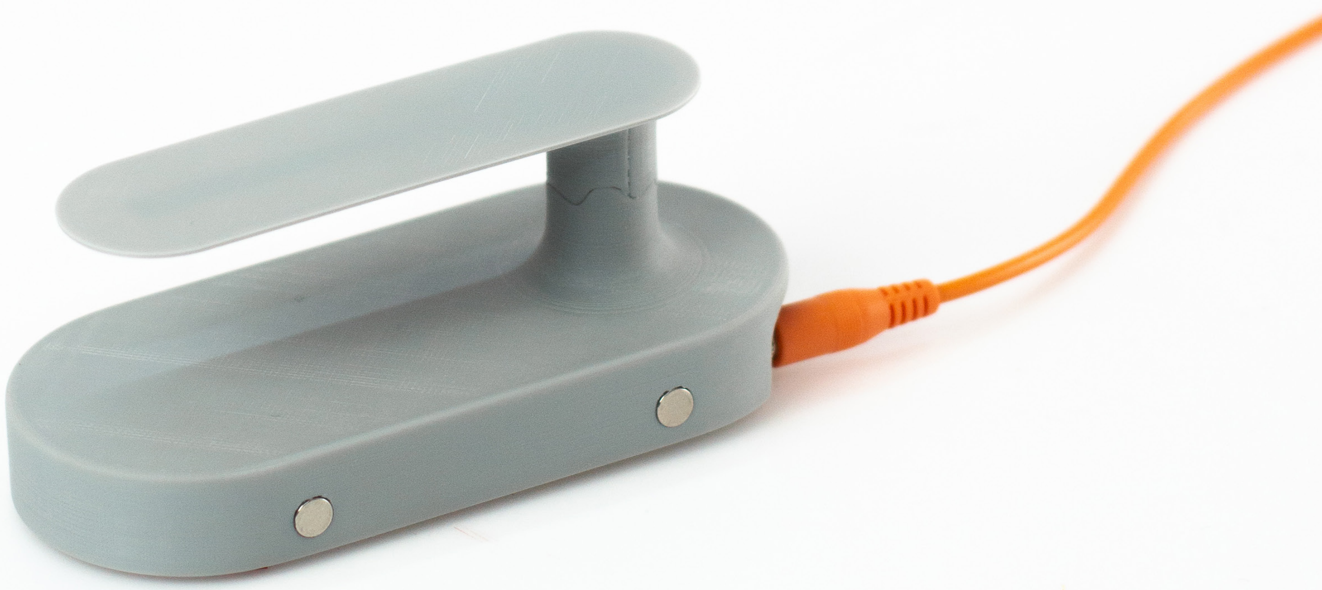




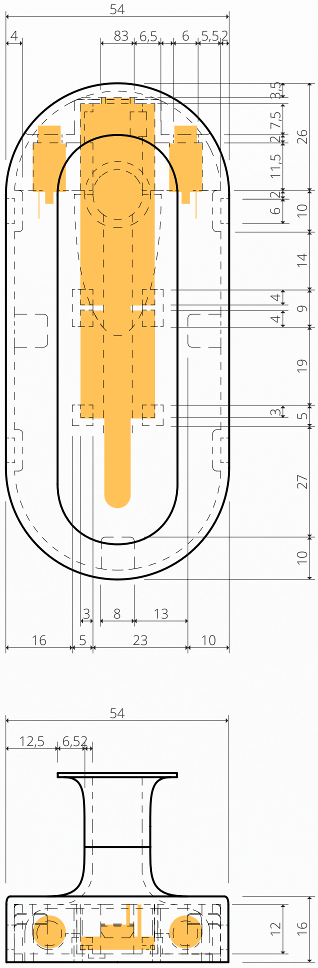
PRESSURE BOARD #2

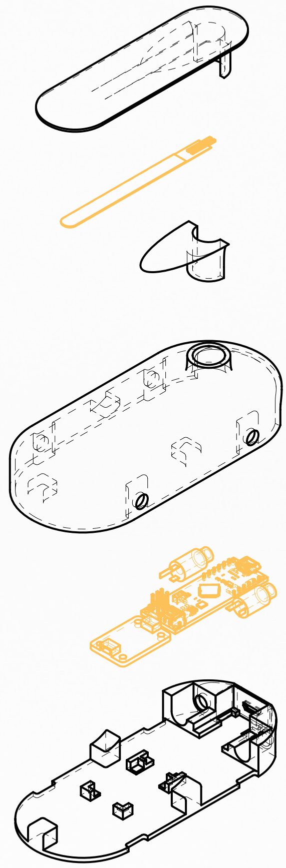
This bender unit is more playful than the first one. Whereas pressure board #1 has a more solid build, this one looks a little more delicate. That is also how the units feel when you use them. The thin board on this unit bends very easily, and you can often hear the vibration of you fingers in the output signal. It has a flex sensor variable resistor in the bending board, which is how movement is measured and how the signal is generated.

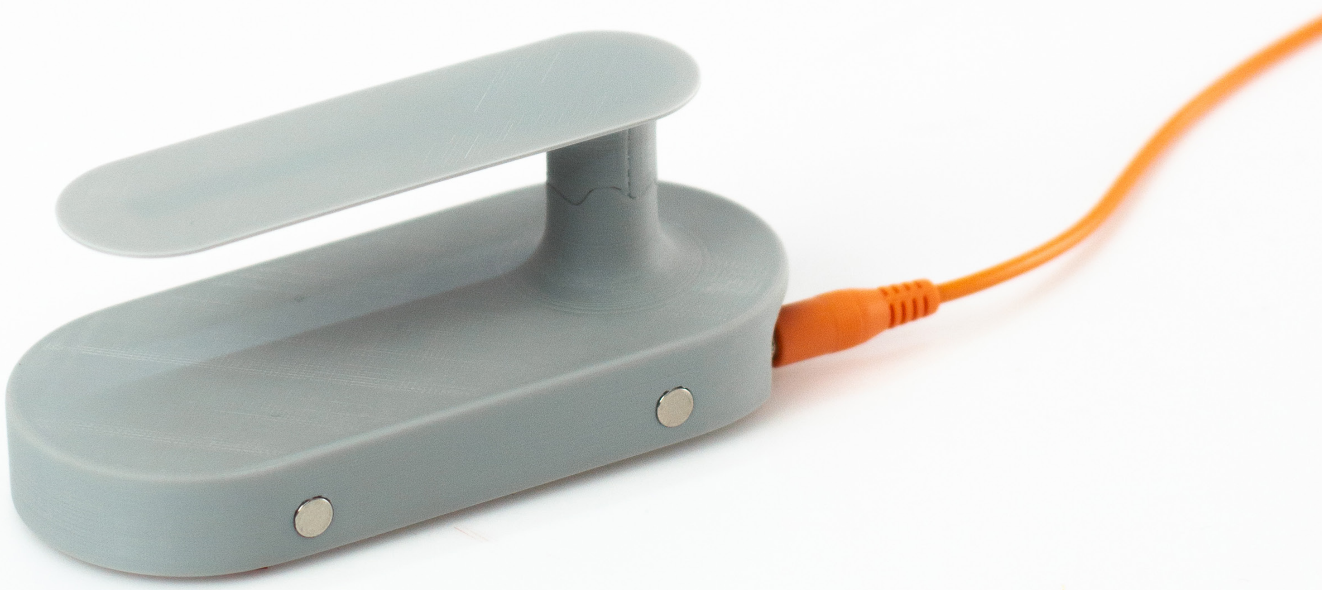




TECHNICAL DRAWING (mm)

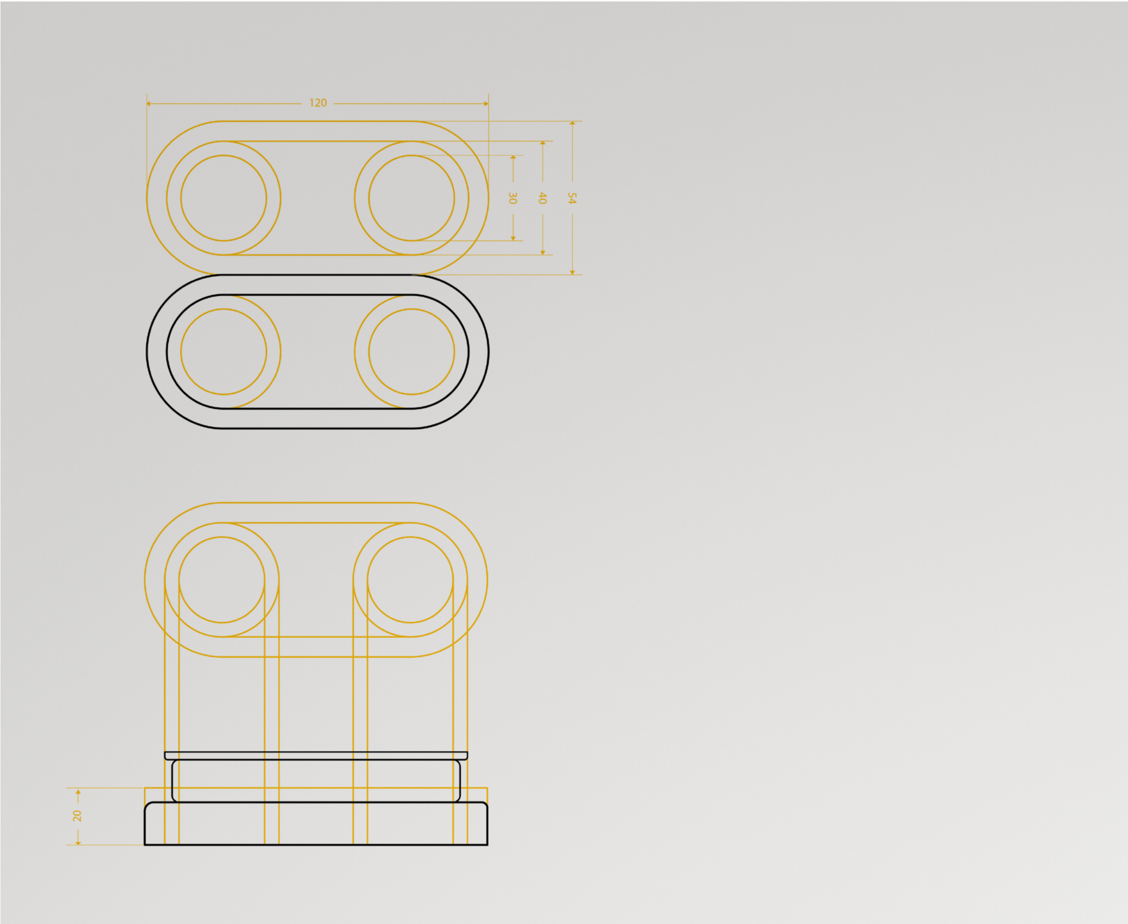


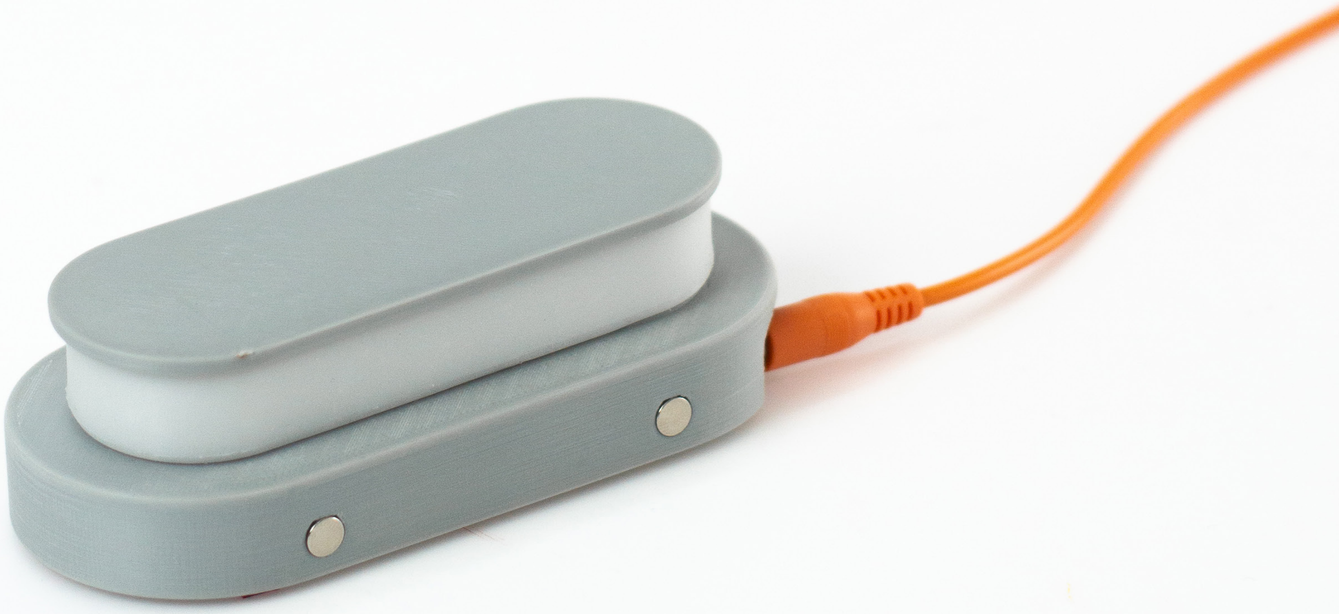




PRESSURE BOARD #3

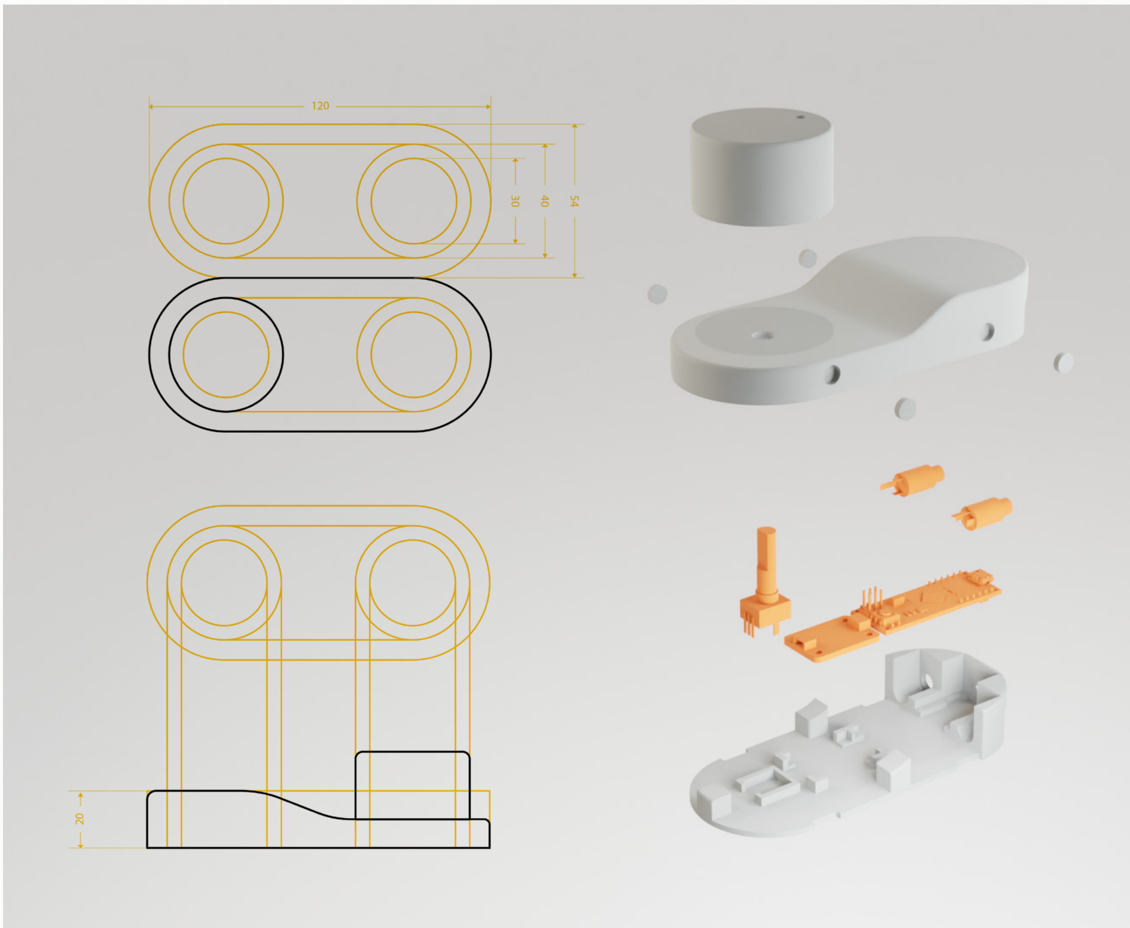
This bender unit has a silicon balloon between the pressure board and the base. Inside of the balloon, there is a component which measures air pressure. Most of the component setup for this unit is planned out, but at the time of writing, this unit has not been built with working electronics inside. The prototype can be interacted with so that the user can get a feel for what it would be like to use it, but there is no computer or DAC that can output a signal.





BIG KNOB

Probably the simplest of the units, this one is just a large constant knob. It is neccessary, as became evident during the user testing sessions, to have a constant parameter to control sweeps over long periods of time or the baseline for a signal. If every bend unit had it's own little constant knob, that would add unneccessary complexity to the units. It would also be confusing to have a built in constant in every unit when connecting them in a chain.



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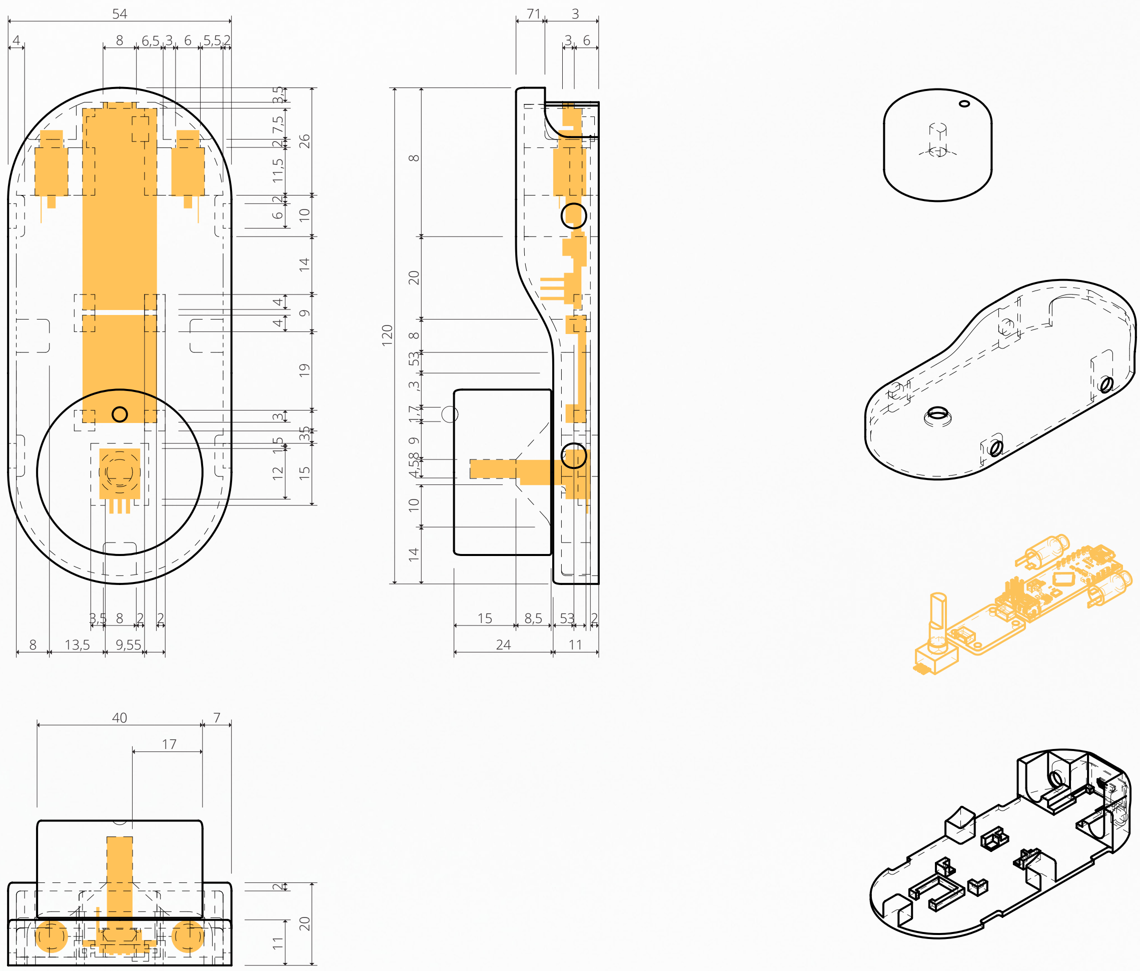
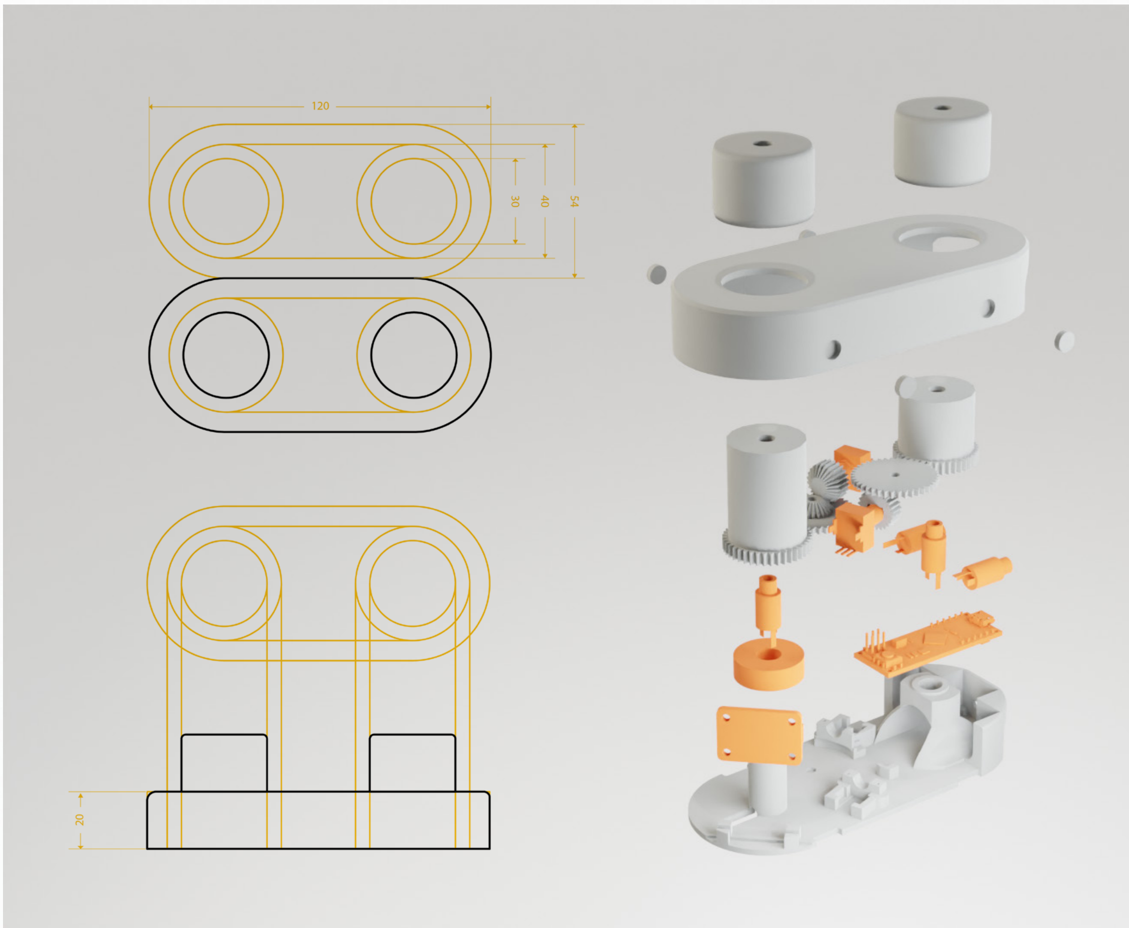
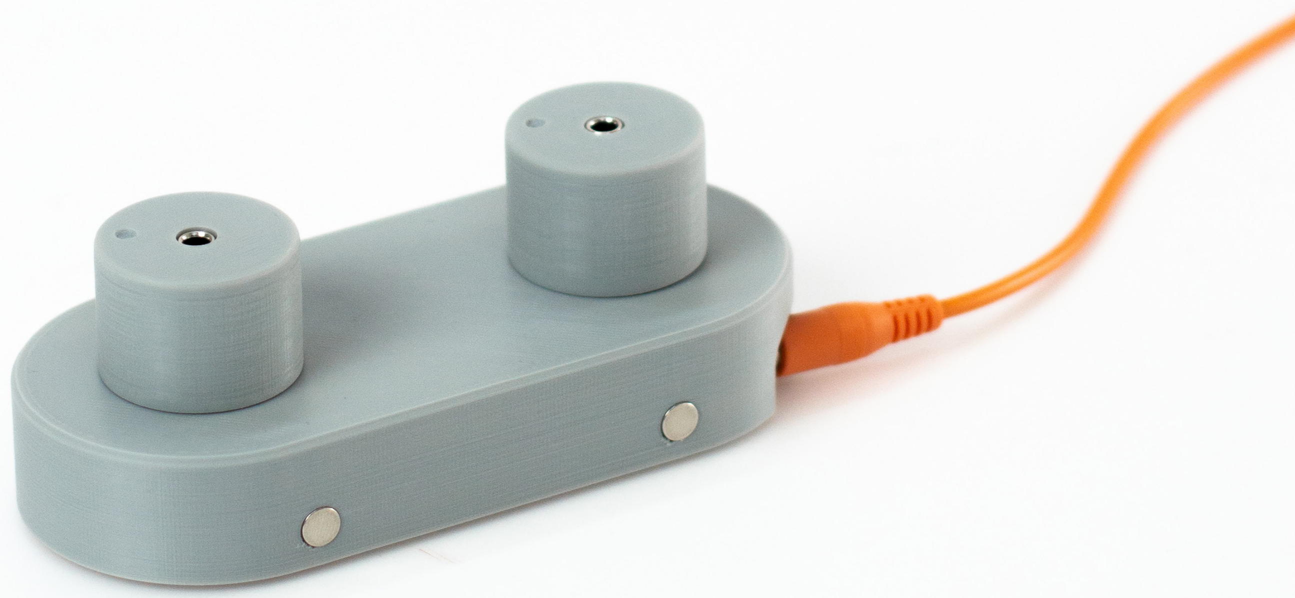


LFO

The modulator unit is an LFO. It generates a sine wave, which adds and subtracts from the signal to give it a vibration. There are two knobs. One for the frequency of the sine wave, and one for the amplitude. Both the amplitude and frequency knobs has a 3.5mm jack in the middle, which means you can use a bender or any other unit to play with those signals if you want to. Adding the jacks on the knobs was a complicated process, but it added a lot of playfulness ans versatility to the unit.





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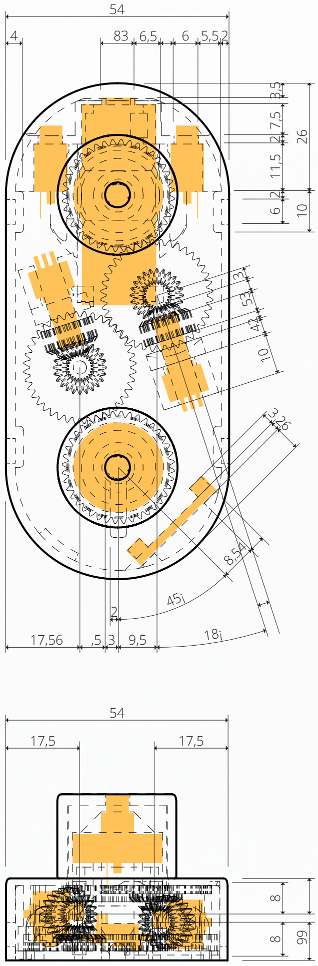
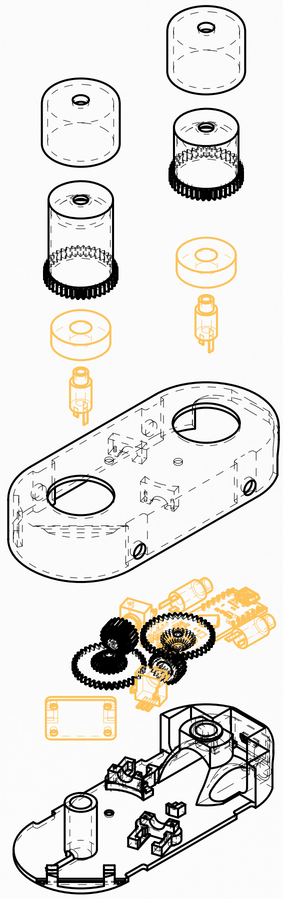
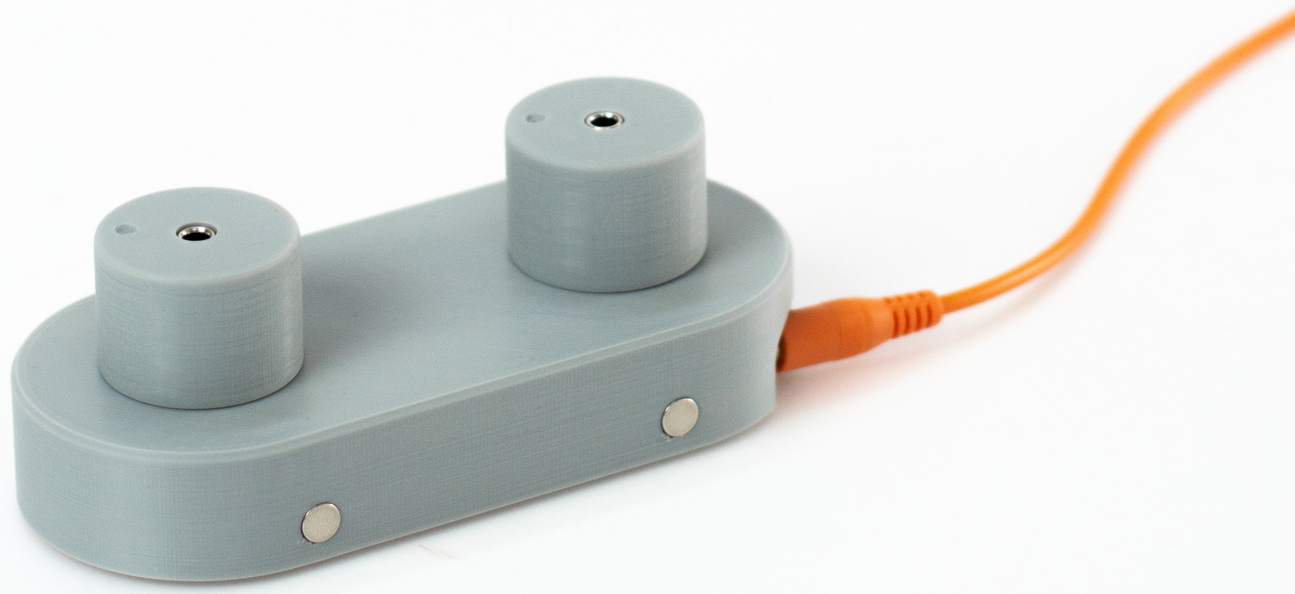


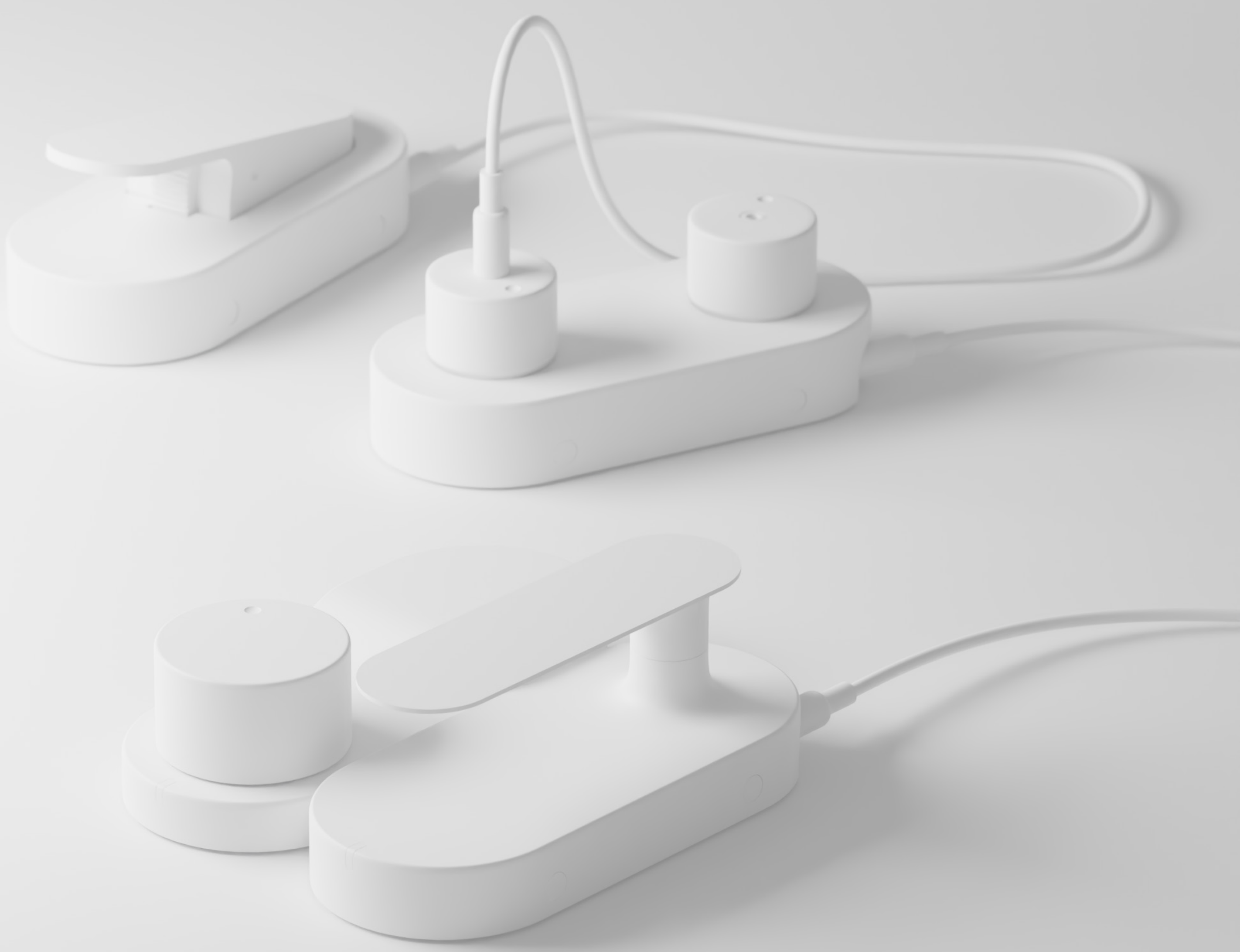


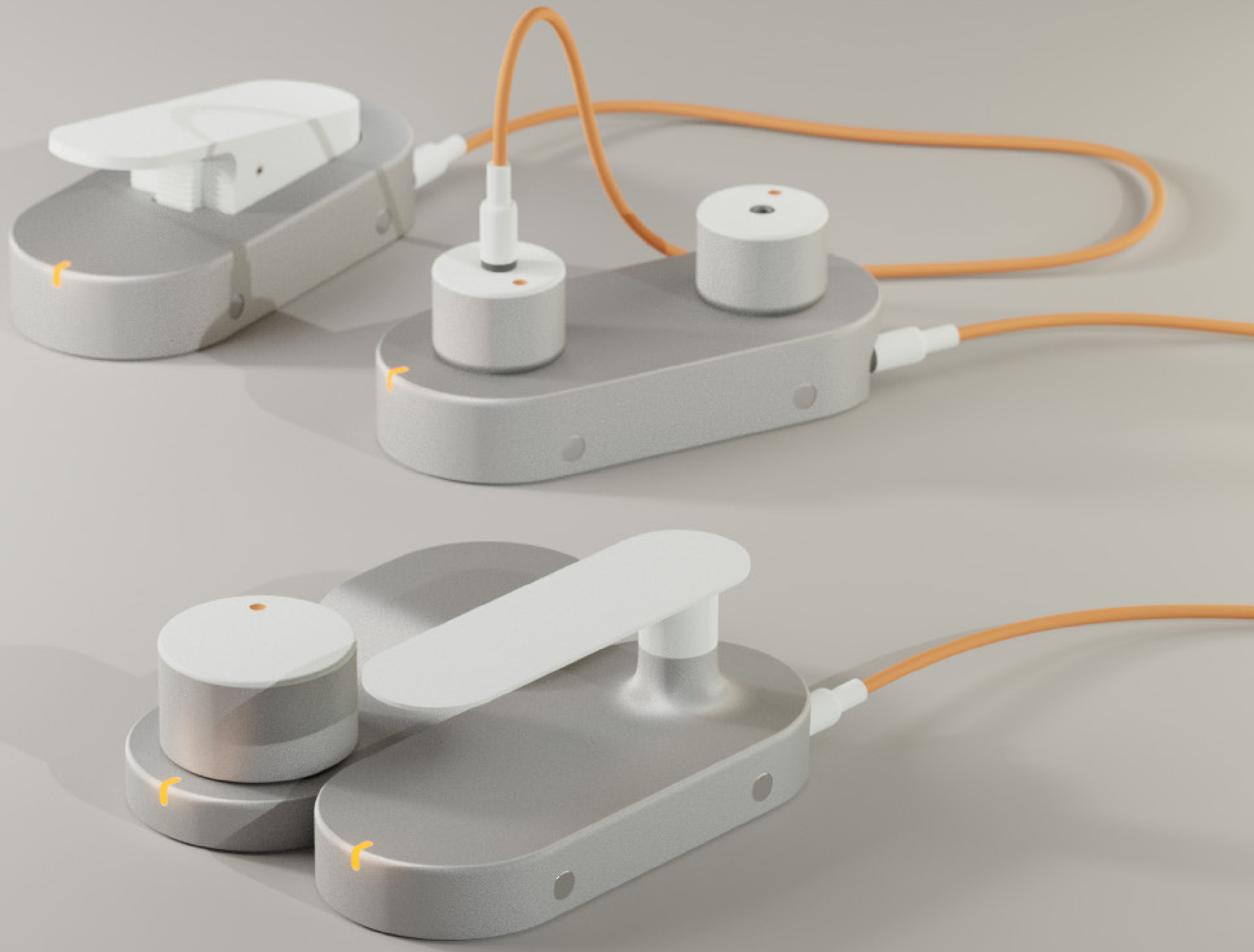


CMF

The heavy workload from the technical aspects ate up a lot of project time, which resulted in that the color, maerial and finish wasn't as fleshed out as I would have liked it to be. The final prototypes looks pretty prototype-y with their grey 3D-printed aesthetic.

To illustrate what a market ready product might look like, this short chapter includes three digitally rendered CMF variations.





SMOOTH, GLOSSY BLACK

Reflection

It has been a blast to do a real passion project. Music and music production has been a very important part of my life for as long as I can remember, and making these experimental MIDI controllers have been an incredibly fun way to combine my passion for music with my growing passion for design.

I have had the opportunity to learn a lot of new skills. Coding, electronics, using gears and other mechanical movement are some of them. Though these things have been challenging, the most challenging part has still been fitting everything into a box. It was immensely gratifying when everything came together, and music could be played on the units during the final presentation.

As always, if I was given the chance to continue with this project there are a number of things that I would like to improve upon.

As mentioned in the previous chapter, I would have liked to have achieved a more fleshed out result when it comes to the finish and detailing of the units. Looking at the result now, I feel like prioritising functionality was the right decision. The shape and feel of the units would never be what they are without real user testing. Still, for them to be market ready, there is a lot of work to do.

Something that came up in multiple discussions with companies and users was intensity settings. Adjusting the intensity of the overall signal of a unit would be very useful for the bend units. For example, if the intensity is set to 50% on a pressure board, a full press down will have half the effect, but double the resolution. Another thing that the bend units would benefit from is a hold function. If there was a way to physically keep the bend unit locked somewhere mid-press, that might even erase the need for a constant unit in some cases.

Right now, the units are anchored to each other with the help of magnets. It would greatly decrease the visual clutter of the setup if the magnet anchoring could also send a signal and we could get rid of all the wires between units.

Finally, I would love to add to the collection and make more of them.

Thanks

ANDREAS HOPF & CLAUS-CHRISTIAN ECKHARDT

A big thank you to my supervisor and my examiner for helping me through the entire design process. I have been very lucky to have two techno-germans as professors who are wonderfully obsessed with buttons, knobs and switches - and who understands the role of electronic music equipment.

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A big thank you for welcoming me to the office and explaining OP's involvement in designing synthesizers for Elektron. Also for taking the time to give feedback mid-process.

JOHAN DAMERAU, ELEKTRON

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NIKLAS TIDELIUS aka CHROME SKIN
HAMPUS FORSVALL

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A big thank you to everyone who tested the prototypes, highlighting issues and helping me to understand which problems needs fixing.

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