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Design av sensorbasert bevegelsessystem med musikaisk output

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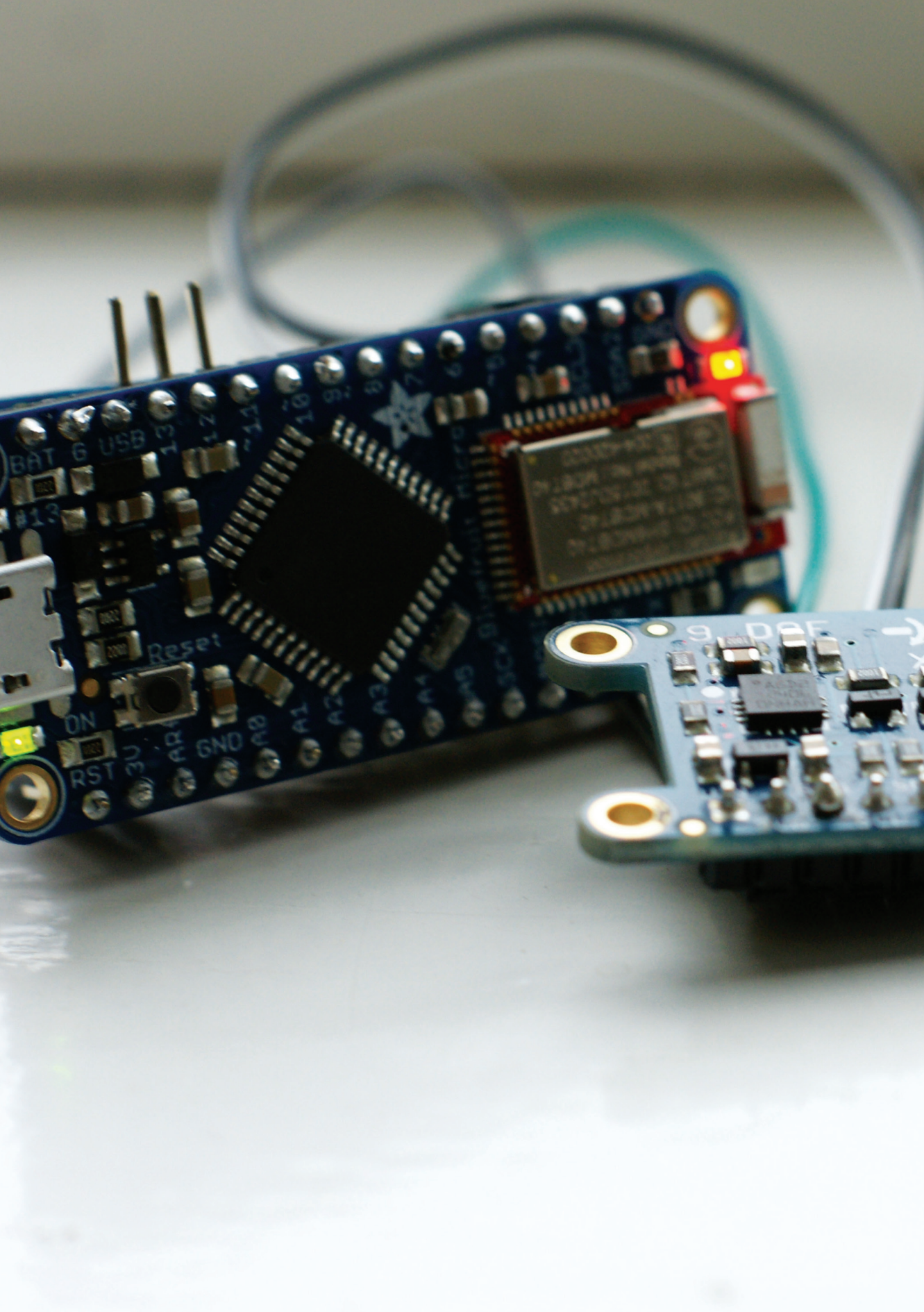
Industriell design
Innlevert: januar 2016
Hovedveileder: Trond Are Øritsland, IPD

Norges teknisk-naturvitenskapelige universitet
Institutt for produktdesign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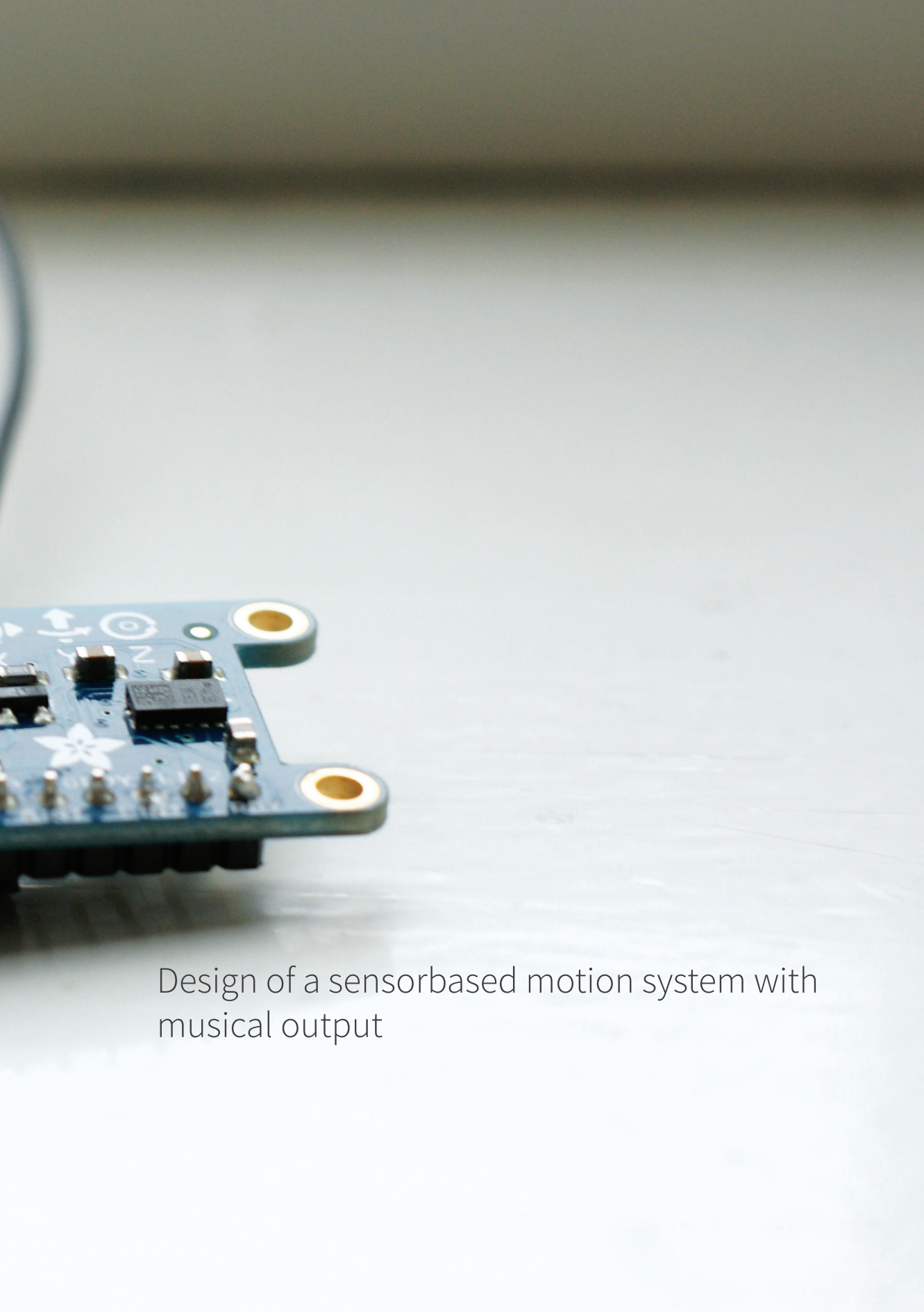

Design of a sensorbased motion system with musical output

ABSTRAKT

Bakgrunnen
Dette prosjektet har blitt gjort i samarbeid med studenter fra fakultetet for Musikk Teknologi og Institutt for datateknikk og informasjonsvitenskap. Det har vært et ønske om å lage et sensorbasert kroppsbårent musikk instrument. Produktet snur menneskets oppfatning på musikk skapning.

Mål
Målet har vært å teste levedyktigheten til ideen vår. Sluttmålet har vært å lage en MVP for å teste om brukere og Innovasjon Norge liker ideen.

Prosess og metode
Ideen hadde ikke vært utprøvd før, hvilket medførte en grundig analyse av eksisterende teknologi, marked, brukere og brukeropplevelse. Prosessen baserte seg på teknikker og innfallsvinkler fra The Lean Startup og designmetodikk. Raske visualiseringsmetoder ble tatt i bruk for å kunne reiterere løsninger hyppigst mulig.

Resultat
Teknologien som trengs fins, men er ikke programmert slik vi trenger det. Mye tid ble brukt på utviklingen av det fysiske aspektet, samtidig som vi fikk en stor innsikt i menneskelige bevegelsesmønster. Resultatet er visualiserings modeller for videreutvikling av MVP.

ABSTRACT

Motivation
This project has been done with students from the Faculty for Music Technology and the Faculty of Computer Science and Media Technology. We wanted to create a sensorbased motion system for musical output. The product changes the way people experience music creation.

Objective
The objective has been to tests the viability of our product. Our final objective was to create a MVP to test if customers an Innovasjon Norge liked the idea.

Proccess and method
The product doesn´t exist yet, and a thorough analysis of existing technology, markets, users and user experience was done. The process used techniques and approaches from the Lean Startup. Rapid visualization was used to reitered existing consepts as fast as possible.

Results
The technology we need exists, but not programmed to solve our needs. A lot of time was used to develop the hardware , while getting indepth knowledge about human motion. The results are visualized models to be used for further developing the MVP.

FOREWORD

This master thesis is written at the Department for Product Design at NTNU winter of 2015.

First of all, I want to thank my team for all the effort they have put into this project, you inspire me. Thanks to you I know more about music, programming, leadership and myself than I would ever have managed to learn on my own.

Further I want to thank Sune Jakobsson for stepping in when the ship was sinking and solving the biggest problem we had, now making this a feasible product. You make it look easy!

Next I want to thank Trond Are Øritsland at the Department for Product Design for insightful and supportive guidance during this project.

Also I want to thank Dag Svanæs at the Department of Computer and Information science for his help in understanding human movement and motion tracking.

Thank you Andreas Bergsland at the Department of Music Technology for inviting us to workshops with MotionComposer and for your valuable tips on mapping.

Thank you Stein Are Gjersvik for our talks about dance and for letting us observe and understand dance motion through watching your classes.

Next I would like to thank my friends and classmates for an inspiring environment and great feedback

Especially I want to thank Ingrid Jakobsson for the support and a calmness I don´t posess.

Finally I would like to thank everyone who shared experiences and insights through surveys and interviews along the way.

TABLE OF CONTENTS

INTRODU

“less is more”

UCTION

ABOUT

This project is a combination of design, business strategy, computer technology, music technology and entrepreneurship.

The layout of the the thesis is based on the Build Measure Learn feedback loop from the Lean Startup. The chapters are organised by topics that the reader should take a look at to understand how we found our minimum viable product (MVP). These are marked as follows:

Viability

Feasibility

Desirability

The viability chapters focus on the bussiness aspect and finding the customer.
Desirability takes an indepth look on the user and motivational factors. The fesibility chapters look at existing technology and prototyping tools we used.

CHOICE OF THESIS

Motivation

This thesis is the product of an idea I had in 2014 while on an ERASMUS exhange to Barcelona. I pitched the idea to a lot of people and got an alround positive feedback. If the idea was catchy even before I had created a prototype, it was worth looking into. The master thesis was the perfect time to see if it could be done; with the best location, network and support I could find. Hopefully I could even reach my dream of entrepreneurship so I set up a personal goal to pitch the idea for Innovasjon Norge. If they liked it, I stood a chance at reaching my dreams.

The complexity of the project demanded that I step into the role of project manager, to find solutions on the go. Having to motivate others while adapting the environment to get optimal results over limited amounts of time, has been very inspiring and enriching.

Customer segments

A big part of the motivation for this project has been the possibility to help people with disabilities and injuries through the final product. Unfortunately there was a strict time limit and we had to minimize complexity to reach our goals of a prototype. My supervisors had previously worked with medical products and warned me that creating such products always took vast amounts of time.

Thesis

The evaluation criteria described in the thesis was based on the belief that no such product existed from before and had to be invented from scratch. A solution was found late in the process and we changed goals, setting the customer experience as our first priority and a placeholder for our final product so that we had something to show to Innovasjon Norge.
Creating a commercial product was meant as creating a product that would eventually lead to use by the general population, not as an artpiece for performance art.

Planning

A general plan was created in the beginning, with several milestones that had deadlines to ensure delivery and progress. This plan changed organically with the influense of new information, problems, existing solutions and extrernal factors. Parts for the prototype weren´t delivered on time pushing delivery milestones close too the exam period of my teammembers.
When we understood that we couldn´t finish on time we decided to push for an explanatory mockup and a possible short movie.

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Masteroppgave for student Zuzanna Mantorski

Design av sensorbasert bevegelsessystem med musikalsk output

Design of a sensor based motion system with musical output

En ting alle mennesker har til felles er bevegelse og vi blir mestre på å bevege oss fra punkt A til B opp gjennom livet. Mennesker i alle aldre har et ønske om å uttrykke seg musikalsk, hvilket kan kombineres med brukerens eksisterende bevegelsesevne og kroppsbåren teknologi.

Masteroppgaven gjøres i samarbeid med studentgruppen Lydi fra studiet Musikkteknologi, ved NTNU. Prosjektet fokuserer på å skape et produkt som inspirerer til utforsking og rytmelek, som videre åpner for personlig komposisjon og digitalt opptak.

Dette prosjektet fokuserer på å skape et konsept for et fremtidig kommersielt produkt, med utgangspunkt i kroppsbåren teknologi. Kroppslig bevegelse skal skape lyder, som genereres via sensorer, og deretter avspilles gjennom en ekstern enhet. Det vil bli laget enkle prototyper som testgrunnlag for brukere og vitenskapelig tilbakemelding. I tillegg vil det være et utdypende litteratursøk med fokus på eksisterende teknologi og kommersielle produkter.

Oppgaven vil blant annet inneholde:

- Analyse av eksisterende løsninger og teknologi
- Analyse av brukere,brukerbehov og intervju
- Planlegging og tilrettelegging av designprosess med eksterne aktører
- Prototype og gjennomføring av brukertester
- Konseptutvikling

Oppgaven utføres etter "Retningslinjer for masteroppgaver i Industriell design".

Ansvarlig faglærer: Trond Are Øritsland
Bedriftskontakt: Andreas Engeset, Lydi

Utleveringsdato: 28. august 2015
Innleveringsfrist: 22. januar 2016

Trondheim, NTNU, 28. august 2015

Trond Are Øritsland
ansvarlig faglærer

Casper Boks
instituttleder

Thesis for student Zuzanna Mantorski

Design of a sensorbased motion sytem with musical output

One thing all people have in common is movement and we become masters of moving from A to B throughout our lives. People of all ages have a desire to express themselves musically, which I think can be combined with a user, with any level of mobility, and body-worn technology.

The master thesis is done in collaboration with the students from Music Technology, NTNU. The project focuses on creating a product that inspires exploration and rythmical games, which further opens for personal composition and digital recording.

This project focuses on creating a concept for a future commercial product, based on body-worn technology. Bodily movements will create sounds that are generated via sensors, and then played back through an external device. Simple prototypes will be made as a basis for user tests and scientific feedback. In addition there will be a detailed literature search focusing on existing technology and commercial products.

The project will include:
-Analysis of existing solutions and technology
-Analysis of users, user needs and interviews
-Planning and facilitation of the design process with external actors
-A prototype and usertesting of this
-Concept Development

The thesis follows the “Guidelines for thesis in Industrial Design”.

Thesis supervisor: Trond Are Øritsland
Company Contact: Andreas Engeset, Lydi

Start date: 28 August 2015
Deadline: 22 January 2016

Trondheim, NTNU, 28th August 2015

TEAM

The master thesis has been co-created with students from the Faculty of Musical Technology and the Faculty of Computer Science and Media Technology. We met once or twice per week from the middle of September 2015, creating the prototype. The Music Technology students have created all the parts of the prototype that are connected to any form of music and also helped map movements. They also created the first Arduino prototype together with the student from Computer Science. The Computer Science student focused mainly on the future application connected with the prototype and also helped with the programming of the prototype. I have worked mainly with designing the user experience, finding specialists, designing the prototype, project management, market research and ideation.

Specialists

We have had help from several external specialist along the way, either with knowledge or programming that we were incapable of solving ourselves.

Andreas Bergsland, Associate professor at the Faculty of Musical Technology, has been our Music Technology specialist and has helped us with neccessary information about mapping, motion tracking and user experience from his participation in MotionComposer.

Dag Svanæs, professor at the Department of Computer and Information science, and Professor at the Department of Art and Media Studies, gave us helpful input, insight on sensors, motion tracking and mapping.

Sune Jakobsson, System Manager at Telenor, has helped us with programming and has had the leading role in making the system function. Sune is the man!

Thesis supervisor

Trond Are Øritsland, Associate Professor at the Department of Product Design, has been my thesis supervisor. We had regular meetings during the project .

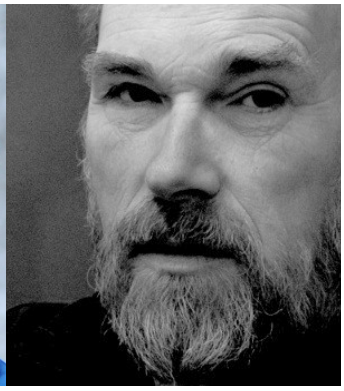
The team

Zuzanna Mantorski, design
Kim H.K Ortveit, music technology
Martin Solheim, computer science
Ada Mathea Hoel,music technology
Daniel Wasa Delâtre, music technology

Andreas Bergsland

Dag Svanæs

Sune Jakobsson



Trond Are Øritsland

Zuzanna Mantorski

METHODS

Desk research
Desk research was done through the whole project, and especially in the beginning to get an overview of technologies, market research and entrepreneuring knowledge.
It was also used to find relevant litterature about technology and information about competitors.

Litterature reviews
Most the litterature were articles found through the desk research, and targeted heavier technological aspects of the project. Especially much was found about human mapping and motion tracking. This was done as qualitative research to find the best solutions for our idea.

Co-creation
Co-creation was used through the whole project to integrate several levels of knowledge and experience design at the same time. In most situations we merged hardware design, music technology, programming and a human-centered design approach.

Interviews
One-on-one interviews were done to test if our product was liked by users in the right age group and life situation as of our customers. They expecially clarified how much more users were willing to invest when they heard our pitch versus surveys.
In their eyes the product got more of an instrumental feel and was attractive as a social creative outlet.
We chose loosely structured intervies, to allow a higher level of questions from the user and flow of ideas and needs.

Personas
Personas were used to create empathy in the technological parts of the design, test scenarios and to reach our intended primary user. They also clarified userneeds.

Scenarios
Design scenarios were used to create the imagined product experiences. These scenarios were combined with our analysis of the interest curve to create the best possible user experience. In addition it helped clarify what kind of requirements our physical product had through the journey.

Prototypes
Ultimately we wanted to create a fully functional prototype, but ended instead with prototyping smaller aspects of the experience for testing purposes. The prototypes were of wireframes drawn on paper, as a mockup of our application and the needs we found during our usercenarios. The final wireframes were

created in Illustrator to have a cleaner look on the video. We also sketched a lot of paper prototypes of the physical product, based on the margins and dimentions found for the elecrtonics through the desk research and the interests of our personas.

Mockups
Foam mockups were created to explore size possibilities and integrating organic surfaces to the product. This was meant as an iteration for usertesting. Previous mocups were created using a piece of bendable copper sheet and plastelina.

3D modelling
This method was used as a solution when casting foam mockups didn't work out like it should. A simplified version was created using Solidworks and printed out using a Cube 2nd generation. The mockup was created as a placeholder for our finished prototype for use in a future explanatory video and form exploration.

Survey
A survey was created and shared on social media. This was to collect quantitative data about markets, income customers and interest in our product. It verified our assumptions about usergroups and product sales price. It also showed us the change in behaviour towards wearables customers already owned and gave us a good indication of why many stopped using their wearables.

Kano
The kano method was used to explore what product attributes were needed to create a delightful product experience. It was also used to measure each iteration.

Mindmapping
Was used to see the combination betwen desired shape and analogies in our product, when we had to change plans and create a mockup for the video. WE

Observation
Observation was used when analysing dance movements. We got our most important reference points for mapping through this method.

Wizard of Oz
This technique was used in understanding how to map human movements to sound. Without this method we could never have imagined what sounds and gestures would function together. It helped us understand what was logical as a responce to dance and it also worked as a discussion and merging point of ideas.

PROCESS

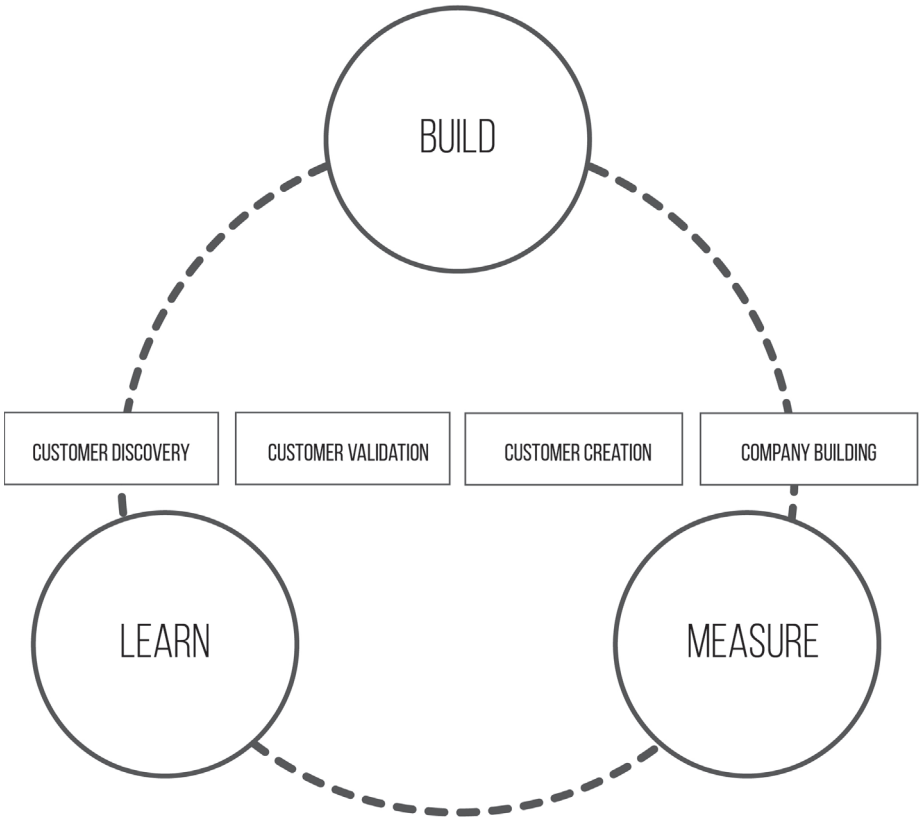
Our process has been far from linear, with several levels of developement happening at the same time. There were continous changes along the way, with major milestone shifts due to unexpected complications and exams at the end of the semester. The design brief for the final product was created late in the process after verifying the customer segment and existing technology.

We began by testing our idea on people. It was changed and adapted based on feedback from users and specialists. We then looked at how we could offer the best experienece and the technology needed. We met once or twice every week and worked on mapping, programming and the user experience. There were several relevant workshops arranged by MotionComposer, one of our potential competitors, that we attended.

We implemented design thinking, business design and a Lean Startup Method.
Design thinking helped us define our users and balanced us in the business, technological and human sphere while creating the product. Business design was used to find future resources and understand what aspects were important in the case of investors. The Lean Startup method helped us speed up our process by using the feedback we got for immediate changes in product offering or value creation. We used principles that helped us coordinate our next steps and removed unnecessary delays. One of the principles we used was the build-measure-learn feedback loop, that steered us in the direction of the minimum viable product. This is a a way of testing an idea using the least possible resources and accelerate learning, by finding our main value offering to our customers.

Due to the strategic advantage of being in an engineering environement, we also worked on the hardware solution to ensure that the product could be realised. This goes against the idea of the MVP but is a critical factor when applying for funding through Innovasjon Norge. Innovasjon Norge doesn´t fund technological developement for startups, so we had to be sure that we could actually find a solution based on existing technology to save money and time later.

“SHOULD THIS PRODUCT BE BUILT?”



BUILD MEASURE LEARN

APPROACH AND STRATEGY

ENTREPRENEURING WITH A TOUCH OF DESIGN

My approach has been to cope with this thesis as an entrepreneur with a new idea, rather than a pure designer with a set task. The idea of money as a response to my design has never been a factor in my design process.

Clarity in product description is essential for entrepreneurs, and it takes a lot of time and practise. Learning pitching techniques has been part of my process and maybe the hardest yet.

Understanding the problems wearable technology companies have had in their product offering and implementation has been a big part of my strategic planning and decision making. Looking to trends and base technology expectations customers have today, I quickly understood that the final product had to be somehow fashionable, simple and that the battery life had to be as long as possible. Taking this into account affected our final product. Another thing is that part of the implementation problems have been the experience these products offer, where the novelty of receiving tracking information quickly lessens and becomes old news, dumping the tracker into the gadget category.

Because of this strategic revelation we had to look at value adding techniques, where the product delivered an exiting experience over time, avoiding the gadget. We also took steps to ensure that we were attractive for early adopters of wearables, so that we could piggyback on other companies success.

Innovation and experience creation have been repeating words throughout the whole project. We focused on the feedback we got, taking time to understand why things were unclear or undesirable. Every new step we took in our design have been based on this feedback, to solve minor problems and create the best possible solution in the shortest possible time. If the solutions weren't good enough, we would change them immediatly.

FOCAL POINT

THE HUMAN EXPERIENCE

Although we have been bussiness oriented, our main focus has been the human experience. Especially when the project took a technical turn and we had to focus on programming and hardware, we took extra care not to forget our end user.
We used several methods and techniques to make sure this would be an emotionally positive experience. These helped us ensure positive user experience and desirability for the of product, while making the technology as simple as possible by using existing hardware.

To maximise the effect of the time we spent creating the product we had to make sure it functioned on several levels.
We had to get to know our user, and this happened through observation, talking to people from the same demographic and market research. This was also so that we could adapt our minmum viable product to their needs and expectations.

The product would eventually have a complicated solution, due to the technical, design and bussiness aspect, which demanded a wide interdiciplinary knowledge base from our team.
Finally we visualised the user experience by using userscenarios, and identifying opportunities using visual market overviews and litterature review of human benefits derived from the music based creative touchpoints in our product.


FIRST ST

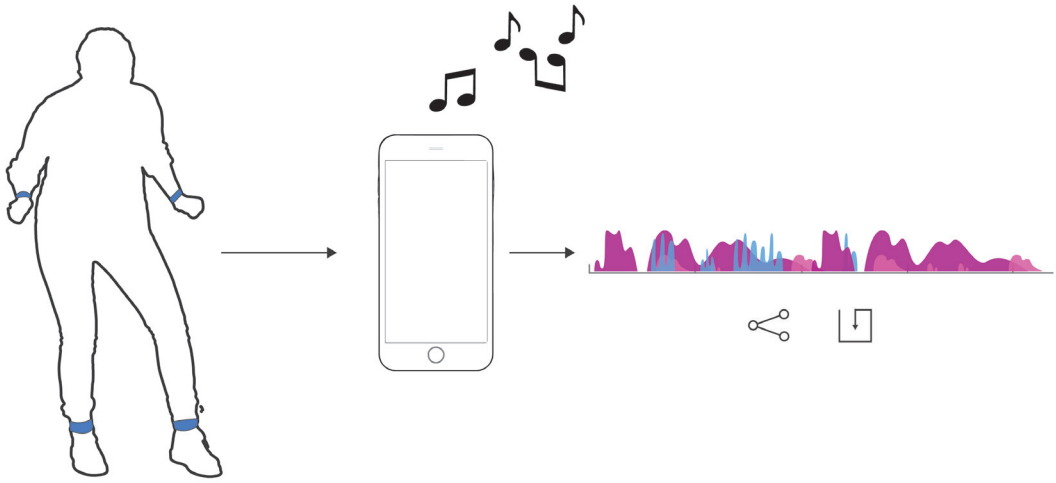
In this chapter we take a closer look at the viability of our idea. First we get an insight into what people think about our product and attempt to discover our potential customer groups. Feedback will be used for reiteration and as a knowledge base for future discussions. If customers dislike our idea we have to rethink it to make it more desirable.

EPS

THE IDEA

The idea is to create a product that allows anyone to enjoy rythmical exploration through movement and games. You can play any kind of music you like, and further allows personal composition and digital recording.
The product will consist of bodyworn technology that sends the sounds through you phone or other digital devices, and will probably be worn around the wrists and ankles.

PEOPLE USUALLY NEED MUSIC TO DANCE, THIS MAKES THEM DANCE TO "MUSIC."



DO PEOPLE LIKE IT?

Feedback showed us that people liked the idea but some had a hard time grasping the concept of creating music from dance and rythmical movement. The idea was revolutionary in it´s value creation and it took time to adapt.
Many expressed a wish to try it and often mentioned people they cared about. They desired to interact musically with older family members like their grandparents, and how great it would be to create something with them as a way of communication. This was especially interesting when they understood that the creation was digitally recorded and they could keep an share the memory.

Several mothers said they would like schools to implement the product as a way of teaching their children about music and as a way for their kids to have an active, creative way to express themselves during the day.

Trying to find a team, I pitched this idea for a whole class of Musical Technology students. I used a quick mockup and told them about my idea and goals. I found my team using this technique and they thought the idea was so good that they agreed to work with me the whole semester without getting school credits. This is a sign of commitment and the fact that people really like the idea.

Through a survey spread through social media, with special focus on international recipients, around 50% were willing to pay over 100$ for it without fully understanding what the product was. (Appendix)

Discussion

People like it, but it's hard to understand the concept of creating music through dance without an example. The musical technology students had a mockup sent to their emails so they were prepared for my presentation. Since the product is complex a simpler pitch is needed.
People were willing to pay money for it, which means that it has potential.

MARKET

The idea will have a technological foundation, placing it in the wearables market. Not only does the product need to satisfy customers demands, it needs to survive on the market with several other suppliers. The wearables market is constantly changing and a strategic plan is needed to survive.

This chapter gives insight into the IoT market, looks at existing technology, trends as a marketforce and reveals potential competitors and partners.

IOT

CONNECTIVITY AND EMPATHY

Things are getting connected to the internet. This expanding connectivity is called Internet of Things (IoT). Objects stream information that can be useful for humans and machines. Connected objects are often called smart devices. There has been a significant growth in connected devices, and this is not expected to stop.(1) An example of a smartobject is the fitness tracker. It streams you information about your movements so that you can make better choices while exercising.

Smart objects are usually connected to the internet via Bluetooth. Information about the enviroment is captured through sensors. These are usually very small devices that respond to physical stimulus and transmits a resulting impulse. Examples of physical stimulus are heat,sound,pressure,motion, aceleration,magnetism and proximity. The impulses are sent to a receiver, like your phone, as data feed.

Empathy in IoT

As new IOT products are created, there is a focus on implementation of empathy in a world that becomes more and more technological.
Empathy is viewed as an important part of being human, and communication online doesn't always allow for conveying or feeling emotions. A vision in the field of IoT, is to create connected objects that convey emotions remotely.(Coulton)

A way of creating emotions in the user is to appeal to aesthetic emotions, through visuals,audio and haptics. Aesthetic emotions are felt during activity or appreciation of the sublime or beautiful.

Discussion

The product we are creating today allow emotional communication, through interactive activity. The creation is of artistic nature and might lead to aesthetic emotions. We should focus on reducing initial user frustration, enabling comfortable communication of the users emotions. The infrastructure should be solid and the product might be a tool for social skills, which is desirable.
(Picard 1999)


-10
GIMME SOMETHING TO DRINK
FIND ME!

WEARABLES

PART OF THE IOT DIVERSITY

Bodyworn smartobjects are called wearables. The feasibility of creating a new product is often verified by existing technology, which can be the most expencive part to create. Wearables are usually connected to the internet by Bluetooth via the smartphone. They use inbuilt sensors to connect to the user, and feeds the data to your phone. The data is usually sent as a information that might help the user to achieve some goal.

New wearables are created daily and many combine the functionality of different types of wearables to create better experieneces. Research done by Forrester Research,Inc,() most users preffered wearing wearables on their wrist. In 2015 the wearables that sold the most were smartwatches and trackers.

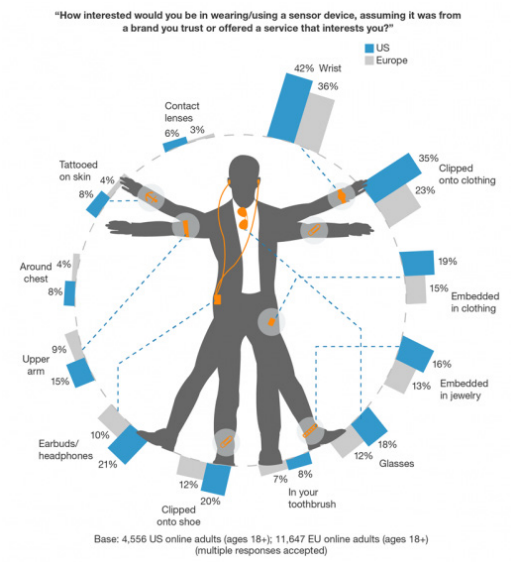


FIG.1

Smartwatches

These are fastned around your wrist and connect to your mobile phone. They notify you everytime you get a call, message, email or updates on social media. The watches are following fashion trends and focus on individuality.

Fitness trackers

Trackers are filled up with sensors and are usually situated on your wrist or clipped to clothing. They keep track of how many steps you take. Some also show you altitude, speed and heart rate to give you a better calorie count.

Smart jewelry

Discretly allerts you about texts, calls, emails or that your phone is out of reach. These are mostly targeted towards women

Head mounted displays

Used for playing games and are under heavy developement at the moment. These either block out all of your sorroundings, called virtual reality, or partly adapt them and give you an augemented reality.
Smart clothing. Garments with connected electronics that create a visual effect to change it's appearance or has integrated circuits that add a functionality to the material, like screening you while you practise a sport.

Smartclothes

These are clothes with inbuilt sensors that track you movements and are mostly used for training. They send information to your phone and gives you a bette roverview than any other tracker oon the market.

Discussion

A lot of the wearables, like smartwatches change thew appearance of their products based on trends. This is to reach more people and different usergroups. Since we know that the preferred areas of wearables are the wrists, this is a natural place to place at least parts of our product. We have to think about how far users are willing to stretch to interact with our product, and having a product that is placed on areas that are not initially desired might be negative for the impact of our product.

MARKET SIZE

Transparency Market Research, “Wearable Technology Market - Global Scenario, Trends, Industry Analysis, Size, Share and Forecast 2012 - 2018” says that the wearable technology market is rising. This is due to demand from the younger population, for small and powerful technological products. The global wearable technology market was $750 million in 2012 and is expected to rise to $5.8 billion in 2018. Fitness and wellness is the dominant player here, with 35.1% of the revenue in 2012, largerly due to changes in the general health. More and more people are getting lifestyle diseases, and a lot of product developement is happening as a reaction to this. The wearable technology market in US,Europe and Canada is expected to continue growing, due to a tech-savvy, health-conscious and affluent population. They further say that the strongest market leaders are amongst others said to be Adidas, Medtronic, Abbott Laboratories, Eurotech, Sony, Nike, and Google Inc. Medtronic creates medical solutions, Abbott Laboratories focus on health and Eurotech creates solutions for IoT.

Discussion

This market is growing and it´s something we can benefit from. The market demands small, powerful products and our product had the potential of becoming one of these. Our product could be categorised as a wellness product, with dancing creating a side effect of fitness. Motivational products that challenge users to move will be on the rise. Markets that are already implementing wearables are easier for us to penetrate, which makes USA,Canada and European countries logical target markets for us.
Companies that focus on health and fitness can be possible future partners for us.
Our product also touchesthe entertainment market, and we might find users here that don’t neccessarily utilize wearable products from before.

THERE WERE 2 BILLION SMART DEVICES IN 2006 AND IS EXPECTED TO RISE TO 200 BILLION DEVICES BY 2020. THE EXPECTED REVENUE IS

6.2 TRILLION DOLLARS

ADDED TO THE GLOBAL ECONOMY, BY 2025 (1)

MARKET LEADERS

SMARTWATCHES AND TRACKERS

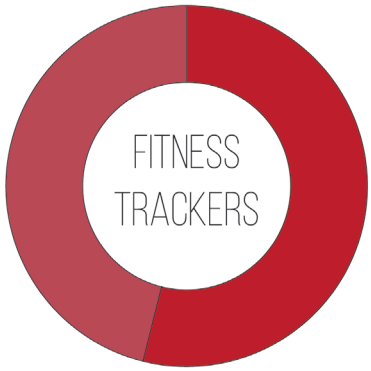
Looking at official records for 2015, Fitbit Flex is the most sold wearable worldwide. This fitness tracker is closely followed by Xiaomis' Mi Band, Garmins' Vivofit and Vivosmart, Samsungs' 2G Gear and Jawbone Up3. (2)
Apple wasn't added in these calculations, but other surveys found that most consumers consider buying this first.() Misfit is another company that continously releases new products that look like jewelry or is very fashionable, while holding the prices down.

Fitness trackers and then smartwatches are the most sold wearables in the US today. Reports show that one in ten adults own a tracker and that customers choose their wearables based on their needs and their style.()

54% of all owners of fitness trackers are women. Fitness tracker owners ranked accuracy and battery life as the most important attributes, at 70% and 64%. Durability had an importance of 73%. Around 35% of the women who used these trackers were between 35-44.
71% of all smartwatch owners are men, and 45% of these had an income under 45.000$ a year. Functionality had 81% importance and comfort 79%. Durability was at 83%.
48% of all wearables owners are between 18-34 years old. Both women and men are likely to use wearables. 29% of the buyers have an income ovre 100.000$ a year. ¾ identify as early adopters (3)
50% of consumers who don't have wearables, say they want it, 72% say it's too expensive, 62% wanted more fashionable products with different shapes than wristbands and watches and 53% wanted wearables that looked like jewelry. The research also showed that they were looking to buy smart glasses and textiles.

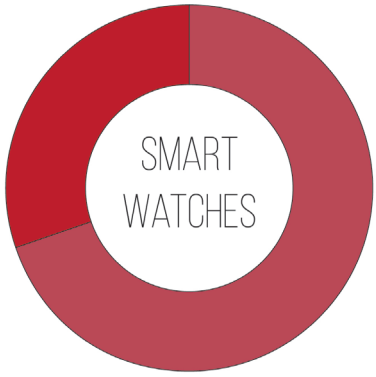
Discussion

Looking at product offerings from Fitbit and and the other companies is interesting for us. We might find the reason for the big market share in wearables, based on what experience and attributes that are attractive to their customers.
We see that both men and women own wearables, and that the consumers that don't own any say they are to expensive or don't fit their style. Another reason might be that trackers just don't give them enough emotional reasons to buy them. Emotional connection is important in identity creation.



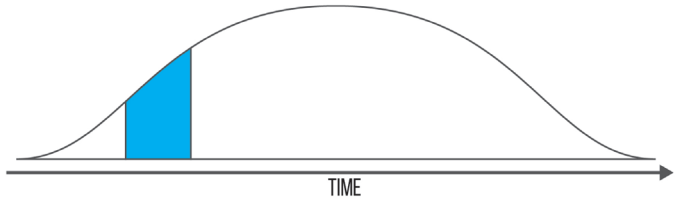
FAVORED ATTRIBUTES:

Durability
Accuracy
Battery life



FAVORED ATTRIBUTES:

Durability
Functionality
Comfort



WEARABLES

FOR DANCE

Since we are creating a wearable product for dancing, music and instrumental expression, we have to examine our competitors. They might give us leads to how to penetrate the wearables market with uncommon wearable solutions.

Orphe

Orphe are LED lit shoes, that have a customizable lighting system and also function as a musical instrument/audio-visual controller. These can be programmed through an app and are targeting artists and performers. They where largely popular on Indiegogo, a crowdfunding page, where they got 93.027$ in funding on May 2015.

E-traces

E-traces are ballett shoes that create digital pictures through an app, and is created as a supportive tool for ballett dancers. They are based on Arduino technology, which is a prototype technology.(see page)The danceruses the smartphone to film while they dance, and can later see and analyse their movement. The shoes are not for sale.

Instrumented bodies

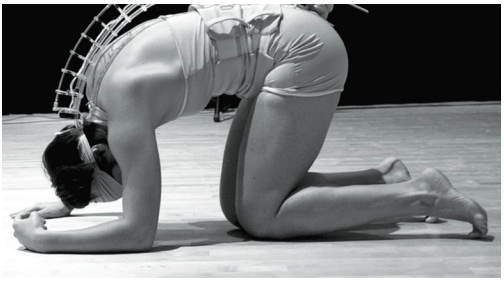
Instrumented bodies are prosthetic musical instruments that create music through body gestures. They can be played while hand-held or attached to the body, and target performance artists. The products are lit from within using LED light.

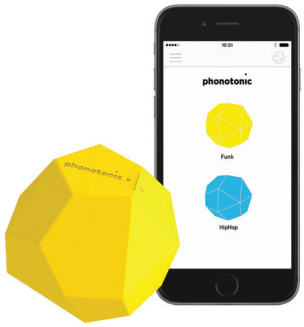
Phonotonic

Phonotonic is a hexagonal ball that interacts with your smarthphone through an application. You can control the beats, melody and sound effects. Two people can play at the same time, separately playing the melody and the rythm. It can be opened and the sensors can be taken out. Price: 79.90€

Discussion

We see that most wearables for dance are targeting performance artists. The shapes dictate the use, and it's unlikely that anyone would wear this on the street and use it for anything else than a statement. We want to reach out to other types of users, people on the street. . We see that lights are often used in dance related products. None of these products are our competitors




phonotonic
Funk
HipHop

WEARABLES

FOR MUSIC CREATION

There seems to be more viable competitors in the wearable music creation market.

Auug

Auug is a a product you attach to your Iphone or Ipod, and transforms it into an instrument. you can create music through movement of your hands and touching the screen. It can connect to any other IOS sound application you have, giving you access to their sounds. Auug can also be connected to a computer, and can steer visual software. The screen overlay integrated in the product gives tactile feedback, so that you know what button to press. The price of one unit is: 149 dollars. They are currently creating versions for Iphone 6 and up.It got support on Kickstarter in 2013, and the latest update to their homepage happened 20. November 2015. It seems that they are mostly targeting performers and musicians in their marketing. They got 75.585$ in backup on Kickstarter in 2013.

MotionComposer

MotionComposer uses a videobased motiontracking system that detects a persons movements in a room. The primary users are people with severe physical disabilities or limited cognitive ability. The sound modules are steered physically on the computer by another person while the other user is moving in front of the videocamera. It's sensitive to light changes and changing backgrounds. It's not for sale at the moment, but got 100.000€ in support from the German government when it first started.

Kurv

Kurv is a digital guitar, without strings consisting of two modules and an app. One module looks and functions like a big guitar pick, and let's you pluck and strum like on a regular guitar. The other module is a pad that detects pressure from your fingertips, and gies you control over invisible strings. They believe that the joy of playing guitar should be available for everyone, and it seems like they target users in their late teens up until their mid thirties.
The application let's you play 60 songs of the bat, with a visual tutorial as you play of where to put your fingers. The sound is genereated through your phone. At the moment, they are having a Kickstarter campaign, where they have collected 44.415 £ with 17 days to go. The lowest price for the product on their Kickstarter page is 120£.

Mi.Mu Gloves

Mi.Mu Gloves are open-sourced gloves you can build on your own, created by the singer Imogen Heap and several scientists and designers.(). They have created gloves that allow the user to compose music through motion, while being connected to the computer. It fuses traditional textiles with

advanced motion tracking electronics and algorithms. Also the user can control visual softwares. Imogen Heap has performed using the Mi.Mu. These gloves are targeted towards performers, musicians and artists, and want to break the barrier between technology,performance and the audience.

Machina

Machina is a fashion brand from Mexico, targeting men. Their products fusion fashion and wearable technology. Their latest product is a Midi controller jacket, that allows you to play and loop your own music through mapping the movement of your arms. You can change the notes the jacket has using an application that talks to your jacket via Bluetooth. A jacket costs 999$.

Drumpants

Drumpants are soft textile sensorpads you attattch on or under your clothes that let you drum on your own body. They connect to your existing musical apps and let's you play any music you feel like. The Drumpants also offers custom sounds, and drum pedals. Prices aren't shown.

Discussion

There seems to be a lot of support from the public for these kinds of products. Mi.Mu's technology is open-sourced and might be of use for us. Both Kurv and Auug use existing music applications on the phone to create a bigger spectre of sounds available for their customers.

MARKETOVERVIEW

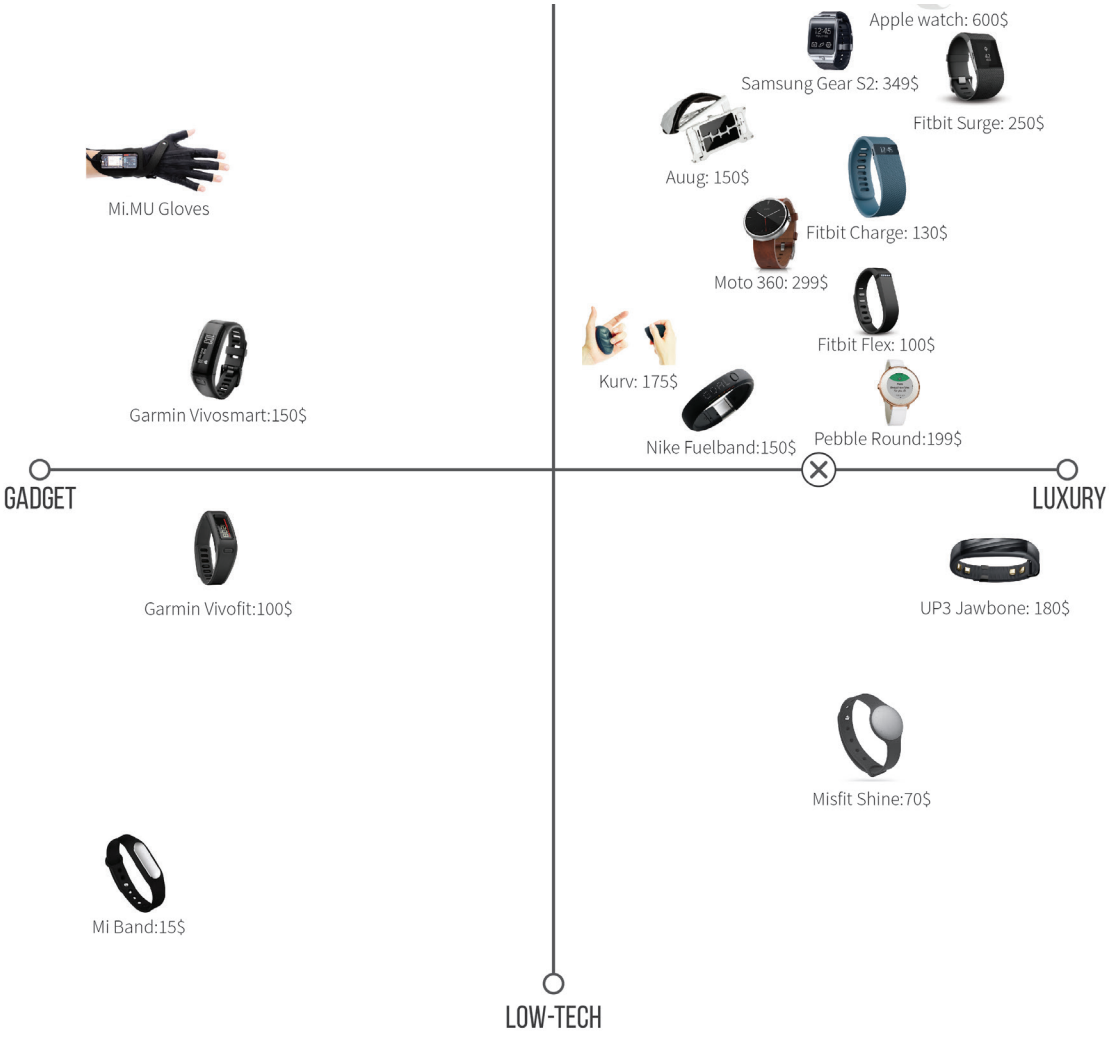
Our main competitors will be Auug. Although they have launched their product and it was supported on Kickstarter, it's unclear how many units they have sold. Kurv is an interesting startup with a great concept, although focused on only one type of instrument at the moment.
We are not competing with fitness trackers or smartwatches, and would rather learn from their success in the early adopters market. The hardest part seems to give people a reason to buy wearable and understand how the products can help them. To understand what they are doing right visually, we need to compare them and see to what extent they vary. Fitness trackers are closest to our probable users, since they are going to move and dance. Our product can seem like an extention of the trackers functionality.
The smartwatches offer more functions than we are interested in offering at the moment but they do have a market that we are interested in.

Discussion

We choose to set up a table based on luxury vs gadgets, which implies higly desired products vs products that are so simple they only reflect base functionality. At the same time we look at high vs low tech products. The high tech products offer more in the sense of functionality, while the low tech wearables offer stable readings and nothing more.

Instruments are hard to master and demand practise and work to become a proficient user and in the end profetional. High tech wearables are often updated and changed out a lot. They are also under ongoing refinement and loose value fast, there is always something better coming out. Musicians invest a lot of time in learning how to play and need to know that the instrument will stille exist in a couple of years. If our product is high tech, users might be unsure of it's worth investing time in it, and if it's too lowtech it becomes a gadget. We chose to look at an are between high and low tech, and slightly onto the luxury side to create added value.

Based on the market research we see that we offer a product nobody else does, especially since our goal is to let our user create music anywhere.This gives us great market potential and a magical new experience


Apple watch: 600$
Samsung Gear S2: 349$
Fitbit Surge: 250$
Auug: 150$
Mi.MU Gloves
Fitbit Charge: 130$
Moto 360: 299$
Fitbit Flex: 100$
Garmin Vivosmart:150$
Kurv: 175$
Nike Fuelband:150$
Pebble Round:199$
GADGET
LUXURY
Garmin Vivofit:100$
UP3 Jawbone: 180$
Misfit Shine:70$
Mi Band:15$
LOW-TECH

POTENTIAL PARTNERS

A potential partner could be one of the fitness tracker companies that offer products in the same area of the market as we choose to place our product. They might have the same way of thinking about product offerings as we do and have prduction sites and knowledge about tracking people.

Auug has a lot of skilled people and know everything about music. They might be interested in co-creating in the future, to have collaborative growth and a ticket into the Norwegian market.

NordicSemiconductor is a producer of sensors and microchips. We talked to these during their company presentation at Samfundet, during UKA-15. They seemd very interested and we were urged to contact their developement department. They have helped another startup company, Aalber Studio, with microchips and programming. We haven't yet had time for this, but is one of the things we will do promptly.

We know that Nike and Adidas are continuing to grow and might be interested in investing in products that touch the human-machine interfaces in the way our product will. They are already interested in sports and Nike offers products for dancers as well.


adidas


NORDIC
SEMICONDUCTOR
Smarter Things

TECHNOLOGY

STRENGTHS AND WEAKNESSES

No specified solution exists for our motion tracking needs yet, but fitness trackers has motion tracking technology and we can base our solution on some of their technology. Looking att their solutions gives an indication to what is important, possibe and also limiting factors in future design. Fitbit Flex is the market leader, Mi Band is interesting beacuse it's the fastest growing competitor to Fitbit and the cheapest tracker on the market . Misfit Shine focus on fashion and long battery life products and is between both on our market overviews.
All of these trackers have a combination of powersupply, functionality and durability that their competitors can't deliver.

Discussion

We see that they all use an accelerometer and their shape is either a small rectangle or a slightly bigger circle. Customers look for durability and accurate sensordata. At the same time most are bothered with having to charge their trackers quite often. Mi Band gives up to 30 days of use. Either we chose this option or Misfit Shine's. We need to test the best solution for our product when we are done creating our prototype. We also want to keep the production costs down and they all use BLE 4.0, which is the strongest low energy Bluetooth connection on the market.

Specifications

Mi Band:
Size:14*36*9mm, weight: 5.0g, materials:100 % aluminium alloy and polycarbonate body casing. Battery: 8 mm, capacity: 41 mAh
Battery type: lithium polymer, 30 days
Input current: 25 mA(TYP)
Input voltage: DC 5.0 V
Bluetooth® version: 4.0 BLE
Waterresistant: Protected against the effect of immersion between 15cm and 1m
Sensor: 3-axis accelerometer
Vibration motor
Totally protected against dust
Locate the Mi.Band through you mobile
Temperatures:-20-70 degrees celcius

FLex:
Size: ?
Weight: ?
Materials:Elastomer,flexible and rubbery
Battery: 5 days
Battery type: lithium polymer
Input current: mA(TYP)
Input voltage: V
Bluetooth® version: 4.0 BLE
Waterresistant: Splash and sweat proof
Sensor: 3-axis accelerometer
Vibration motor
Temperatures:-20-45 degrees celcius

Misfit Shine:
Material: Anodized Aircraft-grade Aluminum
Charging:None
Battery:CR2032 coin cell
Batterlife: Up to 6 months
Waterproof:50 m
Watch function:Yes
Dimensions:27.5 x 3.3 x 27.5 mm (WxDxH)
Weight:9.4 g
Sensor:3-axis accelerometer
Sync method:Bluetooth 4.0 / BLE (Bluetooth Low Energy)
Measures: Steps, Calories Burned, Distance and Sleep Quality and Duration

TRENDS

Fitness trackers mix organic surfaces with rubbery wristbands and details in hard and shiny plastic. New fitness tracker product families have a wide variety in colors, from the classic grey,white and black to fresh and colorful colors that target the younger customers.

Athleisure is the next hot thing in fashion and is athletic clothing that is seen as trendy and fashionable. Users mix training clothes, or have sporty elements in their outfits. Trendsetters in the atleisure are the big brands, like Nike and Adidas.

Wearables are looking to expand their customer groups by directing the design of new wearables in the direction of jewelry. Smartwatches incorporate classic traits from watches and add leather straps and matte metal. The screens are created to duplicate the known watchface, seemingly to evoke a sense of recognition in their potential customers.

The focus on health and fitness will magnify during the next couple of years. Making sure our product fits this cathegory might lead to a simpler acceptance amongst our users. Using colors might also attract the younger users, and can be easily implemented. Our product will probably only be used when our user feels like creating something or moving around, and that means that it doesn't have to follow the trends as much.

The identity creation comes from within, through the music. Popular musical seems like a better way to attack trends and can be implemented in the sound offering.


135

PRICES

TRENDS AND MARKET SIZE

The prices of trackers range between 15-250. Smartwatches are found between 200-600. Our main competitor Auug sells their current version for 150$, and the Kurv guitar is about 175$.

At the same time our product is more a tool than any other wearable. A new instrument from Sweden ,Svenska synthen by the young engineers, has newly emerged. The product cuts down on switches on the classical synth, putting restrictions on it's user. The sell their product for 700$ targeting musicians and say that it's a tool. We need to avoid the gadget and put value on our product as a tool. This will allow us to create a better product and add value with our users:it's their tool for music creation, not aother wearable gadget. Also this plays on the identity of classical intstruments as tool.
The price of our product is then somewhere between 150 -700. In our survey, a 157 people would pay over 100$, without knowing exactly what it was.

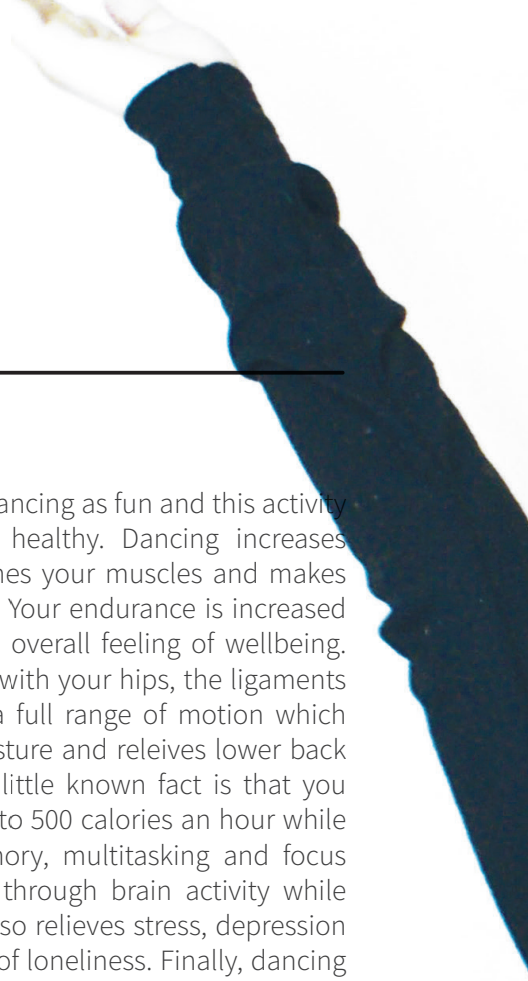
BENEFITS

In this chapter we take a closer look at the desirability of our idea. We all know that music, dance and playing instruments is good for your health. Here we take a closer look at why. With growing health and fitness trends, benefits found in our research can be used for future marketing purposes and value creation. The second part of this chapter takes a closer look at rehabilitation for future reference and possible expansion of user group.

CULTURAL

All people and cultures have a connection to music, dancing and playing instruments. We all know that it's good for us but we don't neccessarily know why. Exploring these fields might uncover interesting aspects that we should implement in our product. We can make sure that the experience becomes as fun and motivating as possible and at the same time maximize the health benefits of the musical interaction.
In addition these can be used as selling points for our customers, and also in sales pitches for possible future investors.
If we have to simplify our product and discard elements of the experience, we can look at the information we find to make better choices.


YORK



MUSIC,DANCE & INSTRUMENTS

HEALTH BENEFITS & ATTRACTION

Humans are rythmical creatures and evrything we do evolves around cycles. We walk with a beat, our heart beats, we talk rythmically, are affected by weather and day/night cycles.

Music

Music sets your brain on fire, giving it a thorough workout. Listening to music is good for people of all ages and is directly connected to memory and higher mental functions.. Music can dig out old memories we have stored deep within our brain, and it also makes us more attentive. Brains need exercise to stay healthy, just like the rest of the body. Dopamine and endorphines are released into your bloodstream when listening to music. Humans love these hormones, since they make us happy. Research has found that music with a quick tempo and high key, and also listening to your favorite music release especially high amounts of such hormones. Some types of music can even lower cortisol levels and bloodpressure. Cortisol is the hormone that makes us stressed out and is known to be bad for the immune system(Moreno).

Dance

Dance is defined as moving rythmically to music,and is part of our social interaction. Dancing improves brain functions and balance. It also allows you to express yourself, which is one of the fundamental needs of every human being. Most people experience dancing as fun and this activity is also very healthy. Dancing increases flexibility, tones your muscles and makes you stronger. Your endurance is increased and gives an overall feeling of wellbeing. If you dance with your hips, the ligaments go through a full range of motion which improves posture and releives lower back problems. A little known fact is that you can burn up to 500 calories an hour while dancing.Memory, multitasking and focus is increased through brain activity while dancing. It also relieves stress, depression and feelings of loneliness. Finally, dancing releases a lot of endorphines, which make you happy.(Alpett)

Evolutionary psychology suggest that we attract partners through the way we dance, projecting quality of genes and hormones to potential mates. Animals from several species have dance displays for their mates, which is part of their courtship cycle. Men who are good at dancing are perceived as more masculine and attractive and women become more desirable the more they move their hips.

Instrument

Learning how to play an instrument increases memory, creates new nervepathways, increases control over motor skills and, enhances hearing and also gives you a higher IQ. Children who get musical training get better visual, verbal,math and reasoning skills. They

MUSIC+DANCE+INSTRUMENT
=
HAPPY SUPERHUMAN

understand words better and explain of these easier than ther peers. Playing a musical instrument also sets your brain on fire, engaging several areas at once. The auditory, visual and motor areas of the brain are especially affected. We can apply the strengths we gain learning to paly an instrument to other activities. Playing music activates both sides of the brain and strengthens the executive functions. These are the interlinked tasks of planning, startegising and attention to detail and allows you to process both cognitive and emotional aspects of a problem at the same time. This impacts our memory, enhancing the storing, creating and retrieving memories more efficiently.(l)

Discussion

There is no limitations to the benefits of our product. Combining the tree makes you a happy superhuman and it would be interesting to to also use it in a research study to see the direct effects. Learning how to play an instrument gave the most benefits and should be the last to go if the product needs to be simplified.

NEUROLOGICAL DISORDERS

Parkinson Disease

This is a progressive, neurodegenerative movement disorder that affects 6 million people worldwide and often leads to reduced balance,mobility and quality of life. Research has shown that dance in the mild and moderate cases are good for balance and mobility and often helps reduce other symptoms like depression. In some cases, dance seems to thrump the effects of normal excercise on motor impairment. (Earhart)

The American Parkinson Disease Assosiation state that music therapy has great effect on people with PD. Some types of music stimulate the production of dopamine and serotin, hormons that amongst other help us move fluidly, helps us focus and resist depression, impulsive behaviours and mood disorders. Also they make us happy, and these hormones are dimineshed in PD patients, this form of therapy changes that. Further research from 2000 shows us that dancing helps PD patient with stiftness, but music and musical creation helped them with daily performance like cutting food and getting dressed. The beat is important, it helps them to set a cue that they can follow.

Alzheimer Disease

This is a progressive, degenerative disorder that attacks the brain, resulting in loss of memory, thinking, language skills and leads to behavioral changes. For people with AD, music has several benefits. It evokes emotions that bring memories. By playing music over time, the patient uses rythm to create new memories of these activities. Although AD patiens forget a lot, music aptitude and appreciation remains and helps others reach them. Also music helps AD patients shift moods,manage stress and coordinate motor movements.

Dancing is the greatest benefactor for AD patients, especially couple dancing. Researches found that dancing affect the neuroplasticity of the brain by forcing it to make split-second decisions, and creates new nerve pathways to information stored in the brain. This fights the degenerative effects of Alzheimers. Playing instruments also has a positive effect by reducing risk of dementia.(5)zzz

REHABILITATION

PHYSICAL AND NEUROLOGICAL TRAUMA

Studies show that musical theraphy in physical and neurological trauma give continous positive results. Rehabilitating functioned both with music in the background and when playing an instrument, increasing motivation, gait, fine and big movements especially when the music functions as a timekeeper. The music created increased engagement in the training and decreased the perceived exertion while training. Music decreased stress and increased the interaction with the enviroment. Although this depended on the attitude of the user, there are generally very positive results when using music for therapy.

Dance therapy is especially effective as treatment for depression and anxiety. In addition dancing release hormones that reduce pain and increase energy, while reducing stress and increasing the quality of life for the patients.

Discussion

Our product can definitely help both PD, AP and other patients and should be implemented in our future strategic developement.

THE USE

Understanding your users is a must for businesses. It is what gives you an edge or what leaves you behind in the market. Using Lean Startup, users and MVP are at the core of every decision. All actions are verifications of value creation in co-creation with the user, and every step demands feedback to create a good and desirable product. In this chapter we define our MVP, take a closer look at the existing customers of wearable technology, and define our usergroup. Personas are created based on research and dialogs with external sources to understand user scenarios and needs.

R

DEFINING OUR CUSTOMER

Market research showed us that the main customers of wearables today are younger users, between 18-34 years old. These are both female and male, but they tend to buy different products. Women are the biggest consumers of fitness trackers, while men are mostly buying smartwatches. These customers have high income, are tech-savvy and style oriented. Demographically our customers will be from Europe, USA and Canada.

A lot of our customers will have jobs that keep them seated in front a computer, which is very damaging for their overall health.

Owners of wearable technology today are defined as early adopters. These are the first after innovators to try out new products, and because sales of wearables are on the rise, a diffusion towards early majority seems imminent. This group starts buying new products after early adopters they know and trust have used them for a while, before purchasing themselves.

Shearing personal experiences and stories on social media is part of the younger users daily habits. Finding new ways of social expression is researched, opening for new social media channels.

Discussion

Our primary user is a woman between 18-34 years old, who is looking for a new experience and way to express herself. Males in this agegroup have a buying pattern that targets functionality. Meanwhile we are trying to create an experience that focuses on the human expression and not the physical product.

Early adopters want to be the first to know and actively search for news. They search for words like “social”, “cloud” or “sharing” which indicates that this is what they want to experience. Offering a new way of self-expression on the internet will be attractive to these users.

Incidentally our team is in the agegroup of our customer which makes it easy for us to emphatize with our target audience.

Understanding rythm as a social need in interaction, like dancing in the club, makes our product attractive for these users

This group is interested in fitness, health, trends, personal expression, identity, new experiences.

PERSONAS

To capture our user we have to create personas. These are representations of our ideal users, with a full overview over behaviors, skillsets, expectations, goals, wants and jobs they need done. They will be our user archetypes, and taken into account in every design decision.

MATILDE AARHUS

Age:23 years
Relationship status: Single
Profession: Law clerk, 2 years
Favorite places: Eplehuset, Deichmanske bibliotek

Matilde works as a law clerk at a big lawfirm in Oslo. Matilde is interested in law but gets bored easily, so going back to school is not a goal. At work, she spends her day in front of the computer, which she doesn't mind. She has the best Mac at work and got this and a raise after daring to suggest a whole set of productivity apps for her boss that saved the company millions. Secretly she is an Apple fanatic and is pationately interested in all their products. At work she is the silent and mysterious librarian type and very introverted. When she comes home she turns into Christina Aguilera unleashing her inner sexy self by blasting music and dancing through her appartment while singing passionately. She managed to sync her Apple watch with her proximity to home, so that the sound of music motivates her to sprint up the five floors to her appartment. She learned programming through Oslo Girl Geeks, where she helps with arranging meetings.

"THERE IS AN APP FOR THAT"

Matilde has few but close friends and they are the only ones who know how crazy she really is. Their favorite thing is to have "Taco & Tequila" parties where they dress up and talk about life.

Tech Savvy: 8/10
Time spent on technology every day: 8 hours
Salary: 50500$
Motivators: Her friends, new applications, music and dance

MARK JOHNSON

Age:28
Relationship status: Has a girlfriend of 3 years
Profession:Freelance graphic designer
Favorite places: the gym

Mark lives in California and loves to express his style through buying new stuff. He feels like a trendsetter. His friends are all guys and they hang out every day. Mark has the newest Apple watch and feels updated and good at technology, but coding bores him and he doesn't really understand it. He trains every day, either pumping iron or jogging and has all the newest training equipment. Technology inspires him to push himself further and he loves seing his progress on his smartphone. He goes partying with his friends every weekend and feels he´s getting old. Sundays are usually spent cuddled up on his girfriends lap, popping Aspirins.

Tech Savvy: 7/10
Time spent on technology: 10 hours a day
Salary: 68.000$
Motivators: New and better stuff,
adrenaline, status among friends, challenges

"GOD CREATED ME FOR THAT!"

JACKIE DEPRAUX

“THERE IS NO TIME BUT NOW. LITERALLY”

Age:34
Relationship status: Married, two kids
Work: CEO at Telus
Favorite places: driving

Jackie has worked her way up through Canada’s biggest telecommunication company Telus. She managed to get to CEO two years ago and her life is now work. Time is her biggest struggle and she somehow manages to juggle being a CEO,wife and mother with a pinch of luck, her secretary and a great nanny. Her children are 10 and 7 years old and her husband works as a consultant in for an oil company. He’s gone for longer periods of time, traveling back and forth from Canada and Texas.
Jackie loves her family and work, but misses her true self. She became pregnan with her first child just as she was about to go backpacking and see the world.
Instead she got a part time position at Telus to make ends meet.

Jackie struggles with separating her work from her freetime and ofthen picks up work related phonecalls during dinner. Her children complain that she never listens to them and that they never do anything together. Her doctor has precribed relaxtion, meditation and exercise to lower her bloodpressure, which she would do gladly if she had more time.

Tech Savvy: 6/10, knows what she needs to know
Time spent on technology: 4 hours, the rest is spent on management
Salary:100.000$
Motivators: Results and happy children

NEEDS

We see that on a personal level Matilde needs to build up her confidence and help her express her opinions and thoughts. Stylewise she's into simple and clean products, like Apple. The technology needs to be hackable, so that she can adapt it to her will and at the same time create a possible challenge and a way of personal growth.
Mark is strong willed and is looking for the feeling of power, exitement and adventure through the things he does. He is willing to spend money on trendy and enabling technology.
Jackie needs to connect with her family and create good memories and moments. She needs a product that frees up some time by merging family time with health time. Simple and durable technology will catch her interest.

Discussion

We now understand some of the needs of our users. Our product will affect them on several levels. There is the social, functional and emotional level and our product will offer them a solutions through the day. Creative outlets function well for identity and confidence building, Dancing makes you happy and lowers stresslevels and bloodpressure. They all like to be enertained and due to their age and demographic, parts of their identity is created through social networks. For Jackie the most important part with our product will be the connection to her family by interacting with our product. Through our survey we also found that many wished for a product that you could use in interaction with others. If we implement it, Jackie can have fun creating with her kids, while Matilde and Mark can use it in their social circles. This might also lead to empowerment and confidence.

SOCIAL	FUNCTIONAL	EMOTIONAL
Skill recognition	Creative outlet	Empowerment
Belonging	Co-create	Autonomy
Bonding	Sharing stories	Affiliation
Skill recognition	Entertainment	Fun

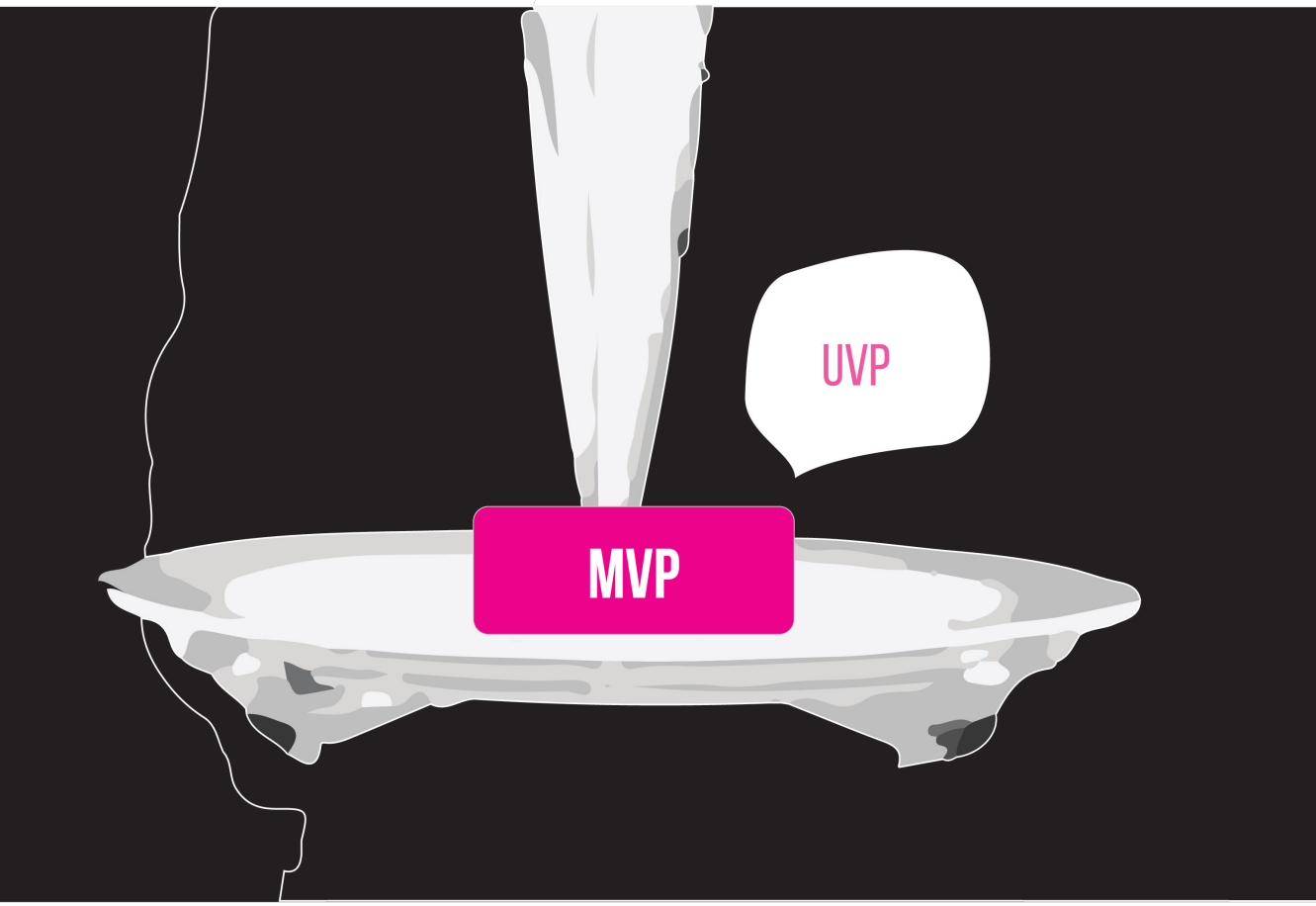
UVP AND MVP

A minimum viable product should immediatly express why it´s special. To have overhead on the market the value offered has to be so unique it cannot be copied or experienced elsewhere. This is the unique value proposition (UVP).

Discussion

Our UVP is that we let anyone express themselves musically in a rebellious new way through dance. This while sounding like professional musicians and being able to share it with others! Now you really tell a story through the way you move. Nobody else has this combined value proposition.

We need a way to deliver this vision fast so that it can be testet by early adopters, and will lead to valuable feedback that will help us adapt the product even further in ways that we haven't thought about.


UVP
MVP

USER SCENARIOS

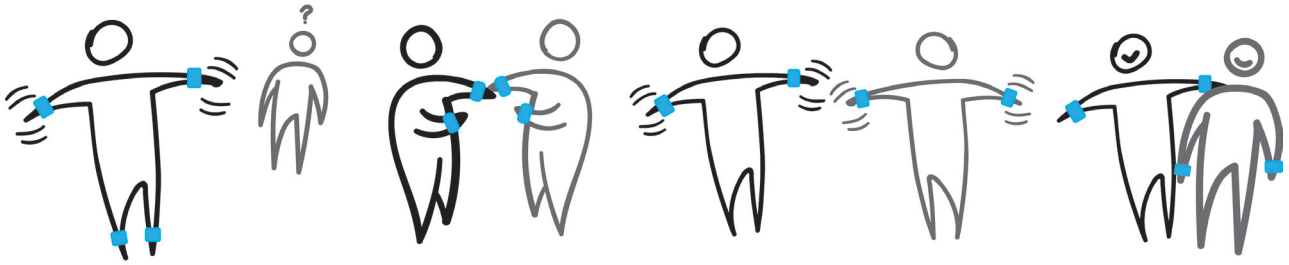
Scenario 1 takes place in the forest. The user is out on a walk and becomes inspired by the sounds of nature and decides to record what he feels.

In scenario 2 our user is dancing and another person becomes curious about what he is doing. Our user shares his sensor and they create music together. Music and dance creates a sense of belonging, so they now feel happy and connected.

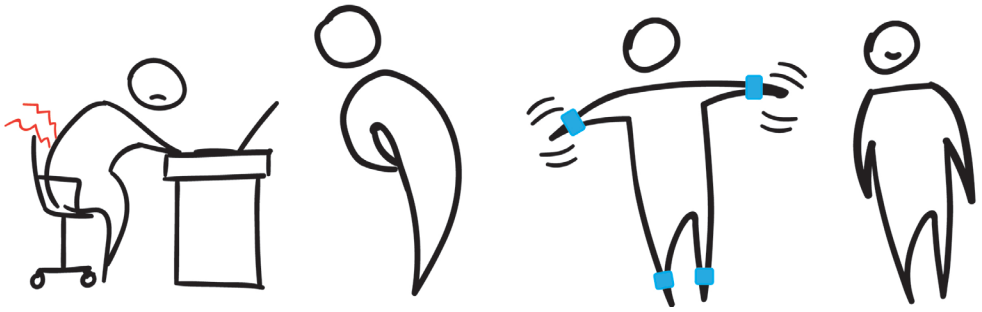
Scenario 3 shows the everyday circle of our users. Backpain is a seeping danger and the user becomes demotivated by starting on the screen. He decides to stand up, move around and create something for fun. He feels much more satisfied after dancing.

SCENARIO 1: INSPIRATION IN NATURE

SCENARIO 2: SHARING IS CARING



SCENARIO 3: LONG DAY AT THE OFFICE



THE COM

In this chapter we take a closer look at how our company presents itself to others. We clarify our values and envisioned future while anticipating threats and creating a strategic plan for achieving success. The SWOT model is used and a SO-strategy is laid based on the perceived opportunities and company strengths.

IPANY

DIRECTION

Mission,visoin and goals

Our mission is to provide an intuitive platform where everyone is a professional musician through dance. Our vision is that in 5 years we sell a known musical platform that has changed the way people send personal messages. Our short term goals are:

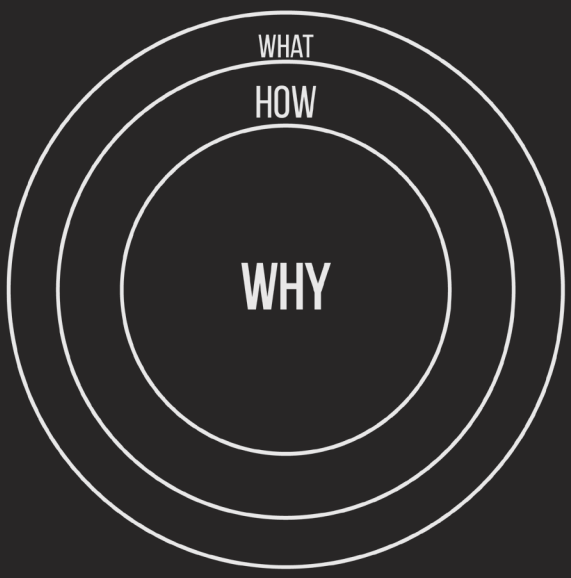
Finished MVP by 20.desember 2015
5/10 understand our value proposition.
8/10 thinks it's fun
3 out of 10 people want to buy it

In 5 years these are connected to us:
#mybeat#inmyzone#awesomefeeling
And you can talk about with your baker.

Why,how and what

Our why,how what are our core ideas and values. They define why we are creating this product, how it's different from our competitors and what technology we are using to create the products. We chose to define this late in the process beacause we wanted to be able to position our brand well.

“We believe in freeing the creative soul and challenging the the way to do so. Therefore we offer a unique and fun musical experience that lets you play like a pro from the first move. You can save your creations as memories on the go for you to share with your friends and family. We are creating a small wearable motion tracker that tracks all your movements accurately. “

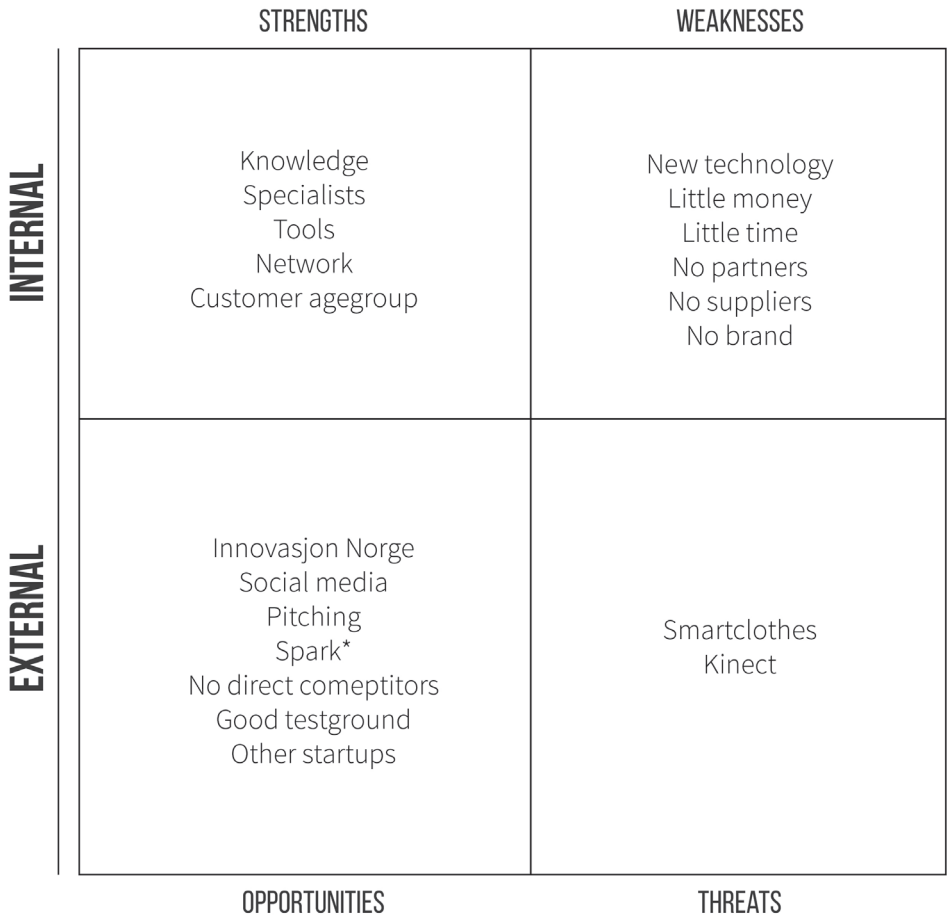


SWOT

A strategic plan defines what a company stands for, the market it is in and how it will compete. Analysing these factors shows us what steps to take to ensure success and will help us avoid the biggest threats. We already know who our competitors are and have defined what we stand for, we now need to take a closer look at how to compete well on the market.

Since we are running a lean iteration process we are already adapting our product to an end user. We have a limited amount of time, money and people and need to take well concidered choices as to where we should implement our resources. This is where the SWOT analysis comes in as a great tool for discovering what internal strengths and opportunities we should lean on, and what threats and weaknesses we need to take into consideration.

To create our SO-strategy we use our objectives as filters to decide what to do and what not to do during our project and if there is something we need to do now for the long term effects of a startup.


STRENGTHS
WEAKNESSES
INTERNAL
EXTERNAL
Knowledge
Specialists
Tools
Network
Customer agegroup
New technology
Little money
Little time
No partners
No suppliers
No brand
Innovasjon Norge
Social media
Pitching
Spark*
No direct comeptitors
Good testground
Other startups
Smartclothes
Kinect
OPPORTUNITIES
THREATS

SWOT

ANALYSING THE RESULTS

STRENGTHS

Knowledge

Our team has all the knowledge we will need to create the first prototype. We have people that are good at musictechnology,prototyping and have tried mapping before. We also have programmer that will help us with the application and knitting the systems together. Also we have a designer that steers the results into something people can use and like.

Specialists

For the part that we might not manage when it comes to programming and the hardware, we have several specialists that have agreed to help us and also work as mentors for us.

Prototyping tools

We have some basic prototyping tools available and can manage to find more on campus if we need to borrow more or anything is destroyed. The fact that NTNU has a lot of Arduino lying around and is in use by students, also mean we can ask for assistance if we get stuck.

Network

We have a wide network and can get in touch with them if we need to know something or find someone else through them.

Age

Our team is in our customer demographic and this makes it easier for us to relate to the needs of our envisioned end users.

WEAKNESESS

New technology

Our biggest weakness and possibly greatest asset is our technology. We will use technology that exist from before, but will have to merge it in a new way specified by our user needs. This will take a lot of programming and adaptation. Based on the fact that we don't have any direct competitors, launching a product based on our technological solution will make us market leaders for the time being. If other companies with more people, time and money want to create a better solution, they can, which is why our product needs to deliver an amazing experience and cater to peoples emotions and create customer loyalty to our brand. We have no guarante our solution will work and this is a major risk. At the same time our solution will target technological problems like latency and drift (see page) which is a major problem in todays wearables. If we manage to minimize drift and latency we will become desirable co-creation partners for other companies.

Little money
We have some funds, but just enough to buy the extra technology we need to create a viable prototype. If it doesn't function we have no cash left and we might have to stop the project, unless we find funding somewhere else.

Little time
Our project has limited time and we have to get as far as possible, as fast as possible. In this round it's important to create a solution that explains our MVP to our customers. If we don't get more money or an investor, we will have to spend a lot of time for free for an indefinite period.

No partners
Having partners is essential to avoid crashing if something unexpected happens. We might need to find partners or co-creators to secure the future of our product.

No suppliers
Having no suppliers makes it difficult for us to estimate costs and the fesibility of our solution. Many standard components and possibilities are unknown to us and might have created simpler hardware solutions.

No brand
We have yet to create a brand identity.

OPPORTUNITIES
Innovasjon Norge
Getting funds from Innovation Norge has been a leading goal for us. We have followed all the steps they want covered to give any form for support and see this as a possibility if we manage to create a MVP
These funds can be invested in new iterations of our idea and to create a bigger network.

Social media
Collected we have a great network online, and if we manage to create something visual that expresses our MVP, we can share it here.
Also social media and the internet loves young startups and gladly supports them with visibility and reviews.

Pitching
Pitching at Technoport and other venues might help us find investors, new valuable teammembers and funding. Creating a good pitch should be targeted as part of our short term goals.

Spark*
This is a NTNU based mentor organization that can help startups with ideas and possible funding. Spark* consists of students, who work on their own ideas and startups. They are the same age as us and are a source of inspiration and motivation.

No direct competitors
This is our biggest opportunity, because it gives us an intro to a new market. We are not one amongst many and everything we do, find and spread through our channels will reach more people.

Good test possibilities
NTNU is filled up with tech-savvy people in our age group. This gives us an amazing testpool, and we can always find people who are like our personas and talk to them.

Other startups
There are several startups ozing with innovative spirit at NTNU and we can reach out to them to get tips and ask questions. Inspiration leads to motivation, and these already have networks and suppliers we might be able to get in touch with through them. We arre working on solutions and have knowledge that might be interesting in a co-creation setting.

THREATS

Emerging smartclothes
Smartclothes give great human tracking possibilities. The threat of smartclothes can also become a good possibility for co-creation for us in the future, leading to less latency and drift since it's an integrated system made directly to track motion.

Kinect
If Kinect comes up with a solution that gives our users a way to create in front of their system, the product will reach more people than we can, faster. At the same time, you are stuck to a specific area and you cannot let your creativity flow on the go. We would offer different experiences.

SO-STRATEGY

Our main strengths are that we have a great team with loads of knowledge and that we are diverse in what we know. That we are in the same demographic as our customer group makes it easier for us to find users for our prodct. The fact that we are sorrounded by people at NTNU who share our values, creates the perfect hub for our startup and product testing. We might find early adopters with great knowledge that can be added to our product. They might even become teammembers snd increase our value as a team through extended knowledge. All the weaknesses except for the new technology, are expected in a startup. With enthusiasm, networking and good pitches we can find our investors and suppliers. Our biggest immediate opprotunity is Innovasjon Norge, and although they might not support the full brunt of our economical needs, we might implement this money in widening our network and reaching out to paying customers. This might help us get in touch with usergroups we haven't thought of before.

The emerging smartclothes are a potential threat, but at the same time they demand a lot from the user. Dressing for the occasion isn't exactly what fuels the momentary creational spirit, and are not meant for the same users as we have. Kinect might come out with a solution, especially if they hear about our idea, but again their products dictate a lot about where the interaction takes place.

Our short term goal has to be the technology developement, since Innovasjon Norge doesn't support such ventures, and we are at the right place to get a lot of hardware help and have the possibility to find what we need.
Only if our hardware functions will our product be viable, and it is our number one priority, together with understanding our user. The technology is nothing if the user experience isn't fun and early adopters see the potential in our product offering. These two goals will be what we focus on during this project.

DEVELOP

PEMENT

In this part we look at user experience, define evaluation criteria, research movements and human motivators for interaction.
Then we take a closer look at the technological requrements our system needs to deliver our desired experience. Finally we discuss our findings and formulate our designbrief.

USER
EXPERIE

YOU ´VE GOT TO START WITH THE CUSTOMER EXPERIENCE AND WORK BACKWARDS TO TECHNOLOGY

-

STEVE JOBS

NCE

USER EXPERIENCE

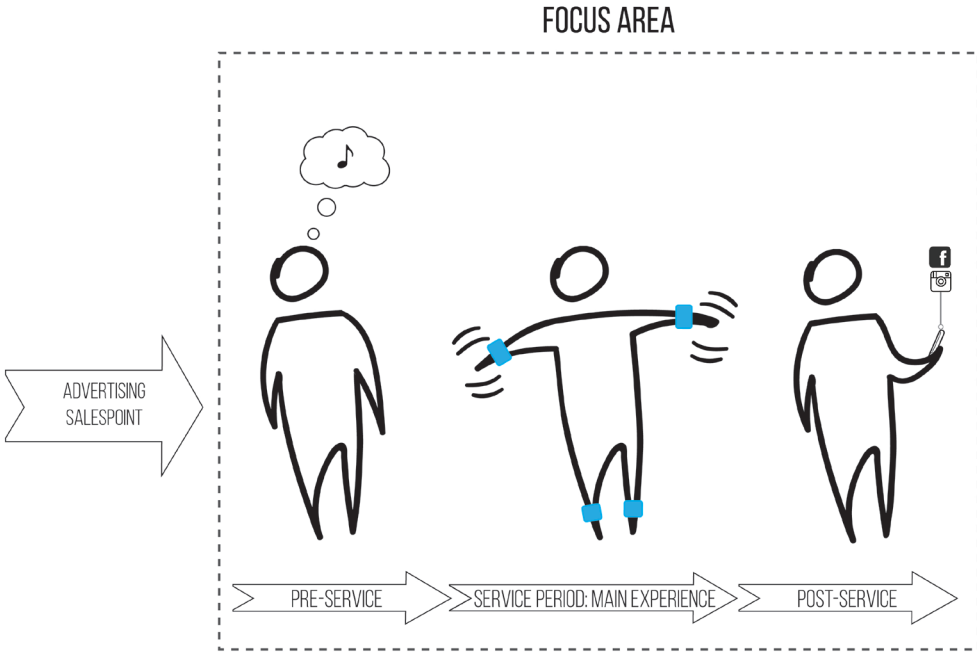
THE CORE PRODUCT

The core product is the benefits a person receives when using a product. You have the actual product, which is the physical product and then you have the augemented product which are the extra services provided.

Discussion

Our core product is the feeling of fun and mastery through creation and needs to be compelling to our user. With this in mind we focuse on creating a great experience while the user is using our product. To offer a seamless experience we have to take mapping, sounds, physical requirements and the emotional story that is told into the equation. The service delivered is the creative user journey and our core product is an effect of merging these.

Our user scenarios help us create a good flow, and ideally every step from the purchase to the direct use needs to be taken into consideration. Because of time constraints we choose to focus on the user-product touchpoints from “on” to “share” as our defined user experience.


FOCUS AREA
ADVERTISING
SALESPOINT
PRE-SERVICE
SERVICE PERIOD: MAIN EXPERIENCE
POST-SERVICE

INTEREST CURVE

THE OPTIMAL EXPERIENCE

Jesse Schell, one of the worlds leading gaming designers, created an optimal experience curve, called the interest curve. The curve applies to more than games, and can be used in experiences, stories and music. He found that the way to create the greatest experience for the user, is by creating fluxuating interest over time.

The graph represents three layers of experiences: inherent interest, poetry and projection. Inherent interest is the underlying drama or fluxuation in instincts, which in our case might be reached by musical progression, ground rythms or musical trend understanding that captures the user. Poetry is experienced through aesthetic appreciation.
Projection is applying the users imagination and empathy, to create an immersed experience. The knowledge of the experienced world and temptation of staying in it, will bring the user back.

Discussion

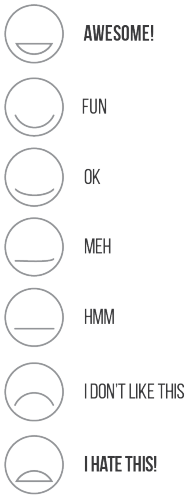
A goal is to create a product that has the perfect combination of these three layers, while moving the user forwards in Jesse Schells interest curve. The more our user interacts with our product, the more they want to use it. Our poetry layer will be the music, sound and the appearance of the interface. It might also be reached by creating a mapping that is experienced as aesthethically pleasing.

The experience has to be pleasing, simple but not too simple so that you can still learn and induse the feeling of great satisfaction. Using techniques from service design we use the customer satisfaction graph. It's based on the expectation and experience with satisfaction as effect.

We will use a combination of the interest curve, customer satisfaction graph and the kano model to evaluate our delivered product.

As seen in the graph, the user starts with some interest in point A, at point B there is a hook that grabs our attention. The user is now excited about the experience, and has had a taste of what is about to come. The interest rises in peaks, shown as point C and E, and has dropping points of interest in D and F. There is a climax, represented in point G and the experience or story is resolvedand the interest dwindles to point H. (Schell)
We will evaluate our product with the interest curve. The closer we manage to create an experience on this basis, the better the product will be perceived. If our designed experience diverges from the interest curve, we will have to reiterate the curve until it is right.

ICONS FOR CUSTOMER SATISFACTION



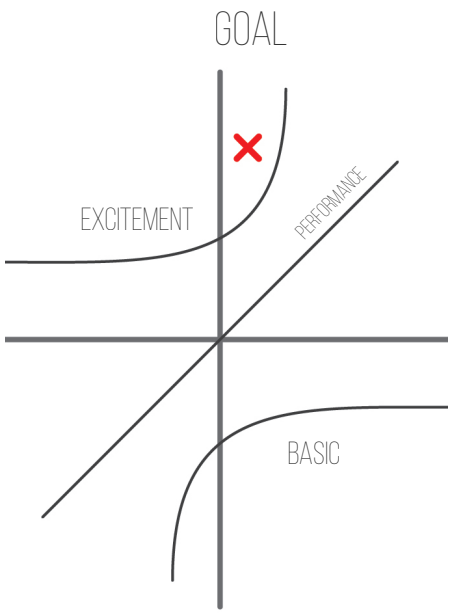
KANO

The kano model differentiates and identifies different product characteristics related to customer satisfaction. As we don't have time to create a perfect prduct in either functionality or looks, we have to focus on the initial user experience and focus our user requirements on the performance attributes. Users don't know the needs our product will cover since it's a totally new way of experiencing music.

The basic attributes in our product is the technology, and the expectation that the wearable technology will function like it should. These thresholds functions are taken for granted by users in all technological products, and only lead to irritation and frustration if they are gone. Most people wont think twice about how our product functions, but if it leads to latency, drift or any other hardware based problem they won't like our product.

In the kano model performance attributes lead to improved customer satisfction and are the known needs that are being taken care of by a product. This level lifts a product from "it functions", to "good". Users relate to the performance atributes as something they already know and expect. Most needs stated by users are found in this category.

The real wow-factor comes with the excitement attributes. These are attributes that are unexpected by the users, and experiencing this in product leads to satisfaction and excitement and makes a product stand out. If implemented in innovations, they give you competitive advantage over the rest of the market and also lead to great customer satisfacton.



Discussion

The user needs to feel like the creator of our music, therefore we have to ensure that they understand that their actions lead to direct responses in the system. Movement has to be thoroughly mapped, and finding logical ways that feel intuitive for the user to move and get musical feedback on is neccessary for a pleasant experience. These will be part of our performance attributes since you expect an instrument to do as you want.

Also the music needs to sound nice, unless the user pushes the system into sound spectres that can be experienced as unpleasant. This might attract musicians, as well as regular users. Being on beat is the goal, laying out a creational basis for all movements. The user should be able to be off beat, but preferrably on purpose. This will lead experiencing having fun and in the flow sone.

Technical aspects as hardware and software has to function and comes under basic attributes. The prototype will cover the basic needs, and is expected to function all the time in the final product, but the prototype might malfunction.

Due to the time limitations our goal is focusing on the attractive attributes with a minimum of functionality. We don't have time to program too much, so the MVP experience will be stripped down and be further developed over time.

MOVEMENT ANALYSIS

RAW AND BLÆST

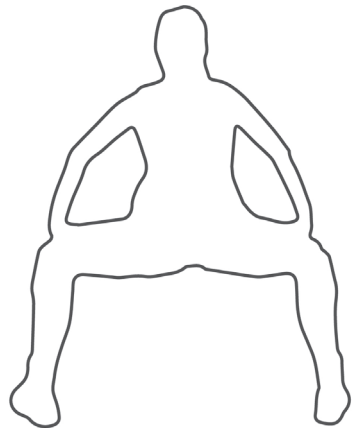
Part of the performance attributes mentioned in the kano model is mapping the movements so that our user understands that actions lead directly to sound. To offer this in a pleasing fashion, we first need to understand human movement patterns while dancing. Our primary users are not dancers of trade, but there might be others in this dancegroup that have different ways of dancing. Therefore we have to observe different dancestyles to understand if there are any similar movements. The goal is to use the observed findings as a mapping baseline for movement in our product experience.

First off we went to RAW and saw how a hip-hop class moved. They had wide patterns, with big movements. They used hips, bent knees, moved up and down a lot and also used ther arms to accentuate the melody. They held that bass with their feet and bottom. The dance was coreographed, meant for a big audience that could see them from far away. Our primary users would be more relaxed as dancers and we decided to look at the way people danced in clubs as well, and decided to go to the club Blæst. We recorded the interaction with a GoPro and observation.
The music style that was playing was house, and people danced by following the beat by stepping and often two-stepping with their feet. Some guys moved their arms in big circular, rythmic movements. but far from range of the RAW dancers.
There was less hip use to this music, probably because of the energetic tempo.
Based on this and previous personal observations we know that all danceforms are diffrent but have similarities in the way that rythm is followed first by the feet and then by the hips. Arms are used to different degrees. We did see though that depth of kneebending often varied to how big difference there was in bass changes and depth. The deeper the bass, the deeper the movements.

Discussion

We understand that we need to let our user move in any pattern they like when creating, and including all dancestyles or just one will be wrong and create a too big mapping challenge in the beginning. We saw that the dance patterns became freer the more people drank, which also made them less uptight and let them follow the beat easier. We need to invest more resources in observation of different dancestyles later.

Our mapping baseline will be:
-bass and rythm held with feet
-arms following melody



MOTIVATION AND DRIVERS

GAMES AND FUN

To tap into the performance attributes in the Kano model, we also need to look at what will keep our users satisfied for a longer period of time. The longer they enjoy what we offer the better; if we get them hooked by our product,they might influence others into purchasing the product. Therefore we take a closer look at what keeps people going and what motivates us to explore and learn.

Games act as learning tools and are based on patterns. When we recognise a pattern we store it for later use and the brain perceives this as fun. Our brains are pattern-driven and look for them everywhere. Games are intricate puzzles we solve, set in formal settings. They are patterns that the brain needs to discern and understand. All patterns are mashed together in chunks, that the brain stores until they are needed. In games these patterns are ready for consumption, while patterns are fuzzy in reality. This leads to games being excellent learning tools. Games that fail to exercise the brain become boring (Koster 2013), and this is why all games become boring after a while; the brain already knows all the patterns. Games are fun, but are inevitably disposable due to boredom.

Fun is “something that provides pleasure”and is reached through physical stimuli or aesthethic appreciation.(Koster 2013) When the brain feels pleasure it releases endorphines and we feel a rush. This can also be reached through mastering tasks, like managing to play a song perfectly after months of practise.

Discussion

Our product needs to be fun to use and be so addictive that it doesn´t turn into a technological gadget that our users forget. We want them to be drawn into the world of creating music and experience the magical wonder of fusing technology , imagination and patterns. If we create a game we will ultimately have to continue expanding the patterns in the games if we want the product to continue being used.

MOTIVATIONAL TRIGGERS

Exept for being pattern-driven we need to look at ways to further interest our users and take a closer look at motivators. Based on psychological research, there are two main types of motivational triggers. One is external and the other internal. External motivation is called extrinsic motivation and occurs when you receive rewards from the outside, or avoid punishment. Cleaning your room so your parents won't punish you is good example. Another is rewards in games. They come in the shape of achievemnt, progress bars, virtual goods, rankings and the like. These act as shortsighted rewards for meaningless tasks compared to the bigger picture of the game. Instead of solving or uncovering a problem, you get a motivational carrot and drop off the learning curve. This eventually turns fun into work.(6)

Intrinsic motivation

Intrinsic motivation is engaging in an activity that leads to personal reward, and activates the areas of the brain that leads to higher motivation and positive emotions through the release of endorfines. This is doing things for their own sake and leads to self-driven learning, mastery, power, curiosity, pride, renewed interest and peer recognition bases on the internal prowess(6). This type of motivation makes you feel like you are doing something important and it leads to greater pleasure and solving capasity.

Drive

Drive builds on intrinsic motivation and is what creates progress and a will to contiue engaging in an activity. It´s based on three things: autonomy, mastery and purpose.
Autonomy is the urge to direct our own lives, mastery is the desire to get better at something that matters and purpose is the yearning to do what we do in service of something larger than oneself. To get the best possible progress in anything, reaching drive is proven to work the best.

Gamification

Gamification is implementing design elements from videogames in non-game contexts.(7) An example is adding points and achievements, or competing against others. Although external motivation, through points for example, may lead to feeling a rush, this is only short-term and soon turns to work.

External motivation

External motivation is good over a short period of time, before it becomes work and we get bored. Intrinsic motivation will lead to personal award, higher motivation, pride and greater pleasure than extrisic motivation. Our objective is to create a platform for drive, where our user will experience these feelings over time.
The feelings of autonomy and mastery are exactly what our young adults want, and can be reached in the drive zone.

Discussion

We want people to experience our product as fun, and we have the possibility of making a game out of it or introducing elements of gamification. Problem is games become boring after a while. In addition we don´t want to have a game element on top of everything, taking away the focus on musical creation and adding a whole new level of production to an already complicated product.

Intrinsic motivation leads to greater pleasure and doesn´t stagnate over time, and is what we will focus on in our developement.

TECHNO

In this chapter we take a closer look at existing technology and how these parameters will affect the physical interface of our final product. The following pages have discussions integrated into the descriptions to make the contents easier to understand and to understand exactly how much consideration has gone into every decision.

LOGY

TECHNOLOGY

The feasibility of a MVP relies on the technology we use. From the SWOT we see that our greatest weakness is that we have to program everything from scratch and we avoid further complicatifons by basing our prototype on existing technology.
Our technology clarification showed that most fitness trackers use accelerometers, a motherboard, Bluetooth Lowenergy 4.0 and a battery. We might be able to use these components and might also have to add more sensors if neccessary. The clarification also showed us how small our components can become. We can create a bigger prototype and downsize later based on these metrics. If the product has a noticable delay it will experience as slow. This is a potential pain point, and a definitive bottleneck. The existing technology creates limitations to the end product and we need to find a solution with as little delay as possible.

We want to eventually create an optimalized product, but a functioning prototype is our first milestone to creating a good customer experience. This will be our proof-of concept, which is a documented evidence that our potential product will function and can become a success.

SENSORS

Sensors are techanical devices that respond to physical stimulus and transmit a resulting digital impulse. These are what trigger events on your fitness tracker and send signals to your smartphone during activity. There are several types of sensors,and all are used for specific applications and problems. We will take a closer look at the ones that are connected specifically to the fitness trackers of today, and some other that might be useful for our prototype.

Both the gyroscope and accelerometer experience a phenomena called drift, which is especially present in commercial sensors. Drift is a phenomena where the sensors indicate movement when the object is in real standing still or vice versa. In commercial grade sensors this happens after about a minute, before needing to be recalibrated. These affect the measurements and estimates pre-programmed and need to be adressed when creating all sensorbased product

To avoid drift as much as possible, great amounts of programming has to be done, and it also helps having dffernet sensors used together, like in the IMU Combining the sensordata opens for longer periods between recalibrating the system.

Accelerometer

This is a device that measures acceleration, the change in speed over time, and tilt. This sort of sensor is amongst other used to calculate a smartphones physical position, and notices when you flip your phone. Accelerometers detect changes and movement, and is therefore often used in fitness trackers It can measure the change of velocity in any direction.

Gyroscope

A gyroscope measures rotational changes, and is used to maintain orientation in comparison to the earth. It measures the degrees an object has changed direction and is often used in game controls like the Wii. The gyro is not affected by changes in magnetic forces or speed.

Magnetometer

Magnetometers measure compass direction and the intensity of a magnetic field.

The accelerometer, gyroscope and magnetometer are often used together in a unit called IMU, “inertial measurement unit”.These are amongst found in aircrafts, rockets, mobiles and unmanned vehicles and are used for maneuvering.

Pressure sensor
These sensors can be used to measure force and might be used as a trigger.

Heart rate monitor
There are several types of heart rate monitors and one is the ECG. This measures electrical signals that are created in the heart with each beat of the heart, and can be measured via the users skin through electrodes.

Pedometer
This is a combination of an accelerometer and a software, that counts steps. Fitness trackers often use these, and the accurrcy of the pedometers used vary.

Haptic devices
These are connected to our sense of touch and are not sensors. They often indicate a change in enviroments via tactile feedback. Haptic devices use sensor inputs like touch, force or torque and give the user feedback through tactile signals

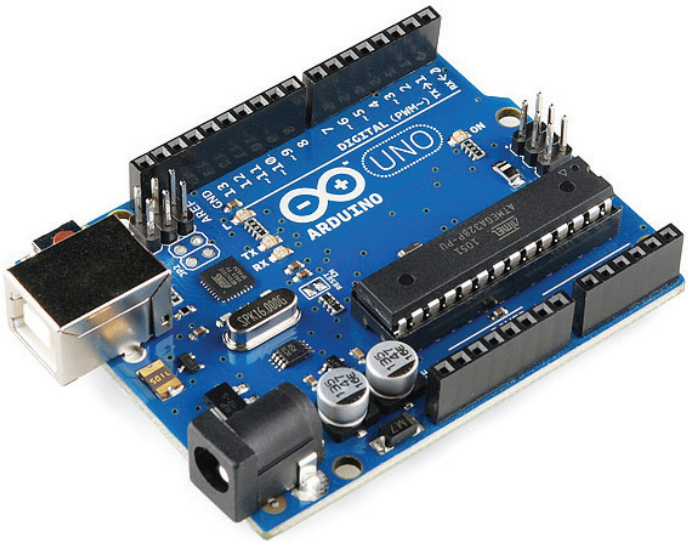
THE BRAIN

MOTHERBOARD AND BATTERIES

Controlling all the sensors, the motherboard is the brain of our system.The motherboard is a microcontroller board, with chips and controllers and circuitry imprinted on the surface. All the sensors are attatched to it's surface and get commands from it. The commands are placed on the board by programmers, via a port. The motherboard is connected to a powersource that is feeds the system with electricity.

There are several types of batteries. Batteries for fitness trackers are usually rechargable using an external USB charging cable. Other trackers use onetime batteries, that have more electrical capacity and are often bigger in size than the rechargeable ones. Rechargeable batteries weaken over time and need more frequent and longer charging than in the beginning.

The size of the motherboard,powersource and sensors dictates the minimum size of the final product. Connecting to the internet consumes the most electricity so we need to find a Bluetooth that uses as little as possible. and BLE 4.0 seems like a good candidate. The battery challenge is inconclusie as both recharging and onetime batteries function, and most people seem fine with it. At the same time Misfit Shine sales grow and there is more power delivered.


DIGITAL (PWM~)
UNO
ARDUINO
ON
POWER
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E603450 7B20
E7B02-D60-1
1000mAh 3.7V

MOTION TRACKING

We are looking to create a system that tracks human motion. Several such motion tracking systems exist, but have specific user applications. Wearables of today track humans in different ways, based on what kind of sensors they have. There are many ways to track movement, and a perfect motion tracking system is defined as tiny, self-contained, complete, accurate, fast, immune to occlusions, robust, wireless and cheap although this system doesn't really exist today. () This is due to the many applications the systems have to adapt to, and every system has to be created to solve a spesific problem. A system wil have advantages and disadvantages, and we have to make sure to know exactly what we want to achieve and what the requirements are to generate a good solution for our users. Often in fitness trackers today, a normal way of tracking calories is by using a pedometer and calculating steps taken based on the times the accelerometer sensor gets a strong enough impulse.() If you shake your arm while dancing for example, the tracker might register this as steps and the calorie count becomes inaccurate. Many new solutions chooses to track heart beats instead, but the surface of your wrist might not be the most easy to read (), so fitness trackers often give you an estimation, not the exact count.

OPTICAL TRACKING

Vision based tracking is used by both MotionComposer and in the Kinect. This type of tracking system consist of three components, a sensor, a camera and an emittor or reflector. Light from the sorroundings and sensor data from a moving object are captured and analysed. This way of motiontracking is very lighsensitive, and functions best with stable lightsources. Other disturbances like shadows and pattern recognition affect the quality of the experience. The camera corrects drift by visually constantly tracking the moving object and have the least latency. Latency is a form for delay experienced through digital systems, and is the time a tracker needs from the actual motion to the output, in our case as sound through the smartphone.

The most detailed tracking today is motion tracking through a bodyworn suit, that covers the user from head to toe. Every movement is captured through tracking small,white balls connected to the suit, and gives a full 3D motion capture.
This system gives the absolute best result, but demands that the user get's fully dressed and is filmed from all angles. An optical tracking system will always deliver, but is very sensitive to light and requires that the user is in one distinctive room or dedicated area.

A factor of good product experience, is to have a system that avoids recognizable latency.If the user notices the glitch between movement and output, this might be experienced as if their movemnts aren't making the sounds. Our system needs a high feeling of accuracy, low latency and thus high update rate.

Fitnesstrackers of today don't give the degree of accuracy our product needs, but allows the user to be wherever, whenever. This is a degree of freedom that is interesting, and our solution will have to either combine the existing solutions, or have a software system that reduces drift. Another solution is to create a form for smartclothing that integrates the sensors into the fibres, like the 3D motion capture.()

Vision based tracking systems are very lightsensitive, which means that you can't use them outside. Donning a whole suit to create music is too much work for our users.

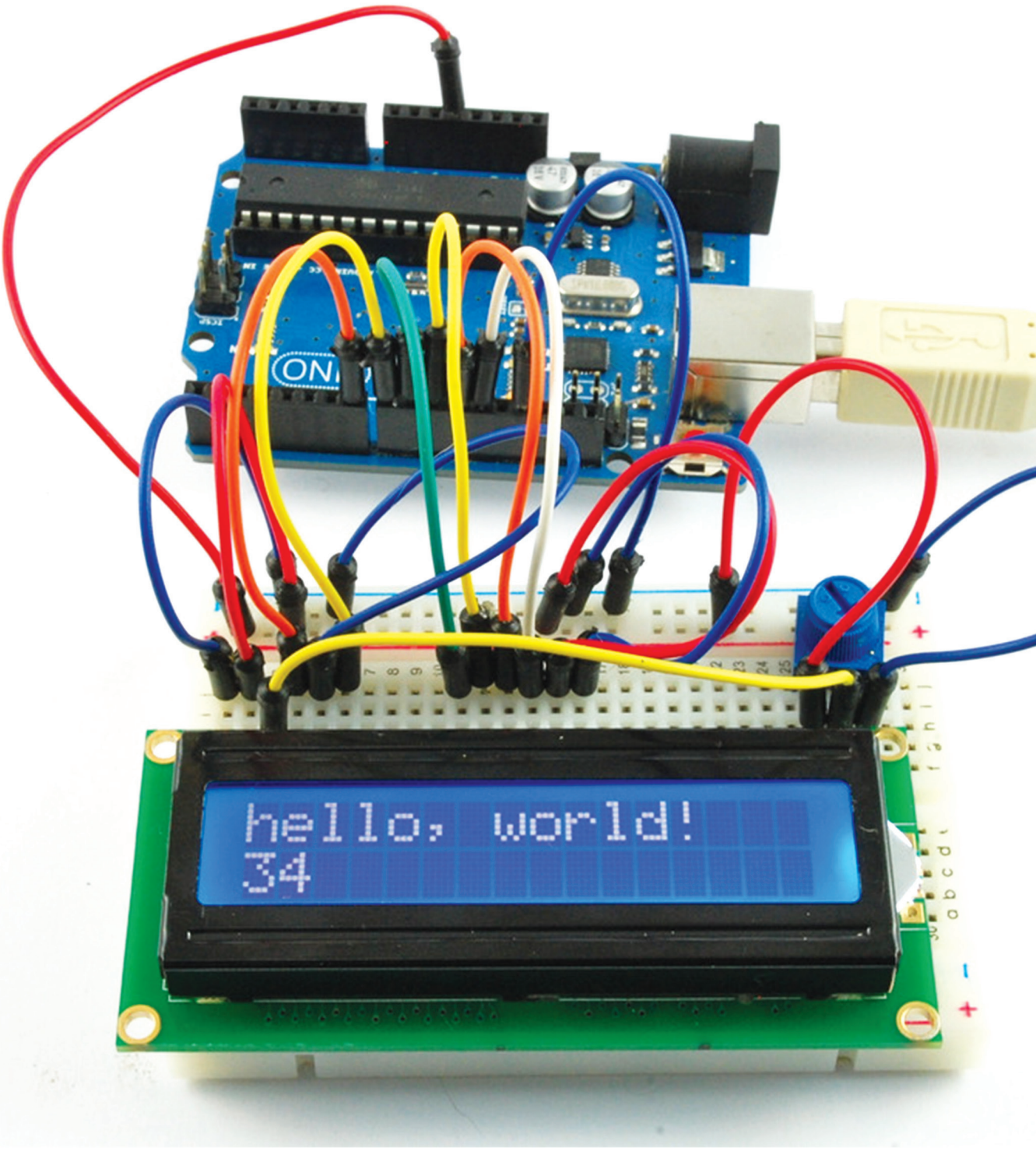

GM

ARDUINO

PROTOTYPING TOOL

Arduino is a simple platform for creating electronical prototypes, meant as a tool for artists,designers and amateurs. The goal is to create digital devices and interactive objects, that are directly applicable in the physical world. It has an open-source, which means that all software designs made by them are free for all to use and opens for improvements by it's commuity and users. The software language is Sketch, which has a big library on the arduino homrpage,and also supports other programming languages. Arduino and other subvendors, like Adafruit and Sparkfun, offer cheap sensors, motherboards, controllers, Bluetooth connections and anything you would need for a prototype. There are tons of tutorials out on the web, and Arduino is a normal prototyping tool for students at NTNU, which leads to available specialists.

To create our first prototype we should go as cheap and simple as possible. This enables several iterations and changes to the sensorsetup if we have to. The Arduino is the perfect tool for us in the beginning, and will be easy to usetest.


hello, world!
34

MUSIC
TECHNO

In this chapter we take a closer look at mapping and digital sound. Understanding the musical parameters is critical when creating a music based user experience.

LOGY

MAPPING

An essential part of creating any new instrument is mapping. Our product should feel like an extension, allowing the user to flow with creativity instead of thinking about the product they are wearing. This demands a an intricate mapping system. Mappng is the designed link between the instuments interface and output sound source. Music applications are an example, or the strings on a acoustic instrument. Acoustic instruments express various sounds differently based on how the musician plays. Effects are reached through playing technique and the materials the instrument is made off. In an electronic instrument this disappears and control over sound effects like volume, timbre are reached through the designed interface. There are different ways of defining mapping, but in our case it will be the transformation of real-time performance data, to create a spectre of sounds.

The biggest question is if the product should have one-to-one, one-to-many or many-to-one mapping. This will affect the output characteristics. One-to-one mapping equals one sound/effect to each movement. One-to many leads to many sounds or effects to each movement and many-to-one leads to several movements trigging one musical event. Studies have shown that humans are hardwired to expects complex mapping systems when in touch with instruments (Wanderley 2001), so no matter what the solution there is a need for perceived complexity.

When trying to learn acoustic instruments, students try and achieve full control over the physical limitations. Mastering an instrument is reached when the user can make all the sounds and effects the instrument is able to express, and this takes great amounts of time and might be why so many people give up on instruments. Their perceived results and reached goals are not correlating, and the student finally gives up. Reaching the mastery stage without so much hassle might bring joy to musical expression again, and inspire our users. At the same time mastery has an expected difficulty connected to it, and the product cannot be too easy, and always lead to a slight challenge. If some of our users have overlapping experience with giving up on an instrument,the product might want to seem simpler to master than an acoustic instrument but have a complex map that creates a long term relationship through complex control.

The one-to-one mapping gives the user direct control over each sound and seems the best solution for us. Also, this was recomended by our expert Andreas Bergsland, based on previous experience with the MotionComposer.
Our product will need a level of complexity to be perceived as an instrument and not

as a gadget. Although reaching a level of mastery of an instrument leads to pride and the feeling of achievement, most people never reach this level because of the time investment needed. Users don't reach their full musical potential and freedom of expression.

Digital sound

DIGITAL SOUND

Our goal is to let our users experience the joy of creating a music on their own. Most songs are based on a ground rythm, with a driving tempo, having the melody as the leading focus point with some musical effects. To create an authentic experience of music creation all these things have to be part of our solution.

Melody

Melody is a tune, and the main focus of the song. It expresses the melodic contour, which are the emotions the composer wants the audience to feel. It shapes our experience of a song and is stored in memory.(Juslin) A lot of pop songs today have the same chord build. Chords are three or more musical notes played at the same time and can create a melody. Most common songs today have a repeating chord structure, which makes it appealing to people since we understand the patterns. Using these in our product might be beneficial as a way to create connection and recognition, making it easier and pleasant to use. At the same time having tones that are not part of the known chords makes the music exploration more interesting and appetizing to existing musicians.

Rythm/BPM

Many people claim to have no sense of rythm. They mean that they can´t discern and hit the beat, the underlying driver for any music. This drive is the tempo or speed in music. Tempo is measured in beats per minute,BPM, and affects the way we experience music. If the BPM is high, it feels very energetic.

Filters

To create the same or different sounds digitally as acoustically, you can use filters. Filters change the heard sound, and affects the music. There are extensive amounts of filters,like volume,resonans and looping.

Stems

Stems is a digital multi-track audio format file, that is split into four musical elements. These are called stems, and can be parted in a drum stem, bassline stem, melody stem and vocal stem. Files can be found online in several communities and are used for mixing music. Each stem can be controlled and interacted with separately, which might be interesting for our prototype. The stems have the same bpm, so it´s almost impossible to fall out of rythm.

Max MSP

Max MSP is a visual musical programming language and platform for digital music creation and has been on the market for the last 20 years. It has several libraries and is used by musicians and software designers all over the world.

Csound

Csound is another programming language is Csound, which is programmed with C. This is the programming language we will use when we create our final product, after prototyping.

Discussion

The filters we use will be decided by our music technology students. Later they will be usertested and we will see what is enjyed the most. Creating our product we have to think about taking BPM into account. If our users can´t create a musical piece because they fall out of rythm or the system has a latency or notice that the mapping is off, our product will lead to dissatisfaction. General users might be interested in pleasing sounds that fit together and sound good. More experienced users might want sounds that are more experiemntal and might be thought of as noiceby others. Max MSP is a good prototyping tool and we will use it in our first prototype.

DISCUSSI

ION

In this part we evaluate the information we found through our research in regards to our initial idea. We then use it to create a design brief that will steer us in the strategic direction we desire, while designing our first solution.

EVALUATION

RESEARCH MATERIAL

People like our idea and we need to create an explanation that translates our idea faster. A lot of good feedback was given and schools as potential customers seems like a great opportunity. It seems like the idea of flipping musical creation on it's head is really hard to wrap the mind around, and we have to work on the way we pitch the idea.

The growth of IoT is great for bussiness, especially since we are bridging the emotional pain points that most Iot products seem to ignore. They seem to encapsule their users in technology, and forget that we are emotional creatures that need to breathe and express ourself.

Wearables will be the natural endshape for our product, and especially something wristborn and maybe around the ancles. Rythm seems to start in the feet, so this is a natural fixing point for more sensors. Smartclothes are a solution aswell but we can't wait for this technology to become available for us. We could partner up with a smartclothes company in the future, but for now Arduino will be our prototyping tool.

We have a great market opportunity, as the only ones delivering our type of product. Resources will be put in the technological developement due to our position at school, surrounded by specialist and having access to tools we need.
Our MVP will let people experience how it feels like to create music in a new and exiting way. Therefore we have to implement resources in the creation of the experience as well. We need to reach out to the bussinesses world to see what opportunities we have in the future and what they think of our discovery.

We are targeting early adopters, but see that the wearables market is about to spill out into the early majority group. We should probably find someone who wants to collaborate with us and be our public face. This person should probably be a musician, dancer or both.

Our primary customer will most probably be a tech-savvy,affluent woman, between 18-34 years. Also our survey shows us that the information we have from the internet about werables allocation amongst men and women, seem to be correct. The survey had a lot of fitness requests, but we feel this would take our product in the wrong direction. We want to create an instrument and not a fitness gadget. We can however easily implement a code that will transfer information movement to other applications on the phone.

We think that people might have problems creating tracks that are on beat, and we are especially unsure if we manage to

remove latency and drift in this round. We therefore think that working with the idea of stems and creating a mapping system that seems logical with this type of feed will be good in the beginning. This might change, due to the motivational factors we discovered during our research. We need to target the intrinsic motivation, where the user is the creator and feels mastery and achievement through creating music. A great thing to evaluate when we have a finished prototype is if we manage to make our users hooked on the experience. The mapping should be one-to-one or one-to many. The stems should be music our users can relate to to bridge the gap.

We will look at trends and think about the physical appearance at a later point. At the same time we understand that wearables often go from gadget to luxury item or move towards a tool for a higher purpose. We want to reach this and if we become too trend focused we might loose sight of our real goal.

Marketing the sexy, dancing superhuman is something we should also look into at a later point. Our product has great potential in rehabilitation, but we don't have time to focus on this usergroup and their needs at the moment.

Based on the Kano model, we can get away with minimal amounts of technological basis, but this needs to become good, fast! Keeping to the interest curve in the experience will help us take the user through a great story that wants to be shared.

We will use the technology we find at school, but will also have to order parts online that will help our prototype go wireless. The motion tracking systems that exist at the moment aren't usable for our product but we can base parts of the prototype on fitness tracker technology. Videotracking is too sensitive for impatient early adopters.

Auug is our main competitor in musical wearables, and there exists no wearable on the market that makes music through dance that is for sale today. The ones that exist in this specific category are for performance artists only and to cumbersome to use by our user group. This gives us a great market opportunity.

Smartwatches are too functional, and mainly gives the user feedback from their phone. Fitness trackers are interesting as motion trackers, but don't give a wholesome picture of dance movements.

The fitness craze works in our favor, and combining the health benefits from three activities;dance,music and instrument, in our product is potentially very sellable. The health trend is growing and our product helps fight the everyday lifestyle problems of modern humans in a fun way. It gives them a palette to create their own identities through artistic creation using a high tech product and motivates

them to stand up and get away from the computer. Having a movement motivator, that challenges you to move around and dance, will affect posture and sitting related pains.
Interacting with our product sets your brain on fire boosting memory and reduces stress in one go. One of it's biggest values is the possibility of sharing and saving memories in a new way.

We need to avoid the gadget and give our product an emotional projection. It can be sporty, but it needs to feel more luxurious and robust like an instrument.

We will use Arduino and Max MSP for prototyping, then we should get a partner that can create a smaller hardware unit for us.

We don't know the pricerange our product will end up in, but above 150$ and below 850$. It needs to be experienced as an instrument not a gadget and by heightening the price we might increase it's personal value for the user.

Our company needs to have an appearance and vision that fits younger users. It has to be honest, adventureous and exiting.

DESIGNBRIEF

The ultimate goal of this project is to create a product that allows the user to create music through rythmical movement. This will be done through creating an Arduino sensor based prototype that states our minimum viable product. The product should work as a creative outlet and play music when the user moves. It should be surprising and fun. This work should convey “music from every move-you are a pro”. If our users think it’s fun we can apply to to Innovasjon Norge based on our idea.

Mainly, the product will be purchased by women, and then men between 18-34 years old. They are tech savvy and utilize wearables, are affluent and have touchscreen phones. They use apps and fitness trackers and they have a basic understanding of music.

The product needs to balance tech and fashion, in a way that expresses autonomy for the user. Due to the musical focus, the product needs to be easily approachable and invisible during use. The app needs to be intuitive. The prototype should be wrist and ancle born.

Goals
-Finishing wireless Arduino technology
-Finishing mapping and Max MSP file
-Have a basic platform that reacts to input, ie application
-Great user experience
-Test on users
-Physical prototype concepts
-Graphical user interface, GUI; mockup in Axure
-Apply to Innovasjon Norge

Successful if
We want at least 5/10 to instantly understand the value proposition. 8/10 should think it’s fun and 3 people should want to buy it.

If time
Create an application for Iphones that can store and play music. Also, it should let you choose sound types and effects.

Deadline
We should be done with the hardware stage by 9.november, and be done with the mapping and music by 20.desember.

Budget: 4000 NOK

PROCESS

In this chapter we take a detailed look at the workshop sessions and what we learned along the way.

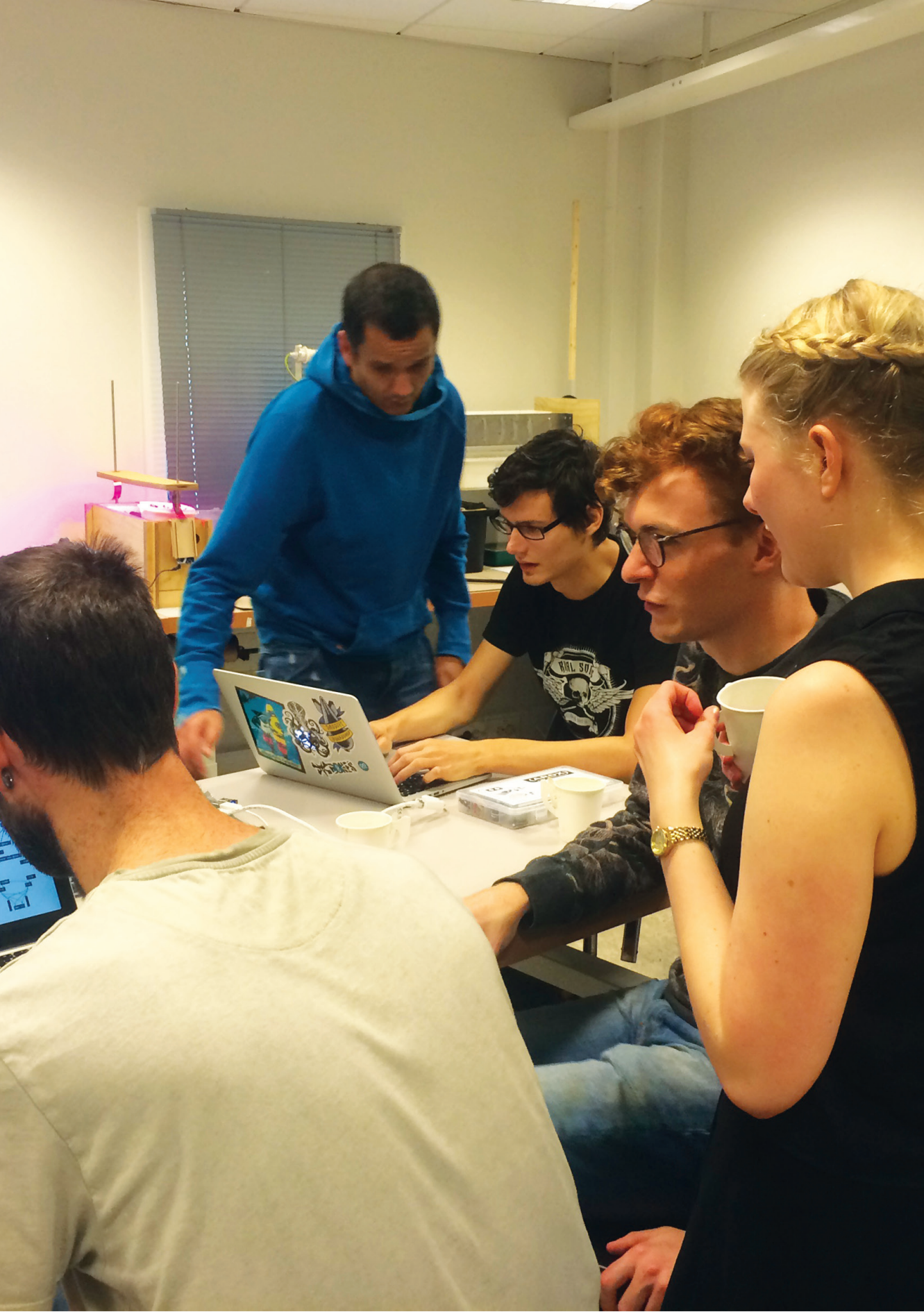
WORKSHOP 1

ICEBREAKER & SENSORHUNT

The goal with this workshop was to get to know each other better and to see what kind of technology we had available. Also, we took a closer look at the prelimenary ideas and knowledge we had about the market and trends, especially on music. Everyone loosened up after a round of very embarassing icebreakers and dancerelated games.

We decided that it was a good idea to start looking at stems and creating our experience around the idea of premade tracks. This was mainly because of the general idea that users without previous musical knowledge would have problems with creating digital music that stayed on the same BPM. The users would mix premade music just like dj's.

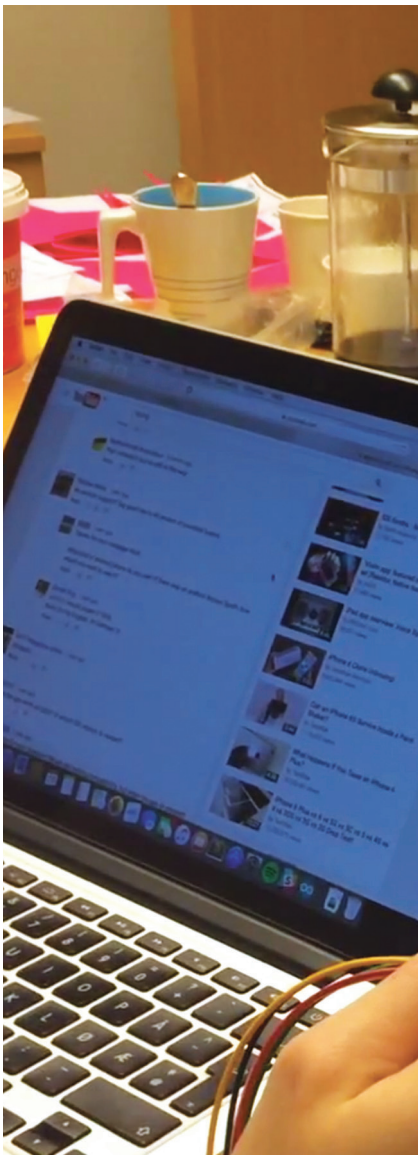
Looking for Arduino we found two 9 DOF IMU sensors, two big motherboards and some wires. Daniel, Anton and Kim took the tech with them to play around with for our next meeting.

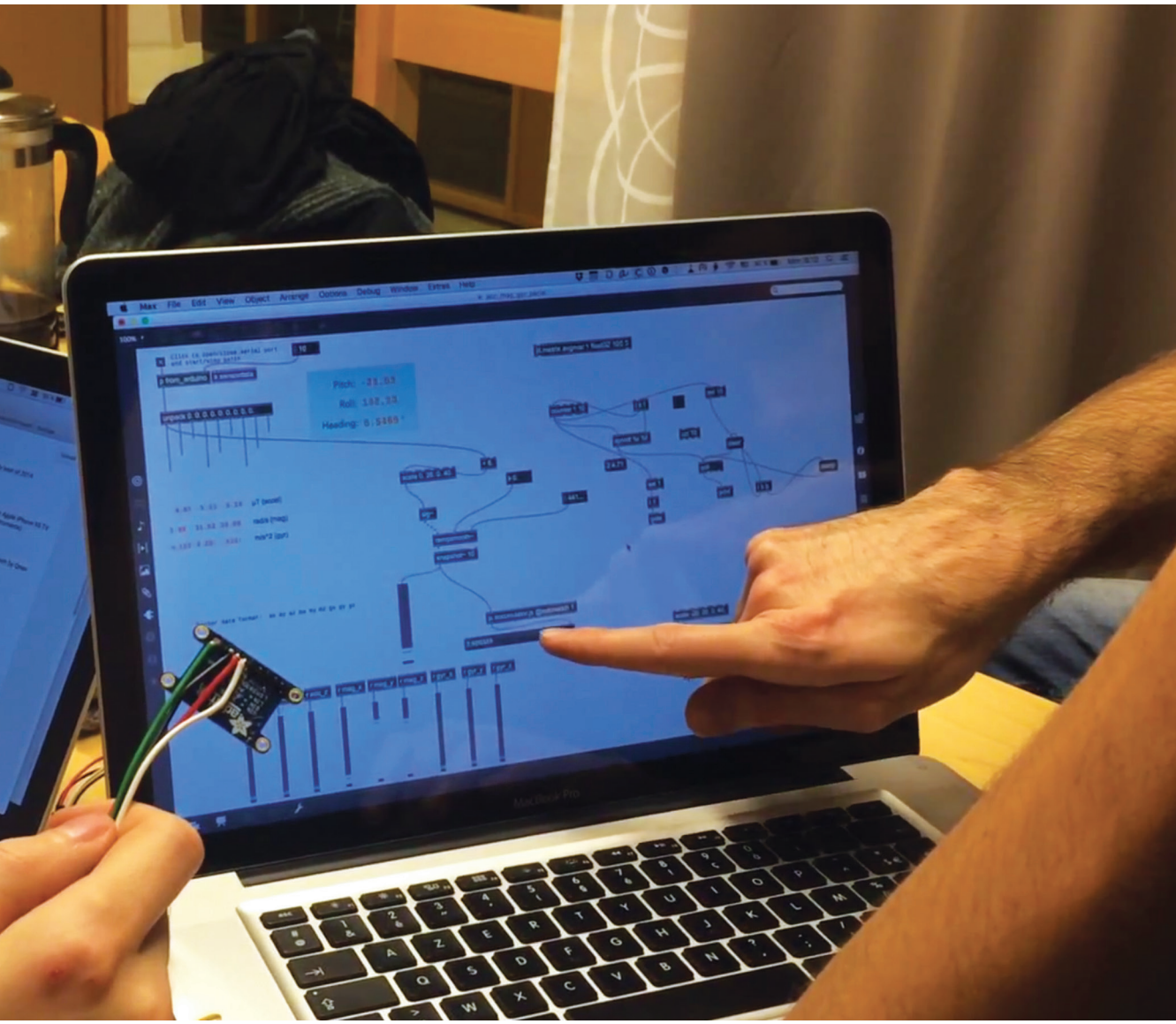


WORKSHOP 2

FIRST SENSORPROTOTYPE & MAX MSP

Daniel,Kim and Anton arrived with a functioning sensor setup and simple MAX MSP programs. They had gotten so motivated after the first workshop that they had sat at home tinkering until they managed to get it up and running. The sensors were receiving data from movement, but the sounds that were coming out were illogical and mushy. The sensors were connected to a big motherboard, with cables to the computer. Both Martin and I gained insight into how MAX MSP worked and the rest of the workshop was used to clean up the signal and start looking at mapping. We quickly understood that it was harder than we had thought; people move in such random patterns, and it's hard to tell how people will move while interacting with our product. This was going to become a very big part of our project. We decided to seek out some expert input about mapping and Dag agreed to meet us during the next workshop. Before we left for the day we started looking at the Adafruit pages looking for Bluetooth and rechargeable batteries.

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WORKSHOP 3

DAG SVANÆS & STEMS

Meeting us at IPD, Dag Svanæs promptly enlightened us about methods for tackling the mapping problems. Mapping is always hard and demands a lot of intricate programming alghoritms. The hardest part is making it pleasing for people, because the digital world is not adapted for organic movements. A simple method of visualizing our own wishes of the system, is using the Wizard of Oz test. Here we imagine a perfect digital product and how it reacts to movements and commands in it's optimal state. Dag suggested that we try this method with threads around our wrists and ancles. They would work as placeholderes while one person played music in the background as a reaction to movements. This is to create a visual and cognitive connection to the music being played and a way of understanding what we really want to achieve through movement. Dag danced and Ada sang as a reaction to his movement, which made our day

Later we decide that stems will be the type of musical output our system will have, and the musical technology students sat down and started mixing.

MOTIONCOMPOSER

RINVGE AND DRAGVOLL

Because of our project we got invited to Ringve museum and a presentation of MotionComposer with disabled people and elderly with Alzheimer from carehomes around Trondheim. By the time we arrived, the Alzheimer patients were too tired to perform. after a workshop they had earlier with MotionComposer. The others were glowing with exitement as they performed and it was amazing to watch. They were all extatic and it was really moving. Every single person who danced in front of us had a mental understanding of themselves as the creators of the music that was an effect of their movemnts. Everyone in the room was emotionally touched and the pure beauty of music and dance was apparent.

Andreas Bergsland had to steer the program the whole time to make sure that the sensitivity of the program fit the inherent movement of the dancer. Many had CP were shaking a lot and Andreas could command the MotionComposer to ignore the tremors. He also steered the musical modes that were being played.

MotionComposer was a bit hard to handle, big in size and needs a lot of refinement before it can be sold commercially.

The day after we were invited for a workshop at Dragvoll where we would actually be able to try the system. It was extremely fun but difficult to understand, and most modes led to what seemed like an abstract feedback based on our movement.
There were some dancers present and they somehow managed to merge with the sounds no matter what came out. It was aggravating not understanding the patterns, but an overall extremly fun experience. The musical mode that was most fun was the house music mode, which somehow was the easiest to understand. It had what seemed like one-to-one mapping.

They also had modes for dancing together which made the experience social. each person had a set of sounds and could talk to each other through movement.

The most positive with the whole experience was to hear sounds genereated by movement. Not understanding why some sounds were repeated when you knew there was a logic behind it the most frustrating. Also the system wass very light sensitive and light from the window created a system failure.

SPARK*

I got in touch with Spark* the 21.october, with the intention of a quick meeting about how to best go forth with our idea. Instead I got a mentor, Andreas Hjelle, who I met several times.
He was adamant on the business part and focused me on the feasibility of our project as a sellable product and introduced me to the business model canvas. He liked the idea, but my pitch was to complicated.
I understood that I had to take a step back and look at this from another perspective than emerged in the technology. The bussiness model canvas coul help steer us in the right direction.
The pitch had to be extremly simple and clear. We especially needed a one line value proposition to our users, which would function as a great reason to invest in us, verifying that the product was sellable and could become a commercial success.

MAKE IT EASIER
TO UNDERSTAND

WORKSHOP 4-5

WIZARD OF OZ 1 & 2-UNDERSTAND THAT STEMS IS WRONG

We continue working with mapping, focusing on the best experiences from the workshop with MotionComposer. Kim has created a set of stems that we use, while I dance and move in front of the group. We cut down on interactive possibilities and work with only pitch and another effect on one arm and two sound stems on the other arm. To start the system the user has to move over a certain amount at the beginning of the interaction. Also the amount of movement decides the volume of the music feedback. A goal is to integrate a change of stems over time, while the user is interacting with the system.

After two workshops I notice that I'm really sick of the stems, not because it's bad but because I've heard it so many times and it's never ending. This might become a problem as the same kind of music is quite demotivating after a while.
During the sessions we film everything as it's extremely hard to map music and movement on paper.

It becomes apparent after a talk with Trond Are we decide that using stems as we intended do is not really fulfilling the requirements of a good user experience based on the interest curve.
Although our mapping feels complicated now, the final user experience will become too simple and repetitive.

We got a greater understnading of mapping needs and possible solutions for all the unexpected movements a person does while dancing.

The technological gadgets we ordered from Adafruit, haven't arrived yet, so we have to continue using our existing system.

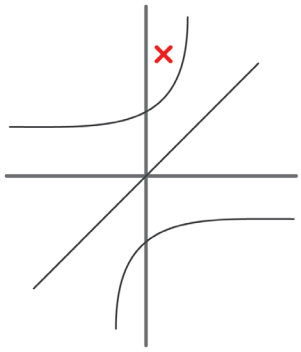

TRX

WRONG SOLUTION

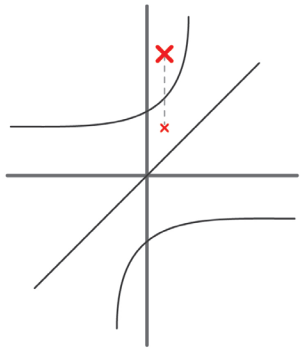
INTEREST CURVE

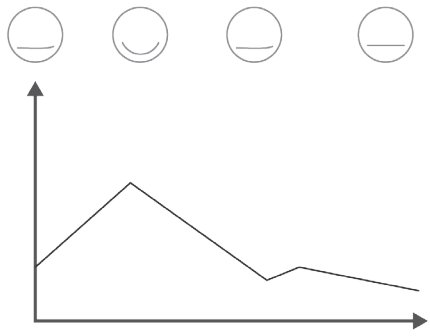
Our first iteration is wrong based on the interest curve and the Kano model. Our solution is exiting the first couple of times, and then becomes less interesting. The user already knows exactly what will happen, and there is too little progression and exitement.

SOLUTION FIRST TIME



SOLUTION AFTER A WHILE





WIRELESS

ADAFRUIT STASH

The 30.october we finally get our get our Adafruit delivery. Daniel and Anton get a set each, and connect everything.
We quickly understand that it's difficult to send meaningful information through BLE as we have it programmed at the moment. It still doesn't function with Max MSP and we understand that we are missing some essential information, and we contact Sune Jakobsson. He advises us to look at finding a baseline for the information, where the system understands that everytime we move in a specific way it gets certain results and it should react with an action in MAX MSP.

The BLE trinket is totally new and there are few tutorials on how to use it especially with MAX MSP. No one at school has tried it either, since it's new.


CAUTION!
(Lithium ion battery)
DO NOT LOAD OR TRANSPORT
PACKAGE IF DAMAGED
For more information,call
Adafruit Pro Trinket
LiIonLiPoly Backpack
adafru.it/2124

GODS OF BLE

WHY DO YOU HATE US?

Everyone is focused on solving the BLE problems, but we have yet to manage and create a good link between the raw data feed from the BLE to MAX MSP. The music technology students don't have more time to invest in this part of the project, so Martin and I take a closer look. We solder the Arduino parts together and find an app called UART that can communicate with our BLE. It doesn't receive any data from the BLE and we understand we have hit yet another bump.

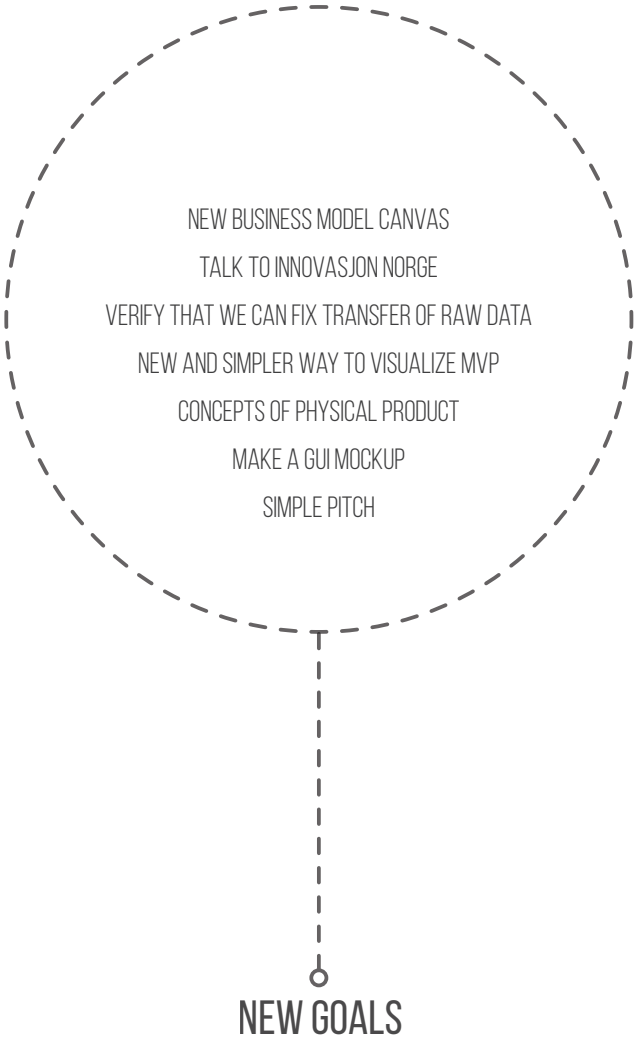
We do find an open source drift regulating program for the sensors, which is good to have for later use.

PROGRESS:STOP

CHANGE OF PLANS

When my whole team has to focus on their exams and deliveries in the middle of november I understand that our goals need to be adapted.
The software of the prototype isn't finished and it wont be unless a miracle happens.
An article has been found online written by two programming students from Berkley, who created a similar product to ours, just focusing on the hardware and programming. Their system is older than ours and have large transmitters and a big battery pack, but functions and was usertested. Their users loved it! (see appendix) In the future, the authors of the article could be great co-creation partners
We no longer have to prove that it's doable and we know it's fun. Also we cannot finish the mapping procedure, since it depends on the wireless setup and that someone has time to invest in it.
I redefine my goals to have something to present by the 22. January.

The concepts and GUI mockup will be used in visualizing the MVP, probably through a video or pictures.


NEW BUSINESS MODEL CANVAS
TALK TO INNOVASJON NORGE
VERIFY THAT WE CAN FIX TRANSFER OF RAW DATA
NEW AND SIMPLER WAY TO VISUALIZE MVP
CONCEPTS OF PHYSICAL PRODUCT
MAKE A GUI MOCKUP
SIMPLE PITCH
NEW GOALS

SUNE TO THE RESCUE

CRACKING THE CODE

It's improtant to verify that we can fix the transfer of raw data because it's part of our technology clarification. I contact Sune and during two evenings he retouches our programming and gets data streaming to the Iphone from one of the wireless sensors.
In the beginning we only get scrambled information, with values from x,y,z from both the accelerometer, magnetometer and gyro on the UART screen. Sune continues working on our programming script and manages to separate the values. We now have a live feed!
The UART app is created to only streaming one source of sensordata at the time. To continue with this we have to create a new version of the UART app that can process four or more sensor feeds available. We need to create the same baseline, but can now get in direct contact with any form of sound source that we have available on the phone.

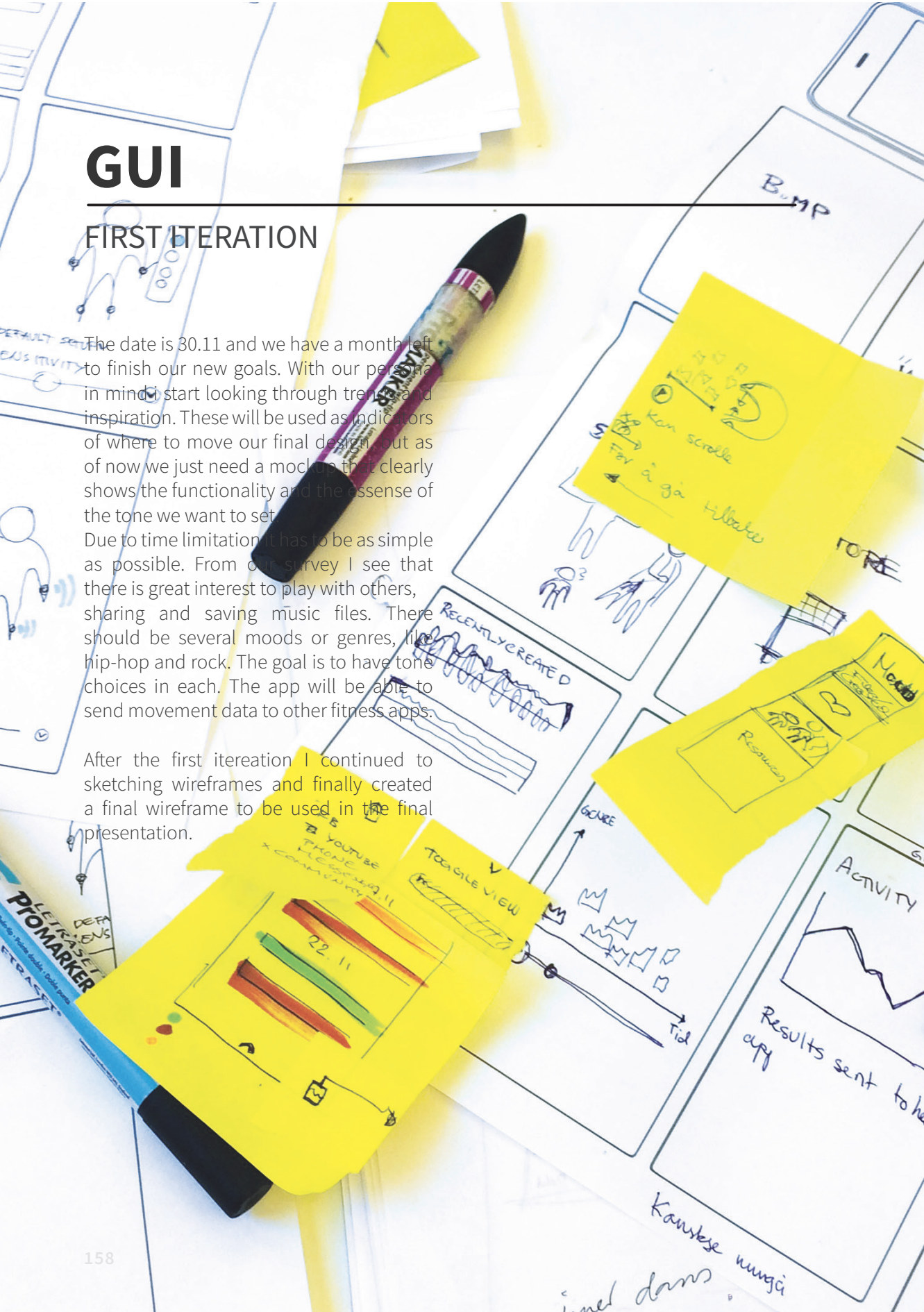
We consider continuing with mapping to start on a baseline understanding of how movement correlates to the raw data.
At home we attach sensors and dance to music, while filming to hear when the music starts and see how the rawdata corresponds. We order more sensors on Adafruit, to have a full set of 4 sensor modules when doing our future user tests.

GUI

FIRST ITERATION

The date is 30.11 and we have a month left to finish our new goals. With our personas in mind I start looking through trends and inspiration. These will be used as indicators of where to move our final design, but as of now we just need a mockup that clearly shows the functionality and the essense of the tone we want to set.
Due to time limitation it has to be as simple as possible. From our survey I see that there is great interest to play with others, sharing and saving music files. There should be several moods or genres, like hip-hop and rock. The goal is to have tone choices in each. The app will be able to send movement data to other fitness apps.

After the first itereation I continued to sketching wireframes and finally created a final wireframe to be used in the final presentation.



PHYSICAL PROTOTYPE

Using the measurements from our technological clarification phase, i create small size mockups and start sketching and looking at good locations for the sensors.

Our usergroup is accustomed to wearables on the wrists, but not so much around the ancles. I look at simple ways of putting and taking them off to enhance the feeling of availability and creative possibility on the go. My main concern is to create a wearable that avoids the gadget and becomes a tool for creation.

PHYSICAL PROTOTYPE

SKETCHING, FOAM, CASTING, FAILURE, 3DPRINTING

Looking for analogies I came up with descriptive words of what we wanted the modules to express. Based on these I started sketching again and chose a form that fulfilled my understandig of the words. Remmebering the suggestions from Ole Petter, a pair of scissors, some material an duct tape, I ended up with a glove you could slip on the hand. I iterated a set of sensor modules in foam and went about casting them in silicone. This was to create a negative form to later cast them in rubbery material. This process ended as a failure, the silicone wouldn set and had reacted badly to the foam surface.

I then sat down and sketched anew and created a simpler shape that I transferred to Solidworks. The result was printed out in plastic using 3D printing.

DESCRIPTIVE WORDS

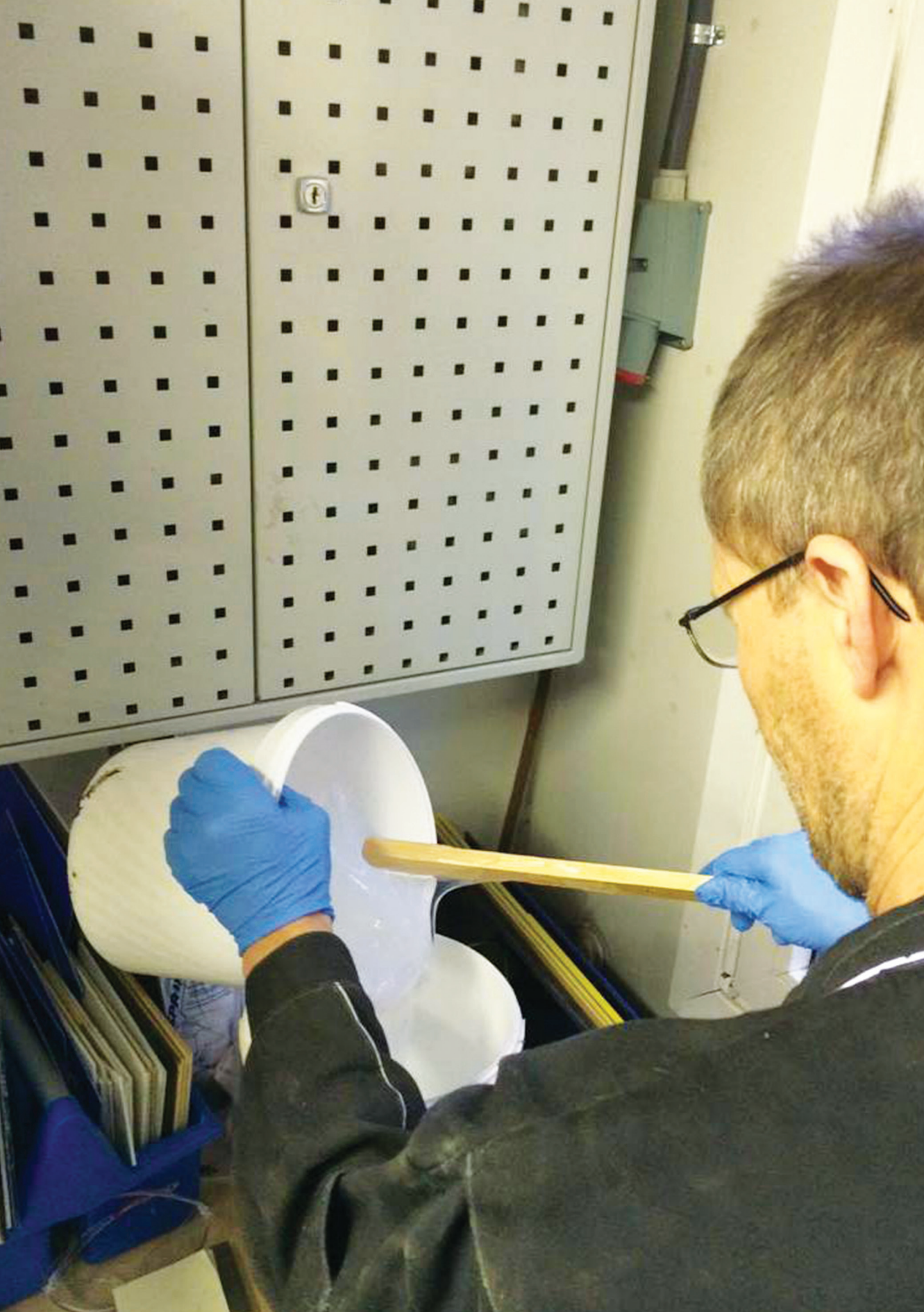
Smash survivor
You can fall with it and it will still keep on working

I**Q friendly**
As simple nd intuitive as you can get it

Holy tech!
Amazing technolog that does magical stuff

Foxy business
Sexy somehow

A looker
Want to look at it again, there is something awesome with it



INNOVASJON NORGE

I attended a startup course held by Innovajson Norge verifying that we had taken the right steps to creating a desirable product. After the meeting all attendees were invited for a short talk where we could pitch our ideas and discuss what steps to take further in the process.
Innovasjon Norge liked my idea and is especially exited about any materials that can show them the mvp, especially a short movie. We were encouraged to apply for support for the premarket evaluation.

After talking to Innovasion Norge I understand that there is an amazing opportunity to continue with this project.
Our mvp is too big, an explanatory video might be enough as a basis for usertesting.
After talking to Trond Are and fellow students we decided to change the MVP to only encompass the beginning and the end of the user experience.

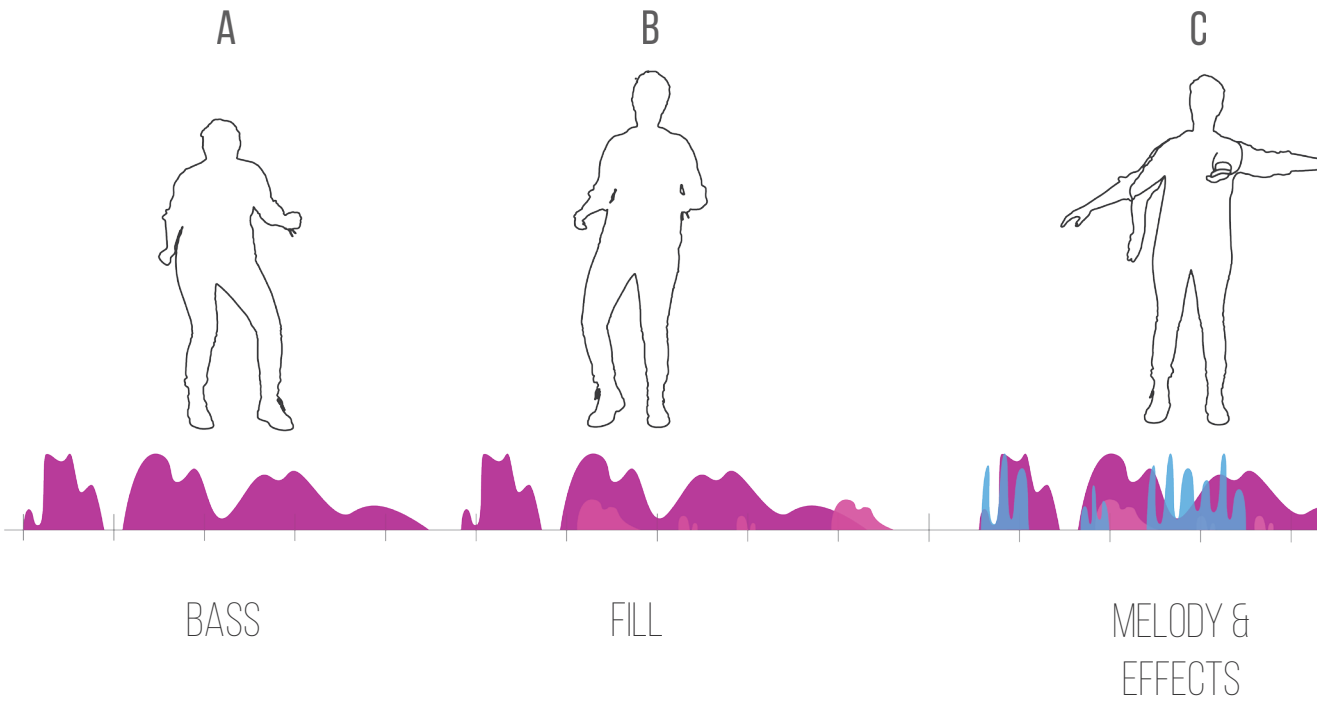
FINAL RE

In this chapter we present our results based on the research we have done, inputs we got on the way and user feedback on needs and wishes.

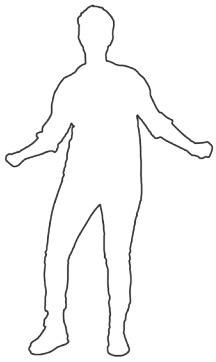
SULTS

USER EXPERIENCE

FULL USER JOURNEY



D



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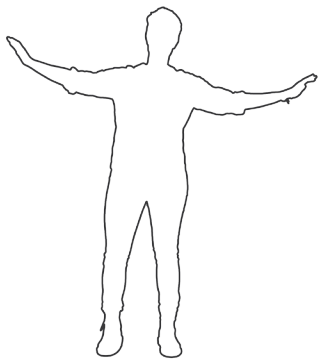
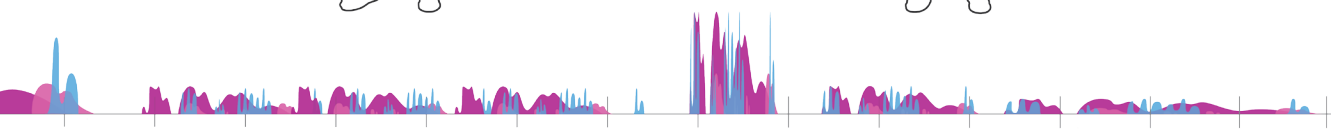




GROOVING

PLAY WITH
MUSIC

USER EXPERIENCE

WALKTHROUGH

Our solution is to use the building steps of the interest curve to create the perfect story. The user turns on the product by pressing on the surface of the physical product, or by going through the application. A metronome starts counting in the background, to help the user keep the beat. This fades after a while.

Bass
In step A the user dances the bass rythm with the feet. The music starts recording 5 seconds after the user starts moving. This is to reduce the noice that comes with random movements. Interaction in point A lasts for 15 seconds. After 20 seconds the bass is looping.

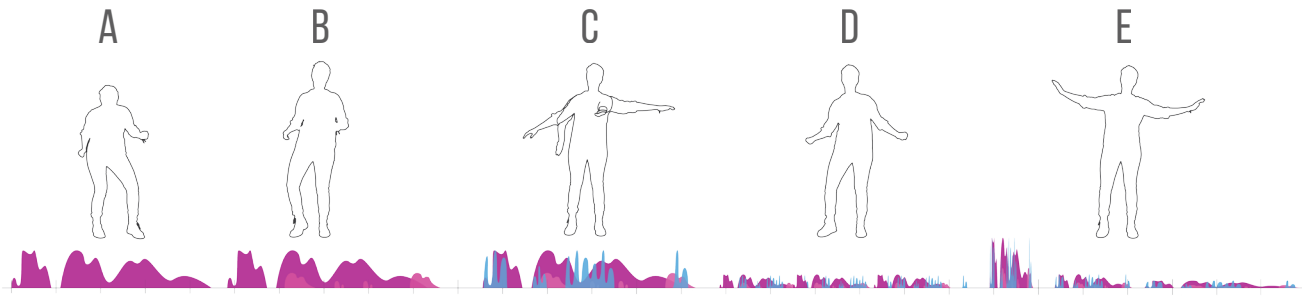
Fill
Step B works as the fill or snare of the intereaction. This creates a more wholesome and dynamic sound. Recording starts after 5 seconds, for the user to adapt from music styles. After 15 seconds, the fill starts looping together with the bass.

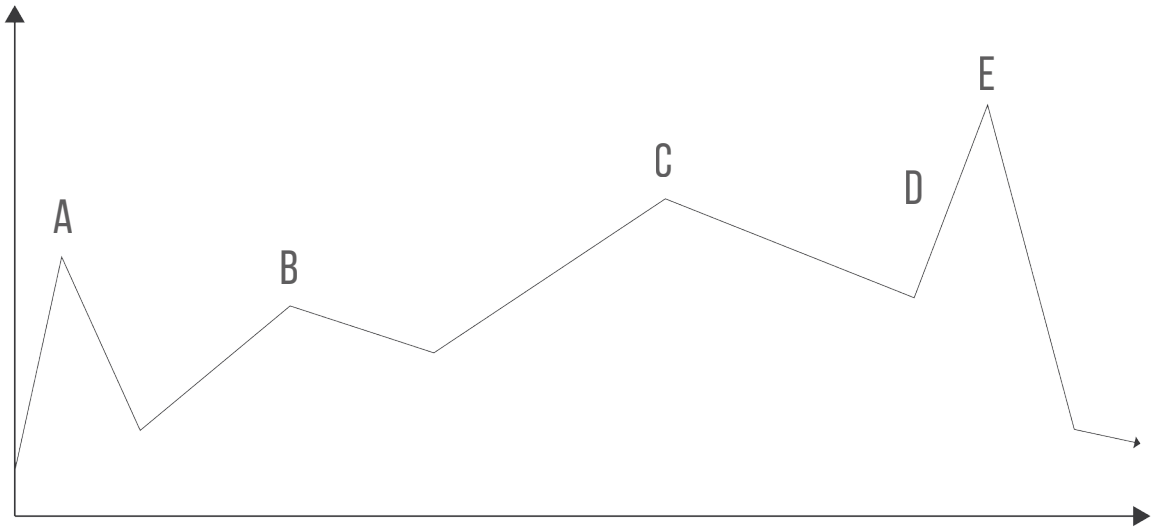
Melody and effects
In step three the user focuses mostly on hand gestures. On the left arm you find four tones and on the right effects.
The user creates a melody with effects while listening to the bass-fill rythm they created. The music starts recording after 5 seconds and the looping of the melody and effects is added to the bass-fill rythm, after 30 seconds.

Grooving
The user is relased from the recording mode and can get into the groove that has been made.

Play with music
The last interaction is the freemode, where rythm understanding is key. The goal is to now interact with their own creation. Now they are the musicians on the radio. If the user manages to holde the same BMP as they had just created, they hear the same music as before. If the user moves fast it sounds pitched and energetic. Moving slow will feel like chewingum, dropping the BMP of the recorded song real low.

Interest curve
We see that the experience journey follows the interest curve and will lead to mastery and desire for longer interactions with the product. This experience has potential of being a success with our customers.

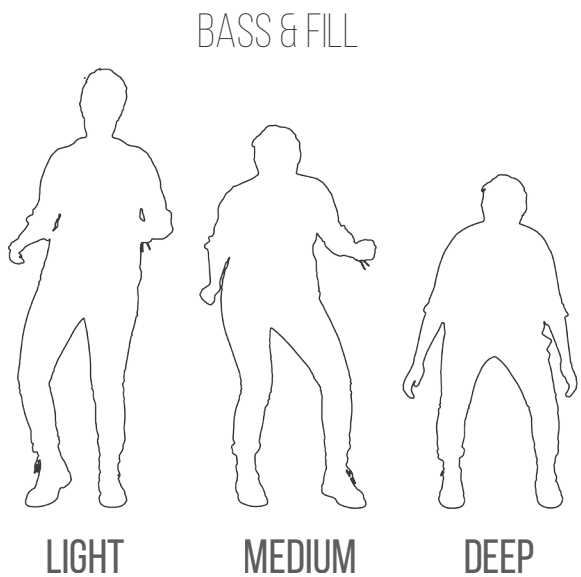

A
B
C
D
E


A
B
C
D
E

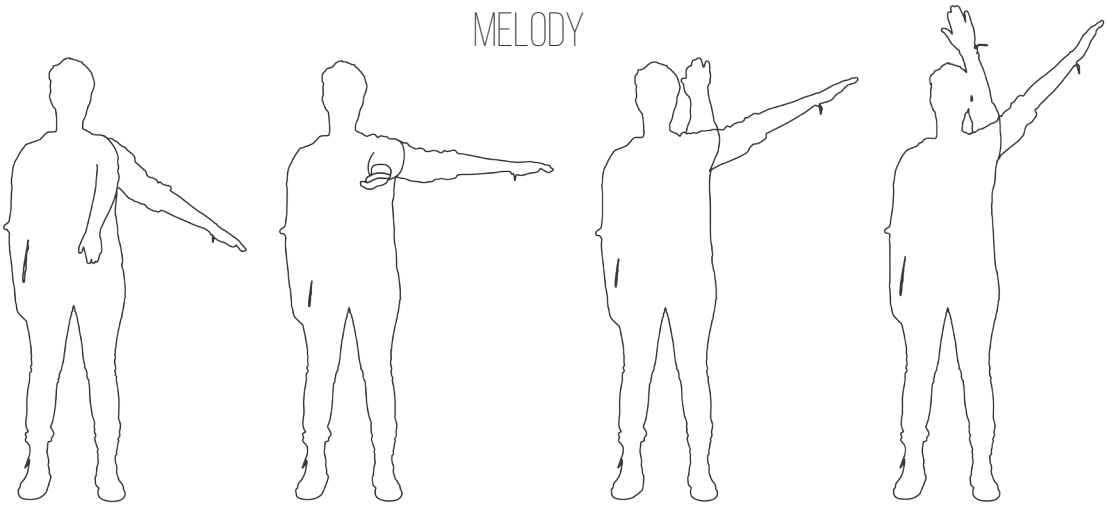
MAPPING

Based on our motion analysis we understood that estimating how a person will move, is impossible. Especially if you evaluate several styles and people, you see that they only have the rythm in common. Therefore we created a different solution, which allows and indulges any kind of movement

Bass and fill will work with three stages: Light, Medium and Deep. The strength and speed of movement will decide what sound comes out. Little force will will give Light Bass and Hard stomps or jumps will give Deep Bass.



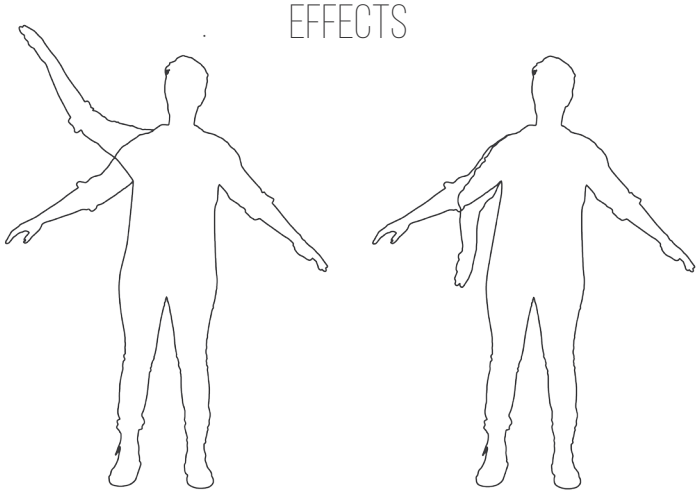
MELODY



E A C# B

Our tones are based on the four chord sof pop, which most pop song today are made up of. We chose this to create a gut reaction to tones in the environment by basing it on previous knowledge from popular music. Each sound has a plane and can be played by lifting an arm and moving it across the body

EFFECTS

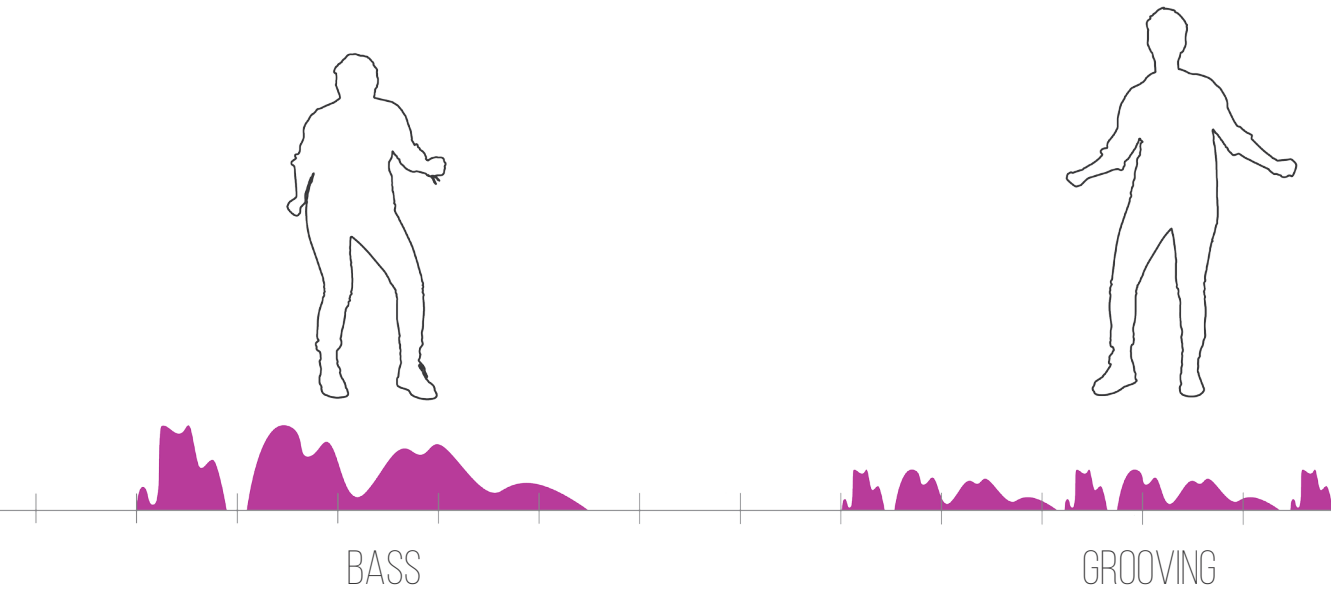


VOLUME PITCH

Lifting the right arm up and down will change volume. Twisting the hand downwards, like turning a knob will shape the pitch. Speed or force have not been taken into account here.

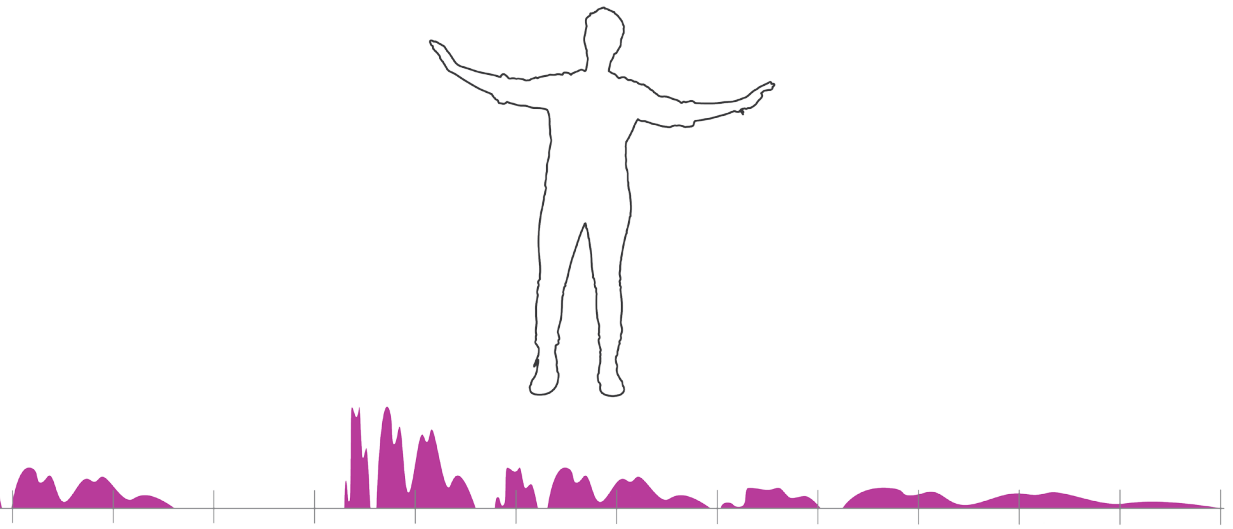
USER EXPERIENCE

MVP BASED USER JOURNEY



After discussing the matter with several people a consensus was made on creating only the bass part for our MVP. The intereaction is short and fun and gives and instant understanding of the whole potential intereaction. In addition it´s so short that it can be shared on social media. New,, fast and direct will please our early adopters . This is also easier to make than the whole system, which eliminates several lmapping difficulties.

The user sets the beat by moving her feet and the beat is almost instantly recorded. It challenges to fast interaction and starts looping after 10 seconds. When the user is left to enjoy the music for 5 seconds, before getting into the playing zone.



PLAY WITH
MUSIC

PRODUCT

SUBTITLEEBIT ALIGENDA EXERATE

This is the final physical product . It seems robust while being light and airy.
The organic surface targets the androgyn user and avoids falling into the trend trap. Although our user is trendy, the driving vision for this product is to make a creation tool. We don´t expect our customer to use it all the time.

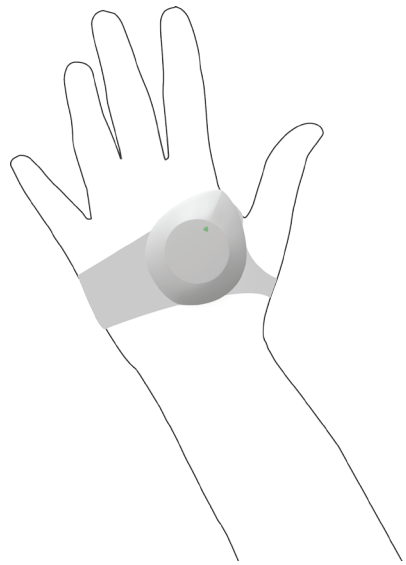
It seems durable, which is one of our customer needs. You fel you can trust it to deliver when it should.

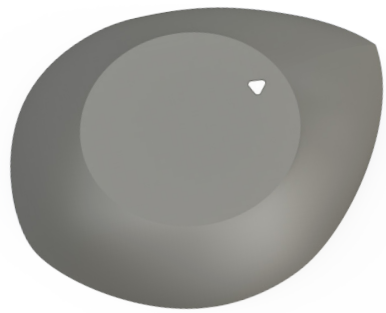
The model was created as a mockups for our movie. It has to be simple and signal that it´s something special from far away.

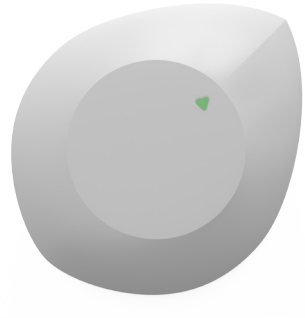
From our survey we found that most people would like a rubbery material. At the same time it should function as a prolongment of the body, that you don´t notice during use but is a looker. It has an unusual shape forwearables and the size.

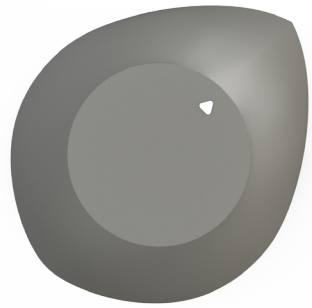
It can be fastned around the leg with a starp or slipped into the shoe or sock for speedy deiivery. The arm pieces will be half gloves that you slip onto the hand.

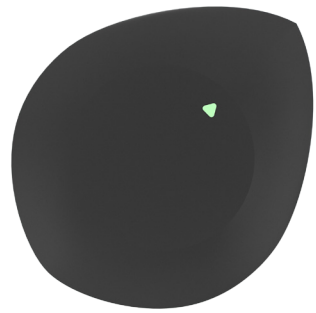
Inside it fits the dimentions of the Misfit Shine product, which doesn´t need recharging.



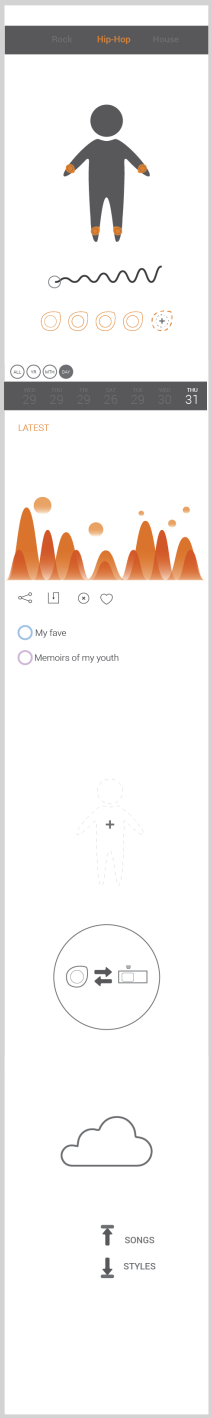








WIREFRAME



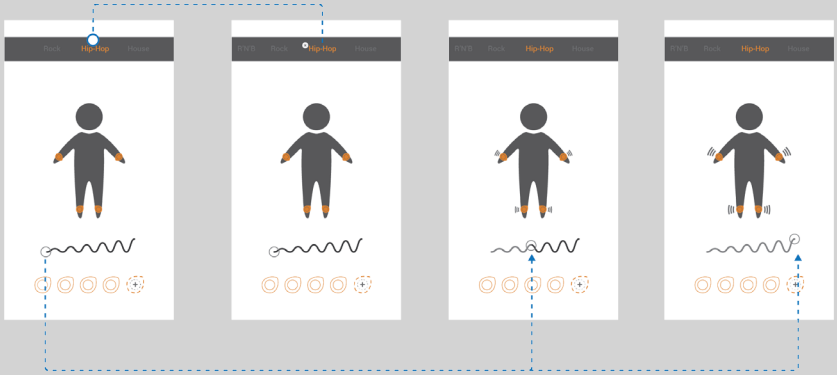
The wireframe strives to be as simple as possible, expressing the feeling of lightness. It should only be of help after or before the musical interaction. Searching for new sounds will be possible, but not the main focus.

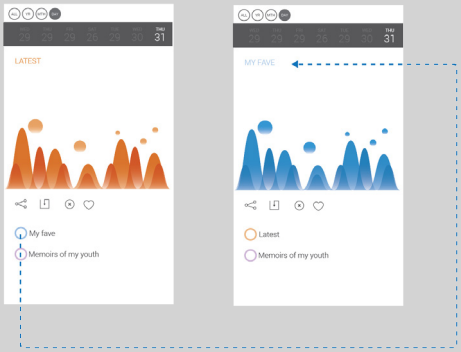
At the top of the page, you can choose what sounds you feel like using when dancing. These sounds are placed in general genres, that give you an indication of the sounds you can experience.
Next you see a figure with four modules on, indicating the user and how many sensors they have on. These can be dragged and dropped on and off. Right under the figure you find a soft zig-zagged line. Here you can choose how sensitive the product is, so that users with disabilities or injuries can still mangae to play like a professional.
After this comes an overview over your files, with your monthly and yearly saved and likes songs. The colors of the graphics indicate what mood the song was payed in. These files can be reused as custom moods.
Then you see the outline of a figure, which is potential co-creators. Adding more people to the jam needs recalibration of the system, which is done automatically here.

The system takes up to four users on the same phone. The applicatiton can be shared with smartphones and trackers via cloudservic. Anyone can get acess to our softwear and an augemented version of the proper product. Finally there is a page that functions like Pinterest, with boards you can save and upload you dancefiles to. Here you can also download other moods.

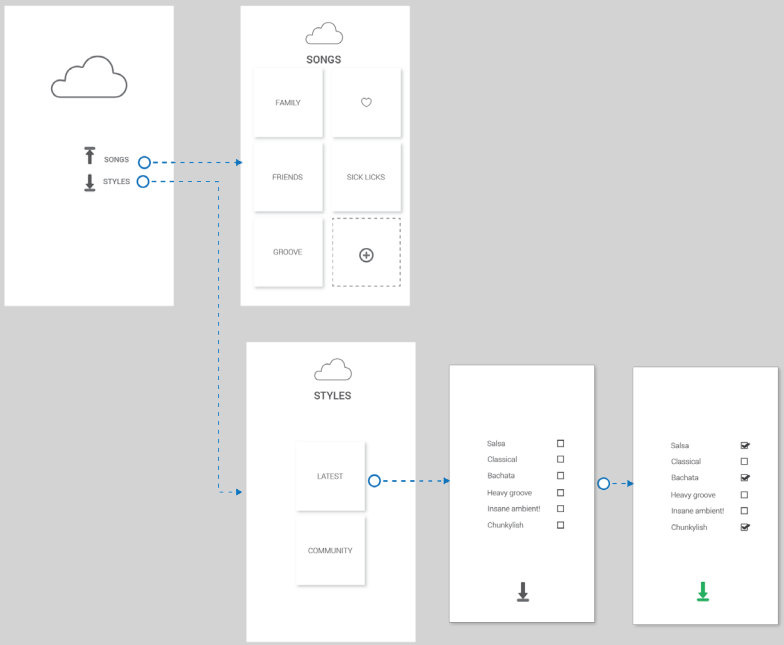
This product refelcts our values. The user is the experience driver, our product is a way of letting inner gretness out.

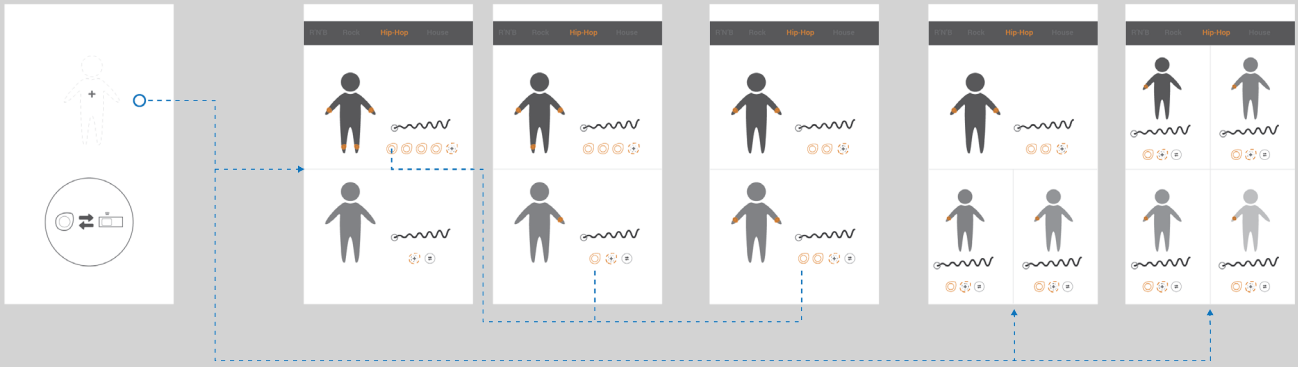
The layout of the application reflects the desires of the people we talked to . Number one was the musical experience, then it was the file saving/sharing, then co-creation and in the end a way to get more out of your musical interface.


Rock
Hip-Hop
House
R'N'B
Rock
Hip-Hop
House
R'N'B
Rock
Hip-Hop
House
R'N'B
Rock
Hip-Hop
House


LATEST
My fave
Memoirs of my youth
MY FAVE
Latest
Memoirs of my youth

WIREFRAME

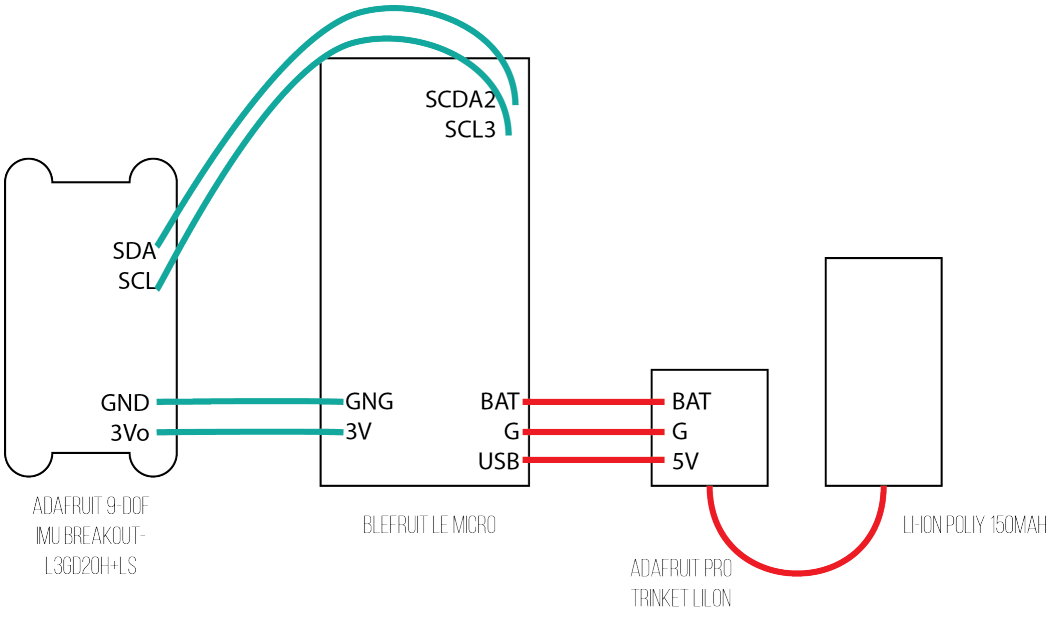

SONGS
STYLES
SONGS
FAMILY
FRIENDS
SICK LICKS
GROOVE
STYLES
LATEST
COMMUNITY
Salsa
Classical
Bachata
Heavy groove
Insane ambient!
Chunkylish
Salsa
Classical
Bachata
Heavy groove
Insane ambient!
Chunkylish

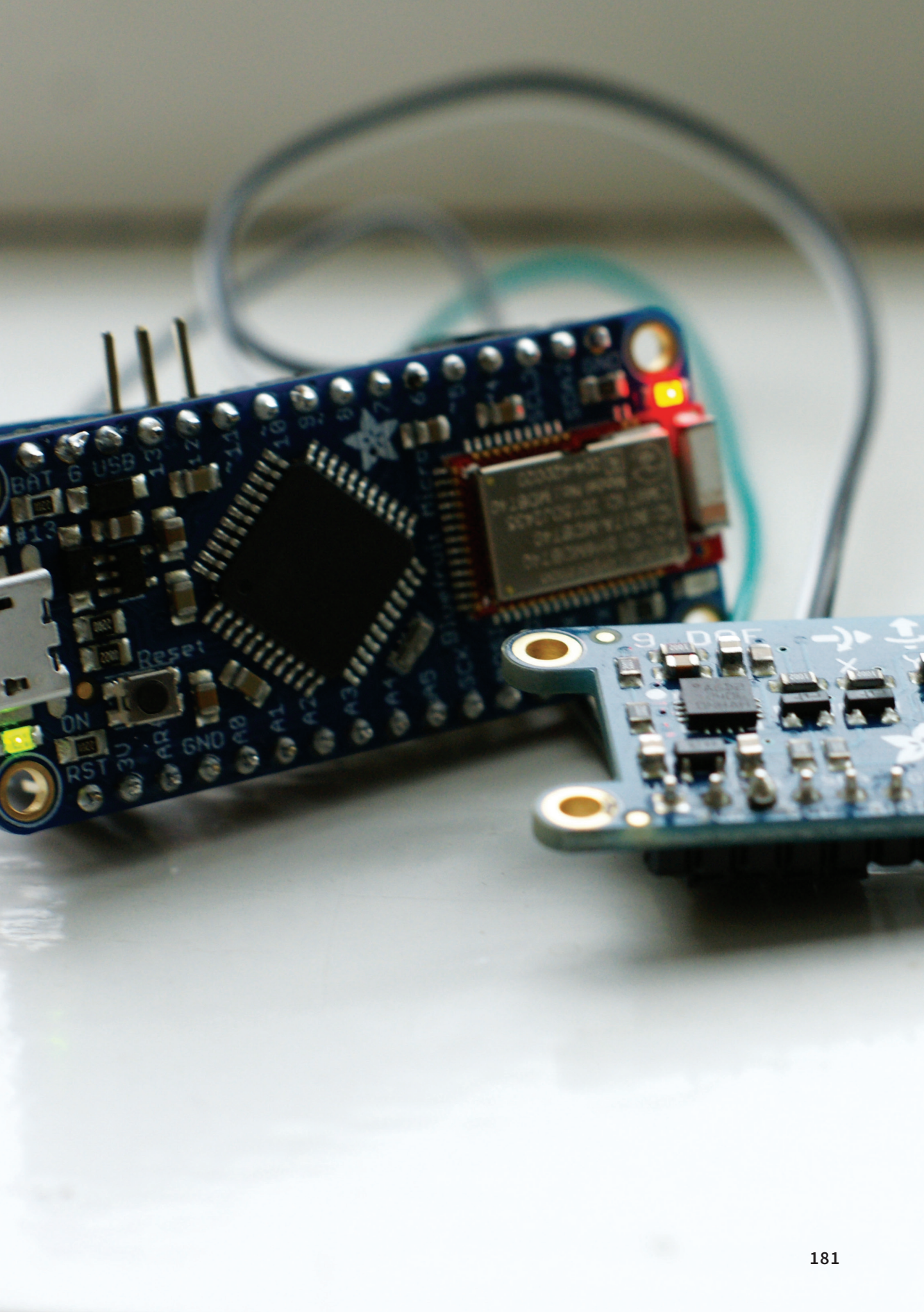

R'N'B
Rock
Hip-Hop
House

FRITZING

OUR HARDWARE SETUP

Following is the harwear setup we chose to use.




BAT
USB
Reset
ON
RST
GND

EVALUAT

This is our last chapter and we take moment to discuss our evalution criteria, what we learned along the way, our progress and what steps we can take in the future to make this a viable startup.Then I reflect upon my role as project manager and how it changed me.

ION

REFLECTIONS

Results

Our goal has been to check if our idea was feasible. To do this we have used a series of techniques which focused on four main elements: feasibility, viability, desirability and MVP.

People liked our idea and this is also our biggest strength and possibility. As soon as someone is willing to pay for the product, we can start producing and marketing it. Unfortunatly, a lot of people are having trouble grasping the abstract idea of making their own music through their body movements. The thought is too progressive and rebellious, but once people get used to the idea we will stand out from our competitors.

Feasibility

The core technology is already on the market, and there is extensive exploration in this type of programming today. Compared to our competitors, we have not used or vested the same amount of time and energy into the product. If we had the same time resources we would quickly enter the market and produce a feasible product.

Partners are also a possible solution to our technical and economical issues within the startup. We must work on getting noticed within the market and actively seek out potential partners.

We are on our way to making an exicting user experience and we are market leaders within our nichè if we realease our product. Our product works in theory and we are hoping to test it soon using MVP methods. The best scenario would be to make it work through simple interaction prototypes so we can simplify the value given to our customers. Our desirability will make good customer relationships, especially through a demanding system that craves interaction in order to work. Our product offers an exciting experience which suits the needs of our early adopters, as well.

MVP comes from thorough analysis of potential customers and desired markets, as well as from direct feedback from people in our immediate surroundings. We used our analysis and feedback actively which was new for me, when I earlier have based my understanding on direct conversations with users to understand their needs.

We must continue to work with our biggest asset: knowledge. We must consider adding extra team members to increase our attraction value.

Innovasjon Norge liked our idea and encouraged us to apply for their grant. This is a very good sign from such a large corporation who has a wide insight in todays entrepreneur market. We need to

work on our pitch and the way we sell our product to potential partners and customers, so that we can expand into further circles. Our next step should be to finish the mvp, then find some mentors and join pitching competitions to hone our public speaking skills.

Unfortunatly, we did not reach our first goal in the constant itertive prosess “learn, build, measure”. The goal is to change if you learn of a crucial component of your product.

After being able to test our MVP, we will focus on our Business Model Canvas to have clear directives on our future goals. The business model canvas gives you a broad overview of stakeholders who affect our business. The model also targets value proporsitions so you easily can define our values and customer group.

PROJECT MANAGEMENT

First of all I am a designer with an idea, but most of my work on this master´s project has been as a project manager. My job was to find the perfect balance between inner and outer motivation for me and for my team.

The team was made up of students with their own projects and school deadlines, so they were not as reliable as a hired team. This meant we had to utilize our time and focus to the maximum, within the time we did have together.

I tried to design the perfect experience of being on a team. I have tried to lead the project in the direction I wanted but at the same time had to allow the others to feel ownership. I had to find a way of keeping everyone satisfied and invested in the project.

On the one side, I made sure that everyone on the team did their assignments within given deadlines. On the other side, I arranged workshops for the team where we did teambuilding while discussing the main problems in programming, technology, design, user experience, and mapping.

Towards the end, I noticed that I had issues in taking choices where i had to sacrifice some the group dynamic we had built in order to make our deadline.

Elements of teambuilding within the group was sharing a meal together during workshops. We often made food together while brainstorming ideas. This helped us get a new perspective on things that needed solutions that were outside the “technology bubble”.

Most of my time went to find specialists that could solve the problems the team could not solve on our own. This helped us keep moving forward and not stagnate on problems we did not have the capacity to solve.

I offered the team a possibility of being on a team that could make a revolutionary project. I had a vision and an idea, but needed a team to make them come true. No one knew where we would end up. This has been an amazing experience that I am sure that I will repeat again.

REFERENCES

The picture of Zuzanna Mantorski, is taken by Janina Lamøy.

Internet pages:

1. http://www.intel.com/content/www/us/en/internet-of-things/infographics/guide-to-iot.html, last checked 24.01.2016
2. http://www.idc.com/getdoc.jsp?containerId=prUS25658315

3https://www.npd.com/wps/portal/npd/us/news/press-releases/2015/the-demographic-divide-fitness-trackers-and-smartwatches-attracting-very-different-segments-of-the-market-according-to-the-npd-group/.

4. http://s1.firstpost.in/wp-content/uploads/2015/01/wearables.jpg
5. http://www.alzfdn.org/EducationandCare/musictherapy.html
6. http://www.playfulwingmen.com/gamification-definition-exrinsic-intrinsic-rewards/, sist sjekket den 20.10.15

Gamification - Extrinsic vs. Intrinsic Rewards jerome sudan

7 http://www.slideshare.net/dings/meaningful-play-getting-gamification-right/13-But_on_to_the_present

Videos:

I.Ted talk; How playing an instrument benefits your brain - Anita Collins ttps://www.youtube.com/watch?v=R0JKCYZ8hng

Articles:

Coulton, Paul (2013) Empathy in the Internet of Things. In: Proceedings of a workshop at the 27th International British Computer Society HCI Conference: The Internet of Things : Interacting with Digital Media in Connected Environments.

Juslin,P.,Emotional responses to music:The need to consider underlying mechanisms, Department of Psychology, Uppsala University, SE-75142 Uppsala, Sweden

Moreno, S., Bialystok, E., Barac, R., Schellenberg, E., Cepeda, N. J., & Chau, T. (2011). Short-term music training enhances verbal intelligence and executive function. Psychological Science, 22, 1425–1433.

Picard, R.W. (1999). Affective Computing for HCI. In Proceedings of HCI International (the

8th International Conference on Human-Computer Interaction) on Human-Computer Interaction: Ergonomics and User Interfaces-Volume I - Volume I, Hans-Jörg Bullinger and Jürgen Ziegler (Eds.), Vol. I. L. Erlbaum Associates Inc., Hillsdale, NJ, USA, pp 829-833

Alpert, Patricia,The Health Benefits of DanceHome Health Care Management & Practice April 2011 23: 155-157, first published on December 2, 2010

Earhart GM. Dance as Therapy for Individuals with Parkinson Disease. European journal of physical and rehabilitation medicine. 2009;45(2):231-238.

Books

Schell, Jesse, The art of game design : a book of lenses, (2015)

Koster, Raph, Theory of Fun for Game Design Paperback – 17 Dec 2013

Figures:

Figure 1. http://s1.firstpost.in/wp-content/uploads/2015/01/wearables.jpg

APPENDIX

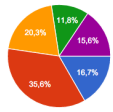
SURVEY

365 svar

Vis alle svar Publiser analytics

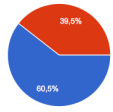
Sammendrag

Age



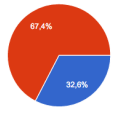
18-23	61	16.7 %
24-29	130	35.6 %
30-35	74	20.3 %
36-41	43	11.8 %
>41	57	15.6 %

Gender



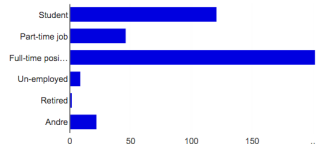
Female	221	60.5 %
Male	144	39.5 %
Andre	0	0 %

Do you own a wearable?



Yes	119	32.6 %
No	246	67.4 %

Occupational status



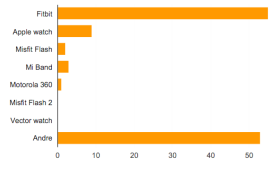
Student	121	33.2 %
Part-time job	46	12.6 %
Full-time position	202	55.3 %
Un-employed	9	2.5 %
Retired	2	0.5 %
Andre	22	6 %

Yearly income

around 10.000$	81	22.2 %
10.000-46.000	104	28.5 %
46.000-115.000	151	41.4 %
>115.000$	29	7.9 %

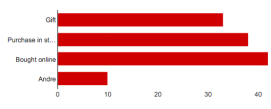
Wearables

What kind of wearable do you own?



Fitbit	55	46.6 %
Apple watch	9	7.6 %
Misfit Flash	2	1.7 %
Mi Band	3	2.5 %
Motorola 360	1	0.8 %
Misfit Flash 2	0	0 %
Vector watch	0	0 %
Andre	53	44.9 %

How did you get your wearable?



Gift	33	27.7 %
Purchase in store	38	31.9 %
Bought online	42	35.3 %
Andre	10	8.4 %

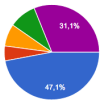
Why did you buy it?

Tracks my running/swimming /cycling. Pace distance/ hear rate. As well as steps general activity.
To monitor heart rate while exercising.
To help me stay active.
to motivate myself to excercize more
To measure my heart rate when playing sports so I could get a better estimation of calorie burn and get the best out of my training.
Exercise tracker
Didn't..
I didn't, it was a gift. But I like the idea of quantifying my activity level in order to try to improve from one week to the next and in order to feel a bit competitive, which helps with motivation.

Do you use your wearable as you intended?

Yes. To track activity
I did for a while some years back. I forgot about it after a while, like most people do. The fact that the iPhone now tracks motion and steps makes it even less likely th
I do, yes
Yes
I think so. I use the sleep tracking less than I thought I would.
The first two years I did. But then I got bored.
Yes, trying to reach weekly goals and as a reminder on the wrist to live healthier.

How often do you use your wearble?



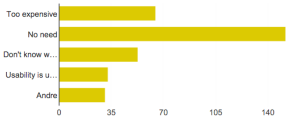
24-7	56	47.1 %
A couple of hours a day	6	5 %
A couple of times a week	9	7.6 %
A couple of times a months	11	9.2 %
Andre	37	31.1 %

If you could get the perfect wearable, what could it do?

More accurate steps. WATERPROOF!!!!!!!!! I want to be able to swim with it
Track sleep, activity, heart rate. Calculate recovery need.
Jeg savner pulsmåler på min aktivitetsmåler
In addition to doing all the other things my polar watch does already, it would work as an alarm clock (buzzing and such) and not need an extra device to monitor my
to listen to everything i say
Heart rate, gps, play music with bluetooth headset, stand alone(work without mobilephone).
Give me electric shocks when I crave sweets

Side uten tittel

Why don't you own a wearable?



Too expensive	65	26.4 %
No need	152	61.8 %
Don't know what's out there	53	21.5 %
Usability is unsatisfactory	33	13.4 %
Andre	31	12.6 %

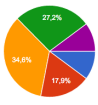
If you could get the perfect wearable, what could it do?

Calendar synced with my Google and work calendars, Spotify with bluetooth earbuds possibilities, camera.

f you could get the perfect wearable, what could it do?

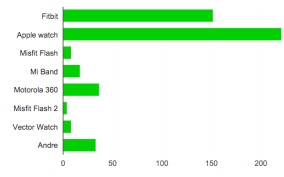
Calendar synced with my Google and work calendars, Spotify with bluetooth earbuds possibilities, camera.
Count calories
I have no idea
rack sleep, steps, and heart rate
Track sleep, track strength workouts, track macros
Erstatte pulsmåleren på brystet med en på hånden som måler like pålitelig. Tungvint å ha den på brystet, og den glir ned ved langvarig trening.
Fitbit
Helping in daily tasks and still be nice to wear. Wearables are very personal gadgets, but also very visible; in this way it's almost like jewelry, so why not design it like jewelry?

low much would you be willing to pay for the perfect wearable?



<20$	25	10.2 %
20-50	44	17.9 %
50-100$	85	34.6 %
100-300$	67	27.2 %
>300$	25	10.2 %

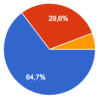
Which of the following wearables do you know?



Fitbit	152	61.8 %
Apple watch	221	89.8 %
Misfit Flash	8	3.3 %
Mi Band	17	6.9 %
Motorola 360	37	15 %
Misfit Flash 2	4	1.6 %
Vector Watch	8	3.3 %
Andre	33	13.4 %

Masterproject

lave you ever played an instrument?



Yes	236	64.7 %
No	108	29.6 %
Several	21	5.8 %

Have you ever played an interactive music based game?

Yes	266	72.9 %
No	99	27.1 %

If yes, did you think it was fun and why?

Yes, immediate feedback and performing
Yes, it was kind of challenging and I got to listen to music I liked.
I enjoyed the competitive part of it, trying to get 100% accurate to the music.
Yes, fun to do with friends and hand eye coordination
Not really my cup of tea, tbh.
Challenging
Yes, because you have to keep up, you can play songs you've heard on the radio. Down side is, you aren't really CREATING music or playing an actual instrument which requires actual talent/ability.

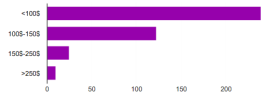
Have you ever wanted to make your own music?

Yes	210	58.3 %
No	150	41.7 %

Would you like to share the music you created with others?

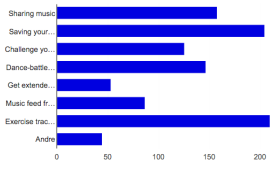
Yes	127	36.3 %
No	188	53.7 %
Andre	35	10 %

How much would you pay for the product I'm creating?



<100$	239	65.5 %
100-150	122	33.4 %
150-250	25	6.8 %
>250$	10	2.7 %

What other functions should the product have?

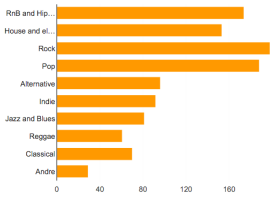


Sharing music	158	44 %
Saving your music	205	57.1 %
Challenge your friends	126	35.1 %
Dance-battle with others	147	40.9 %
Get extended music packages	53	14.8 %
Music feed from other users	87	24.2 %
Exercise tracking	210	58.5 %
Andre	45	12.5 %

Which product material would you prefer?

Rubber	196	54.3 %
Fabric	76	21.1 %
Wicker materials	22	6.1 %
Metal	34	9.4 %
Andre	33	9.1 %

What kind of music styles would you like in a basic package?

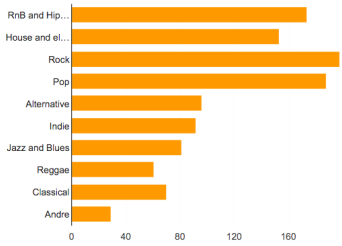


RnB and Hip-Hop	174	49.9 %
House and electronica	153	43.8 %
Rock	198	56.7 %
Pop	188	53.9 %
Alternative	96	27.5 %
Indie	92	26.4 %
Jazz and Blues	81	23.2 %
Reggae	61	17.5 %
Classical	70	20.1 %
Andre	29	8.3 %

How would you use it?

Musical exploration	164	45.4 %
Exercise	225	62.3 %
Social game	176	48.8 %
Avoid sitting still for too long	109	30.2 %

What kind of music styles would you like in a basic package?



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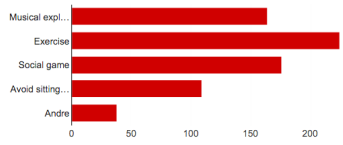
How would you use it?



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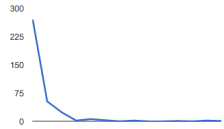
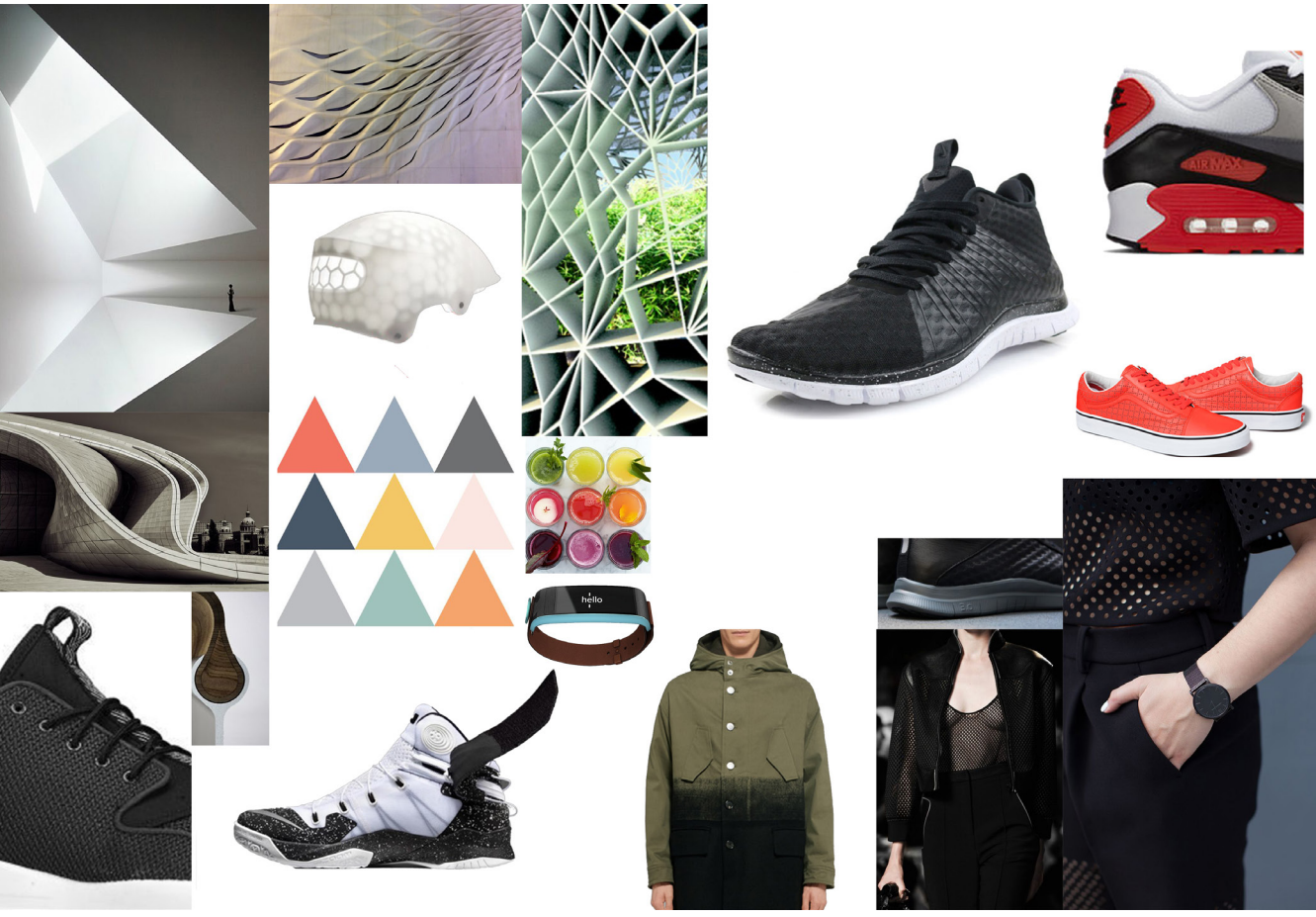
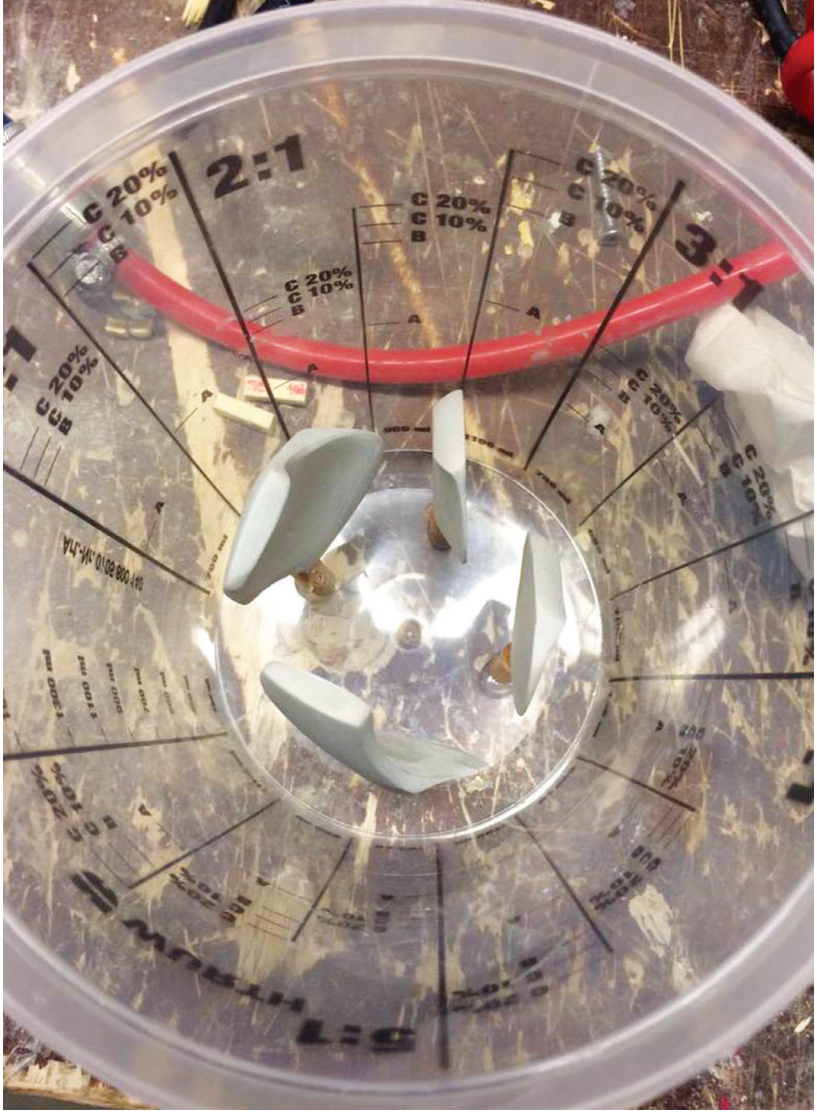
Social game	**176**	48.8 %
Avoid sitting still for too long	**109**	30.2 %
Andre	**38**	10.5 %

Antall svar per dag

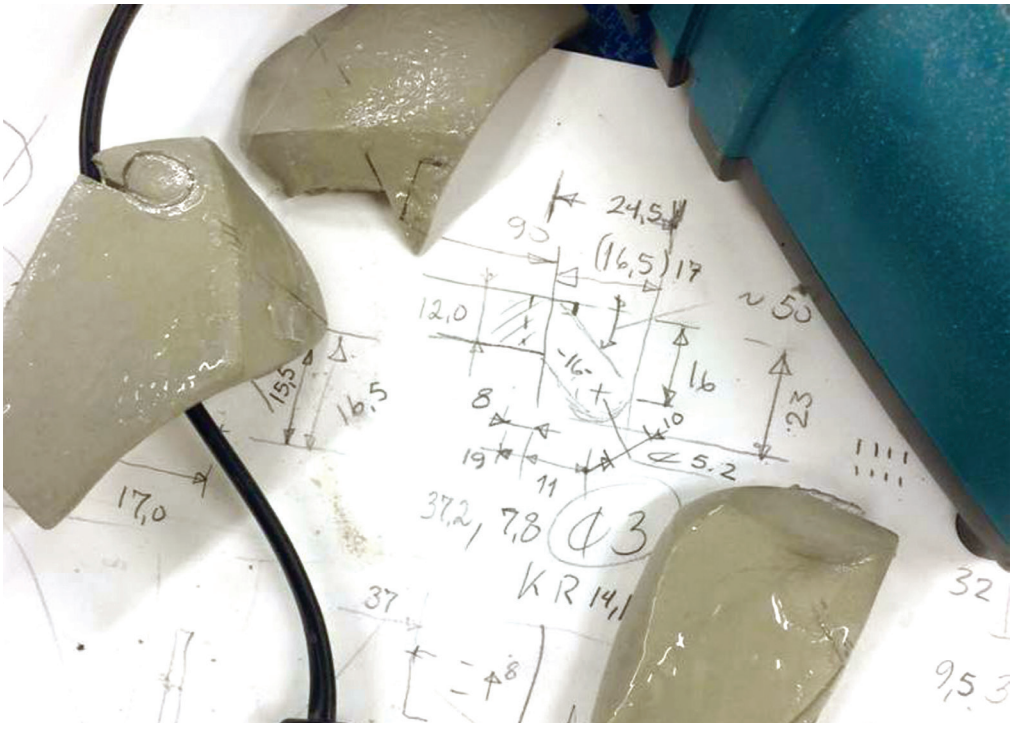


MOODBOARD USED IN PRODUCT DEVELOPEMENT





FAILED TO HARDEN



FUNCTIONING UART