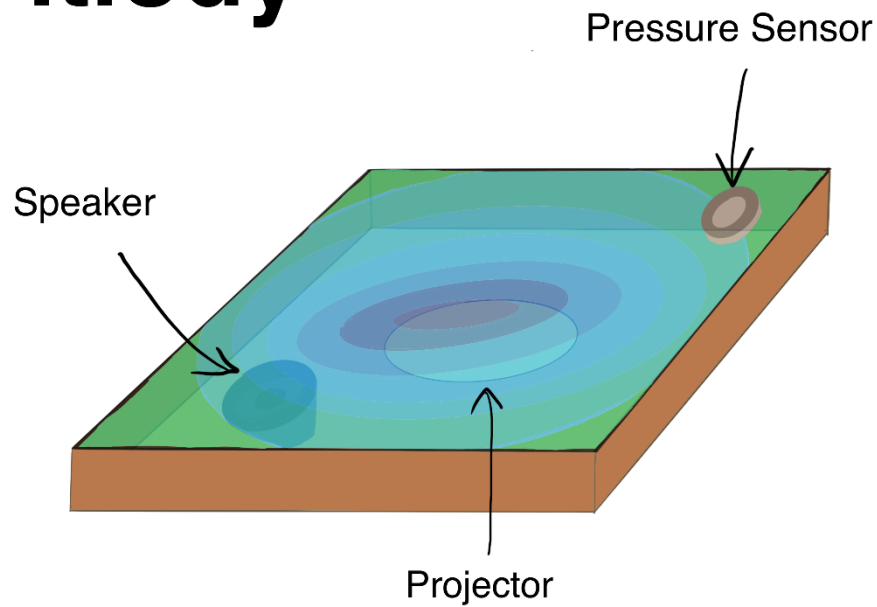


Fitlody



<FITLODY> PROPOSAL REPORT <Team X>

<Tianyi Liu>

<Peiquan Li>

<Shane Wei>

Semester 1, 2020

TABLE OF CONTENTS

TABLE OF CONTENTS

TEAM SECTION

Team Domain	1
Response to Feedback	2
Related Work	3
FITNESS MOTIVATION	3
THE WAYS OF GENERATING MUSIC	4
THE RELATIONSHIP BETWEEN MUSIC AND EXERCISE	5
Audience & Intended Experience	6
Relevance to Theme	10
Reference	11

INDIVIDUAL SECTION

Tianyi Liu

Introduction	12
Focus	12
Discovery	12
Project Constraints	13
A plan for completion of the project	13

Peiquan Li

Introduction	14
Focus	15
Response to Feedback	16
Discovery	16
Project Constraints	17

A plan for completion of the project	18
Shane Wei	
Introduction	19
Focus	20
Response to Feedback	20
Discovery	21
Project Constraints	21
A plan for completion of the project	21

<FITLODY>

<Team X>

<Tianyi Liu, Peiquan Li, Shane Wei>

Physical Computing & Interaction Design Studio proposal

<2020.04.09>

TEAM DOMAIN

Instant gratification is a very important factor that motivates modern people to persist in something. Instead of reading and exercising, people tend to spend their spare time watching movies, playing video games because these activities could provide them with very instant feedback. Although many and many research found that positive outcomes are highly related to one's ability of delayed gratification, instant gratification is also proved to be a good tool used to encourage people to do something they may not like to, for example, combining gaming with education.

What we are trying to do is to translate the physical variable *pressure* into music. Our design will allow the user to instantly “hear” the efforts they have put on exercising, either full of energy or exhausted. Keep fit will no more be a repeating and boring activity, instead, it will be novel and full of fun!

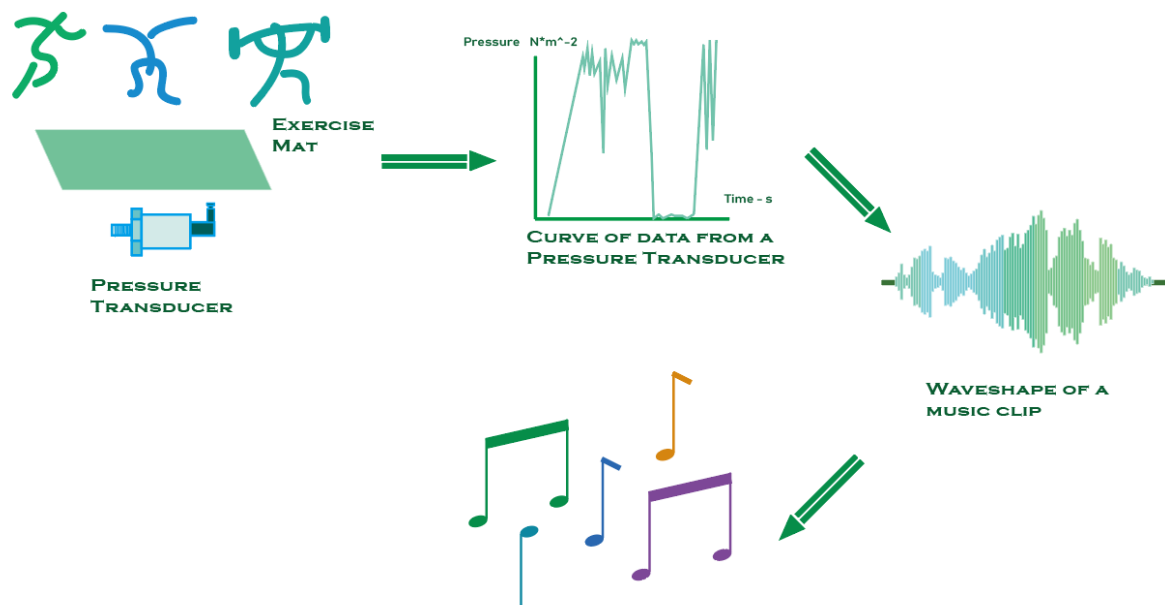


Figure 1. The concept of "FITLODY"

RESPONSE TO FEEDBACK

We received a lot of feedback from our presentation, these comments could help us to improve our design, our team dive into these comments and got some reflections and inspirations.

- Some classmates mentioned that our design could work for both ways, as in the music adjusting to your actions or, you have to exercise according to how the music and lights change. This was discussed previously in our group meeting, at that time, we have not decided to use which mode or involve them together, now the feedback shows some of our audience like to have both. We will do more user research and user tests lately to investigate users' preference.
- Customizable. A further extension of the previous point, a lot of classmates commented that it would be better to let users decide the interactions in multiple ways, like exercise modes, music types, volume control etc. Our team discussed this and agreed that providing options for users could make our device more playful and adaptive to different user groups. Our next step will research users' preferences, we will set up some questions to find out what options are suitable for them while they are interacting with our installation.
- Health status. Fitness and exercise are connected with human's healthcare. Some feedbacks are about heart rate detection to provide health status while they are doing exercise and prevent from exhausting. Heartbeat could also be a data input that connects with physical interactions like light and vibration. Our team agrees that these feedbacks are inspiring and for practical concern, we could involve fitness bands to capture heart rate data. Also, these feedbacks helped us to reflect on our domain and provide us a potential direction to discover in our individual research.
- Motivation. Link back to our original design purpose, one is to motivate people to do more exercise through playful interactions. Our tutor challenged us about how to use our approach to help motivate people who either have no knowledge of how to exercise or have no motivation to exercise. After group discussion, we thought about two options to answer this question, one is to provide a tutorial at the beginning to let users who have no knowledge of how to exercise to be familiar with our device. The other is to introduce goals, achievement, challenges among friends to motivate users to make some changes. Our team will do further research on this area in the following sections.
- Music type, some colleagues mentioned what music people want to listen to while working out and if any particular type of music fits better for specific types of exercise. This requires us to do more literature review to see how music affects people's emotion, music type could also connect to exercise mode, for example, use pop music when users have the intensive exercise and pure music when users just finish their training and relax.
- Promotion, some colleagues suggest that the promotion of exercise can be improved, for example, if everyone is working out correctly, a melody is maintained.

If one person is falling behind – music starts to play out of time (causing frustration and motivation to keep up to pace). Fitness promotion is our next step of discovering our domain, one of our members is currently working on this aspect.

- Music haters, some mentioned that what if there are people who do not like to listen to music or if it is using speakers to play music, it could be annoying in public places. Well, our design could not cover every person and satisfy them, so, when we design this, we have a specific user group and use case, to limit it in household fitness. However, we can still involve some adjustments like using wireless headphones to replace speakers, so they won't bother other people.
- Multiple users & interactions. One of our classmates suggested that it could be interesting to think about how multiple people could interact with the concept using different equipment and how that would change the music. Our team agreed that this will make our installation more playful and involve more users to interact with our product. Having different exercise equipment is one of our considerations. We can try to deploy the same algorithm and data detection across multiple fitness equipment.

RELATED WORK

Based on the feedback from the pitch and consultation, our group decided to do additional research about our domain. The sources are relied on articles, previous study papers, research methods and theories that will help us in our own user research and project design and concept iteration.

We break into 3 directions for our group research: fitness motivation, the ways of generating music and the relationship between music and exercise. This is intended to cover our domain-related information, research methods, theoretical concepts & approaches that could be combined in our project, physical computing technologies that could help us to build our project and interactions that could improve the overall user experience. Below are our research outcomes:

FITNESS MOTIVATION

One of our original designs is to motivate users to do more exercise when they stay at home. Especially at this period, due to COVID-19, while outdoor activities are not encouraged by the government. This current situation encourages us to do more research about how to promote users to do indoor fitness. Our research focuses on two aspects: one is to discover motivation factors and the other is to use current research methods to find out what could be the motivation for our users to play with our installation.

In this article, the authors analyzed the motives of students to fitness classes in a university (E.p, 2013). Through quantitative research, the authors concluded that the main motivation factors for fitness training are improvement of physical efficiency, pleasure and self-confidence. The authors also pointed out that the understanding of own needs and socially significant targets and demands in fitness activities can also promote students. The reason we chose this article is that the research object has common parts to our target user group. After this review, we understand that people's inner understanding and acceptance is vital to fitness motivation. What we need to do next is to find out the trigger to motivation.

Additional research provides theoretical support about the role of self-efficacy and achievement goal in active participation and adherence behavior in students enrolled in university-based fitness courses (Martin, 2006). As an inspiration to our project, achievement goal setting can promote users to do more exercise with our device, and thus, increase user adherence with Fitlody. When we try to persuade our target users to participate with our project, it is necessary to show that they can be better while using our product. This research (Ishihara et al., 2018) found out the relationships of achievement motivation and physical fitness with academic performance, result shows that physiological features are positively related to academic performance and achievement motivation can support healthy behaviors including fitness.

When we are preparing user testing, beyond traditional HCI theories and evaluation methods, we could also combine specific measurements for fitness motivation. The Sport Motivation Scale (SMS) is a new measure of motivation toward sport which can be included in our project (Pelletier et al., 1995). This evaluation method focuses on intrinsic and extrinsic motivation that provides scales with psychological and behavioral considerations. We will use this as part of our user testing plan to find out what factors could motivate our target users to participate in our project.

THE WAYS OF GENERATING MUSIC

Music Predicting and generating are very popular themes in computational creativity. The process usually involves converting the music track (usually MIDI track) into a dataset, and a neural architecture of the machine learning system. In our project, we would not use complex algorithms like machine learning to generate music, however, these research will be also helpful for us understanding the relationship between data and music tracks, and help us to generate simple music based on given dataset.

BachProp is an interesting system that could learn how to generate music from different styles of MIDI corpora (Colombo et al., 2019). The most interesting part is that the system "learns" the music by converting MIDI tracks into a dataset. The music track is firstly converted into a $1 \times n$ matrix which contains all the music notes in the soundtrack. Each note is converting to a 1×3 matrix which contains three parameters, P(Pitch), T(Duration) and

dT(time-swift). Therefore, the system could identify the sound track as digital data and analyze these datasets for training.

MPSG is a much more complex system breaking music notes into data (Triviño-Rodriguez & Morales-Bueno, 2001). It converts the notes into vectors on a two-dimensional graph. To be honest although I read it very carefully, the article is still too complex for me to understand, so it's hard to say what I learned from this paper.

NetWorks (NW) is another interactive music generating system allowing users to modify the rules of the system to generate different music of various styles (Bell & Gabora, 2019). The author identified 5 attributes of a single note, pitch, loudness, duration, timing and timbre. The system is formed by 64 nodes that represent these 5 attributes of note. The connection pattern of the notes could be modified by the user. In this case, when generating music, a new note could come out randomly and the nodes act as a funnel or filter, shaping the music into certain patterns. The system is actually much more complex than this, but the core mechanism is similar.

Compared to the 2 articles mentioned earlier, the music generating method used in NW is more suitable for our design. To digitize the music track as matrices and dataset may be essential for deep learning but might not fit our approach. We don't need fragmented music data to support the system in learning how to generate totally original and novel music. What our translation process would like is to find pleasant structures or models of music, in which we could place our data in, shape them to harmonious melodies. Therefore, finding the common chords progressions and rhythms could be more helpful for us.

Mark Ballora is an expert transforming data into sounds. His work includes transforming the solar winds/heart beats and etc. Our concept is quite similar with his work, but will be interactable, and closer to daily life.

THE RELATIONSHIP BETWEEN MUSIC AND EXERCISE

By reading the literature, we have found some articles that study the relationship between music and sports. In these articles we found that many researchers believe that music can be used to promote sports. Edworthy and Waring found that not only the music but also the rhythm and volume of music are related to the movement by changing the user's background music speed and loudness during the treadmill exercise (Edworthy & Waring, 2006). The researchers set the music rhythm and volume as variables in the experiment. They observed the experimenter's movement status by changing the music rhythm and volume. Finally, the researchers found that music has a significant effect on running speed and athletes' heart rate. Moreover, they found that fast-paced, loud music can enhance physical exercise. This research provides theoretical support for our design. Our project Fitlody can change the generated music according to the different movement methods and the intensity of exercise, so as to promote the user's physical exercise.

<Team X>

Other researchers have studied the relationship between athletes' muscle activity and music rhythm during exercise at different music rhythms (Safranek et al., 1982). They found that with different music rhythms, participants' muscle activities were significantly different. In the experiment, the biceps of all participants who listened to music moved faster than those who did not. Therefore, the results show that music helps to change the muscle status of athletes and prolong the muscle activity time. Beckett studied the effect of music on aerobic exercise (Beckett, 1990). Experimental results show that in the state of music, the athlete's heart rate recovery rate is faster than that of the non-music group, allowing aerobic exercise to last longer. These studies all show that the environment with music is more suitable for people's muscle and heart movement than the environment without music. Therefore, our project will also greatly help people's sports.

AUDIENCE & INTENDED EXPERIENCE

Initially, our target audience were mainly set by urban white-collar workers aged 24 to 45 who were busy with work and rarely participated in fitness activities, and young people who were addicted to electronic products and rarely participated in sports. White-collar workers have difficulty finding the right time for physical exercise due to work. Most young people addicted to electronic products are not interested in sports, and their physical health will become a serious problem. According to these circumstances, our designed product Fitlody occupies less space and is very suitable for being placed at home, so that users can exercise at any time. Moreover, Fitlody has a variety of sports modes, which collects data through the user's movement status and brings timely feedback of music and moving images to the user. This combination of music and image feedback can bring new changes to the original boring sports, so as to attract young people addicted to electronic products to exercise.

Due to COVID-19, schools in Australia have all been closed, the government has cancelled collective outdoor sports, and students can only study and live at home. The time for students to go out for physical exercise has decreased dramatically, and their physical health is also facing challenges. Moreover, most teenagers are not used to living at home all the time, and their entertainment activities are also reduced. According to our survey, we found that they also need some products at home to attract them to exercise, entertainment, and keep them healthy. Therefore, students who have been suspended at home under the influence of COVID-19 have also been added to the target user group of our products.

According to our user research, we made two personas and drew the corresponding storyboard. The first one is Michael. He is a 30-year-old father of a 5-year-old son. He usually works very busy and rarely accompanies his son and doesn't have much time to exercise. Due to COVID-19, he has to stay at home and want to have some fun. In his previous experiences, he feels bored doing the normal exercise, and lack of motivation to keep fit. However, he would like to try some fitness equipment which could help him to stay

healthy and get along with his son. So, he chooses Fitlody. When he opened the Fitlody and started rope skipping, the music and the images also began. After finishing rope skipping, he started push-ups. At the same time, the music and patterns also changed. He felt so excited and asked his son to play with him. Each of them tried lifting dumbbells, both of them were happy to exercise with the music and different patterns.



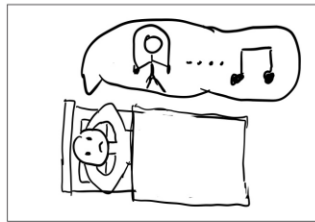
Figure 2. Persona 1

PERSONA: **Michael Wallace**

USER STORY/SCENARIO:



Michael is working at home these days. He always sits on a chair.



When Michael lying on the bed, he really wanted to exercise and listen to music.



So, he opened the Fitlody and started rope skipping. In the same time, the music began.



He started push ups and the music also changed. The pattern changed, too.



Michael also like lifting dumbbells. And the music also changed.



Finally, Michael felt so happy and he became healthier.

PAGE #

PROJECT/TEAM: **Team X**

DATE:

STORYBOARD [NNGROUP.COM](https://nngroup.com)

Figure 3. Storyboard 1

The second user is Alice. She is a 13-year-old junior school student and has a 7-year-old sister. She is very sensitive and a little bit introverted. She wants to be a popular student in school and a role model for her little sister. However, she is always not satisfied with her body. Her school was suspended because of COVID-19. She and her sister stay at home every day, and both of them are bored. So, Alice started to try Fitlody which was advised by one of her best friends. To begin with, she didn't believe she could exercise every day. However, she was addicted to the music and the patterns which were generated by her movements. Both her sister and her fell in love with this device. She believed that she could be slimmer during this "special" vocation and her changes will shock all of her friends.

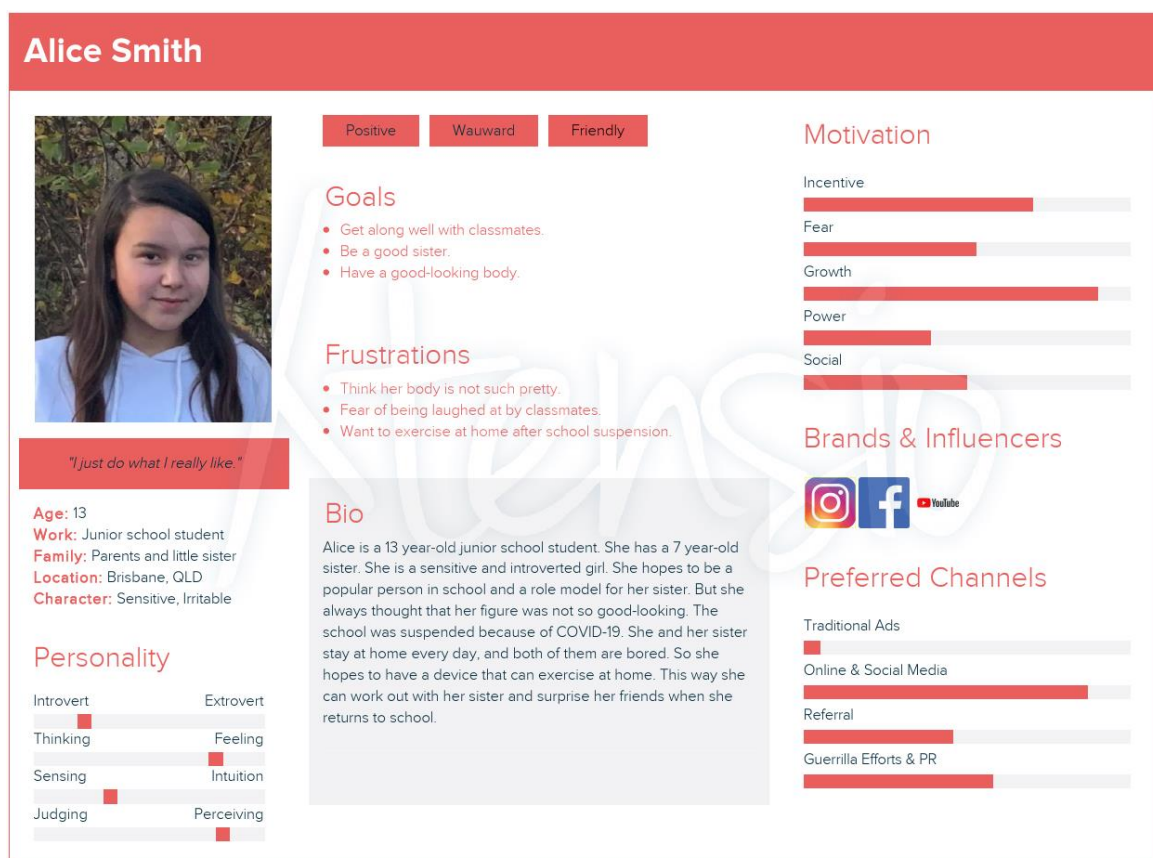
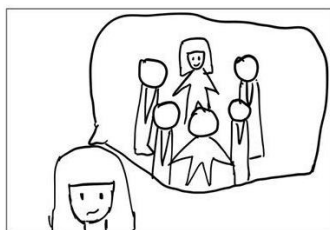


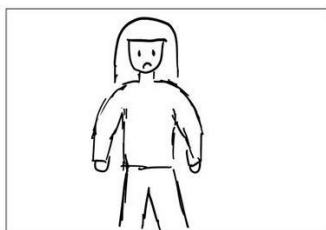
Figure 4. Persona 2

PERSONA: **Alice Smith**

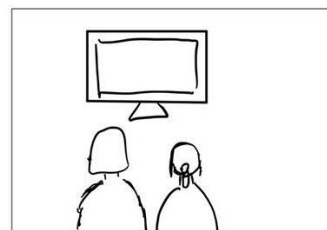
USER STORY/SCENARIO:



Alice want to be a popular student in her school.



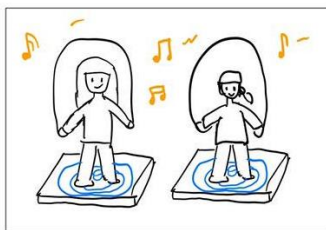
She is always dissatisfied with her body.



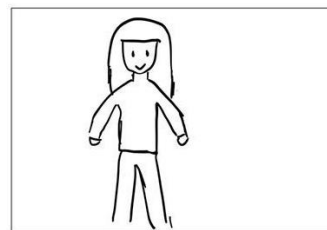
Due to COVID-19, she and her sister stay home everyday.



Alice started rope skipping by using Fitlody which recommended by her friends.



Both her sister and her fell in love with this device.



Alice gets healthier than before and she was very happy.

PAGE #

PROJECT/TEAM: **Team X**

DATE:

STORYBOARD NNGROUP.COM

Figure 5. Storyboard 2

We believe that Fitlody is an interactive device suitable for most groups and very easy to promote. Therefore, in order to attract more audiences, we plan to put it on the streets, parks, museums, schools and other places for display. During the presentation, the combination of music and images and sports will attract more audiences. We hope that our users can experience the fun of creating music and images in the process of sports, and finally let users love sports and maintain good health.

RELEVANCE TO THEME

Our intended implementation will be an open exercising playground, on which users can do exercises. The speakers will play the music generated by the system, and the projector will display the visuals created from the data. The user could interact with the system physically and get an exciting and brand-new experience. In the design and production of this project, we put forward the idea of allowing users to create music in daily exercising. This new way of creating music can better enhance users' interest in exercise. Timely feedback of sounds and images can also increase the user's exercise time. In order to give users more interactive experience, we also provide different exercises modes according to different exercises types.

Our domain is the music metrics. Trying our implementation, the user will not only hear the tempo of various kinds of music, but also hear the tempo of his/her efforts, strength and power.

REFERENCE

- Beckett, A. (1990). The Effects of Music on Exercise as Determined by Physiological Recovery Heart Rates and Distance. *Journal of Music Therapy*, 27(3), 126–136. <https://doi.org/10.1093/jmt/27.3.126>
- Bell, S., & Gabora, L. (2019). A Music-generating System Inspired by the Science of Complex Adaptive Systems. *ArXiv:1610.02475 [Nlin, q-Bio]*. <http://arxiv.org/abs/1610.02475>
- Colombo, F., Brea, J., & Gerstner, W. (2019). Learning to Generate Music with BachProp. *ArXiv:1812.06669 [Cs, Eess, Stat]*. <http://arxiv.org/abs/1812.06669>
- E.p, B. (2013). Students' motivation to fitness classes at technical university. *Pedagogika, Psihologiâ Ta Mediko-Biologični Problemi Fizičnogo Vihovannâ i Sportu*, 6, 3–6. <https://doi.org/10.6084/m9.figshare.714933>
- Ishihara, T., Morita, N., Nakajima, T., Okita, K., Sagawa, M., & Yamatsu, K. (2018). Modeling relationships of achievement motivation and physical fitness with academic performance in Japanese schoolchildren: Moderation by gender. *Physiology & Behavior*, 194, 66–72. <https://doi.org/10.1016/j.physbeh.2018.04.031>
- Martin, M. R. (2006). *Analysis of one structured fitness motivation intervention on self-efficacy, achievement goal orientations and exercise adherence in sedentary and moderately active adults* [Ph.D.]. <http://search.proquest.com/docview/304959085/abstract/DBAB0A88ED9A4525PQ/1>
- Pelletier, L. G., Tuson, K. M., Fortier, M. S., Vallerand, R. J., Brière, N. M., & Blais, M. R. (1995). Toward a New Measure of Intrinsic Motivation, Extrinsic Motivation, and Amotivation in Sports: The Sport Motivation Scale (SMS). *Journal of Sport and Exercise Psychology*, 17(1), 35–53. <https://doi.org/10.1123/jsep.17.1.35>
- Safranek, M. G., Koshland, G. F., & Raymond, G. (1982). Effect of auditory rhythm on muscle activity. *Physical Therapy*, 62(2), 161–168. <https://doi.org/10.1093/ptj/62.2.161>
- Triviño-Rodríguez, J. L., & Morales-Bueno, R. (2001). Using Multiattribute Prediction Suffix Graphs to Predict and Generate Music. *Computer Music Journal*, 25(3), 62–79. JSTOR.

INDIVIDUAL SECTION

TIANYI LIU

INTRODUCTION

I am Tianyi, a second grader of a master student in Interaction Design. I have an undergraduate background in earth science and have accomplished several fundamental science courses. Those basic science courses helped me to form logical thinking, reminding me to always keep an objective cognition. However, although I like those creative works since childhood (storytelling, composing, sketching). Unfortunately, it turned out that I'm really not good at creative thinking, even the outcome of "Graphic Design" could prove this.

In this team project, I will be in charge of the translation process. This is one of the three main sections of our team concept. At the end of this semester, I expected that I could design an interactive prototype that could demonstrate the process of transforming data into music and could combine with my teammates' work to form a complete MVP of our design concept.

Focus

As our team chose to work together on the same design, we will each focus on one aspect of this concept. I will be working on transforming the data of users doing exercise into sound waves that could be output as music. I will probe into the relationship between human exercising and music, explore how music could encourage people doing exercise, benefit and guide people in fitness. Besides, I will also study the formation of music, how to generate music from existing data and what kind of music people want when doing exercises.

DISCOVERY

For the aspect I'm going to work on, I have concerns about the transforming data into sounds. The data we are going to collect from the sensor have two parameters, time and pressure. When people are doing exercise, the pressure they give to the instruments and the sensor will change as the time flows. This will be a waveform of time-pressure. However, the waveform of sound is much more complex. In each single moment, there will be two parameters that contribute to how the music will sound like: sound intensity and frequency. Although the waveform of a music clip looks like it is two-dimensional (like a music track), it is actually a superposition of several individual sound waves and has to use Fourier Transform to split them out and change it to spectrum and only after that we could know how it will sound like.

It seems too complex for our non-professional design team. Fortunately, we could simplify this process. We could select only one parameter in the sound wave to match the pressure in the data, either frequency or sound intensity. But these two approaches could be quite different, specifically, they will emphasize the different parts of the music.

If we match the pressure with sound intensity, the output will be emphasizing the rhythm, which might be suitable for weight lifting and jogging ; if we match the sound with frequency, the output will be emphasizing the melody, which will be good for users using chest expander. I'm thinking of retaining these two approaches and allow the user to switch between them according to which kind of exercise they are doing.

PROJECT CONSTRAINTS

Our team project might be limited by various factors.

Theoretical factors: We are not professional in music making, and we don't have experience handling complex raw data. Thus, we couldn't ensure the output music is pleasant for hearing. There will be noise in the data and will directly affect the quality of the music. Despite the data noises, sounds that directly transformed from data could be unpleasant and might need some designed code to modify.

Methodological factors: Mainly caused by the restrictions given by the government concerning COVID-19. We are not able to do contextual inquiries face to face with the target audience. This might affect the effectiveness of us learning the users' values and needs; We are not able to use the instruments and other resources from the UQ Innovate; We are not able to do face to face user evaluation. The only thing we could rely on is our own laptop, the Arduino Kit, and the tutorials from the course staff.

A PLAN FOR COMPLETION OF THE PROJECT

Limited by our time and materials and other constraints, we are not confident to build up a prototype exactly as what we planned. But we could break down the whole project into several stages and try to achieve as much as we could. Our prototype may not contain all the functional components we expect to implement, but, I think, it should provide the intended user experience, specifically, how will the user interact with the product, what experience they will get when using the product, and they could give feedback as they were using the actual product. However, even though this minimum viable product was much simpler than the final one, it might still require several steps of efforts to accomplish, I expected the following milestones in our design progress.

- User Interaction Prototype
- Functional Prototype
- User Experience Prototype
- Minimum Viable Product
- Advanced Prototype

1. User Interaction Prototype

This prototype should show the interaction method of the product. We will be thinking of how the user will interact with our product. For example, in what way we could place the pressure sensor to collect the data from the user that could maintain the accuracy but lighten the burden on the user or even make it fun. Or besides output as music, what other way could we make use of these data as output to provide instant feedback for users who are doing exercises.

2. Functional Prototype

This prototype should contain the basic function of our design concept. In this case, which is the data input, translation and the output. We will find a way to record the data of exercising from the user, and translate it into sounds, and play it out through the speaker. This will require us to have a general understanding of the mechanism of these technical parts and use them to create our own prototype. For the software part, we (I, if as planned) will be working on how music is generated/formed, and how to use a given data to create music that could be pleasant to hear.

3. User Experience Prototype

This prototype will focus on the user experience, we will combine the 1st and 2nd prototype together and build a prototype that contains both interaction and functionality. Afterwards, we will be looking at the user experience, we will do a few user tests to find out and fix some issues in UX.

4. Minimum Viable Product

Minimum Viable Product is a prototype that just contains enough features for the design team to do early evaluations and collect feedback from the user for further product development. If our team project is processing successfully, this will be the intended outcome for our team at the end of this semester.

5. Advanced Prototype

If we have more time, we will be working to fix the problems identified in the user evaluation of our MVP. Further efforts will be put on either technical aspects or UX, depending on the result we got from the evaluation.

PEIQUAN LI

INTRODUCTION

In this project, I work as a team cooperator. My previous idea is about musical things, so I am keen on music related concepts. During the work café, I found Tianyi's idea was more practical and playful, so I chose this domain and I felt happy to work with my teammates.

As for personal strengths, I think I am good at communicating with people, listening to their ideas patiently and thoroughly understanding their thoughts. I think that is vital for team-based projects, a clear and fluent communication across every team member could make the whole team more efficient. Secondly, I always take care of details, either thought product design or report delivery, which I think is important for the whole user experience and product's quality, I think I will pay more attention to user research and testing sessions in this project. After that, I can deal with some code work and design work, which I will not say I am good at, but I can take some responsibility for them and share my teammate's workload.

As for the shortages, microelectronics will be a major weakness for me. Though, in the previous semester, I have learned DECO7230 Digital Prototyping, which helped me to get in touch with Arduino and some microcontrollers. I have tried these in my first prototype, but they did not work well, so I gave up and used AR tech in my final prototype. That experience was a kind of failure to me, so I hope I could get more confidence during this semester, by learning these skills through some tutorials. Hand tools skills are also unfamiliar for me, considering the course has changed due to the COVID-19, most components are relied on DIY and handmade. This could be a challenge for me. So, my expectation for this course is to improve my hardware knowledge and skills by using Arduino and other physical components to deliver the product. I will seek every resource to strengthen my understanding of these physical things.

During previous group discussions, we already divided our teamwork. Though we are still working as a team to deliver the final product, each one will take care of one part of the whole product and combine them in the final stage. I will divide my work into two parts: research and construction. My approach to the research part is using Sport Motivation Scale as part of our user research to find out key factors for our target audiences' motivation to do exercise. As for the construction section, my approach will be using multiple sensors to capture data for the music generating process. I will cooperate with other team members to complete data transfer and additional designs including feedback interaction and functions design.

Focus

Under the team domain, my personal focus is collecting data through multiple sensors, the data has multiple forms, depending on the sensor I use including pressure sensor, gravity sensor, gyroscope sensor or even heart rate detector. These data will transfer to my teammate Tianyi, and he will be responsible for using these data to generate music, so each one will work on his/her personal focus and we combine our work together to deliver the final product. During the same time, I will do more research about fitness motivation by using Sport Motivation Scale through small scale testing and define the key factors that we could use to promote our users to participate in our

project. This will benefit our team to design specific features like achievement goals to attract our target audience.

RESPONSE TO FEEDBACK

Though I have not amended my focus based on feedback from the pitch, I still found some related feedback from the comments that bring me reflections. As I mentioned above, my personal focus in this project is about data collection. Our original design is to use a pressure sensor to capture pressure value and translate it into music & rhythms. For the type of data input, I found some useful inspirations about the type beyond the original form.

One is a feedback from our tutor, he said we are allowed to use sensors from mobile phones as a data input, as long as the main interactions are not relied on the cellphone. I think this is quite helpful, because sensors on mobile phones are more accurate, compared to those from the Arduino Kit and help us to generate music in real time. I already came up with some ideas about using gravity sensor and gyroscope sensor in different fitness equipment like dumbbells. I will work on this in the following weeks to see how I can deliver this idea.

The other feedback I found useful is to generate music according to the heart rate, which gives me a lot of inspiration beyond the traditional sensors. Including heart rate as a source or data input can bring more playful interactions and also, provide health status feedback. For example, the music type could be determined based on the heart rate and change in real time. Also, collecting heart rate data in the package can prevent users from overreacted exercise and other dangers through warnings. I will discover how to achieve through technical equipment, either DIY a heart rate detector or use current health bands to deliver this.

DISCOVERY

In the previous stage of literature review, I focused on fitness motivation and found a useful evaluation method called Sport Motivation Scale (SMS) (Pelletier et al., 1995). The reason I did this background research is to find an approach to know more about our target audience through previous studies. The next stage is to use this method, adapt it to our project and to discover what could be the best motivations for our target audience to engage in our product. I will use this scale to evaluate participants' intrinsic and extrinsic motivations in user testing sessions, analyze the result and define key factors to do exercise. This could help our team to design specific features that would attract our users and adherence behaviors.

Another concern is, in the previous research, I already found that achievement goals could be a vital motivation for users to do sports (E.p, 2013). The next step is to define

the goals in our project's settings. To be more specific, what goals shall we set up for our target audience. This will also rely on user research including interviews, SMS evaluation and other additional testing methods.

As for the product's delivery, I'm in charge of the data input section. The previous data input form is through a pressure sensor. After the pitch and consultation, we got some new inspirations about using mobile phone's sensors like gravity sensor and gyroscope sensor, combined with fitness equipment to capture data. Another potential resource is heart rate. So, I will discover whether these can be achieved in our project construction process. The main concern will be technical issues, I will rely on online tutorials, tutors' support and teamwork to overcome these.

PROJECT CONSTRAINTS

Although our group has a clear view of what our final product looks like, I am still assuming some difficulties & limitations when I actually build the product.

Theoretical: due to the COVID-19 and government's isolation rules, we might lose access to the university's lab, which might severely affect our final delivery. As an alternative approach, I will mostly rely on handmade and DIY and this might be a challenge for me and other teammates, the quality of the final delivery might not be as good, but we will try our best to deliver. Also, the isolation rules might restrict our teamwork, considering we are still planning to work as a team. My current plan is to work separately as first and then combine our work as pairs, as well as other testing sessions. Communication will be mostly online, fortunately, we found those online tools are quite useful like Zoom, Miro etc. which bring us novel experience in teamwork.

Methodological: again, due to the COVID-19 and isolation rules, we might need to change the traditional forms of user research & user testing for the concern of social distance. Face to face interviews and testing & evaluating sessions will be replaced by online video & audio interviews, I will also consider other remote user research methods including cultural probes that could maintain social distance and to see whether they can be applied in our project. As for testing sessions, the idea that comes up in my mind is to deliver the testing product to our participants, one on one for each time, and test in pairs. This might increase our workload and time, but it is my reaction to the current situation. I'm still confident of overcoming these difficulties.

Practical: the main concern is I'm still unfamiliar with Arduino Kit and other physical work, though we all got these Kits. My personal plan is to learn online tutorials, ask tutors for technical support and learn from experienced classmates. During the building process, we might find ourselves lacking some components and we might need to purchase them online that takes time to deliver. We will communicate with the teaching team to report back any cases.

Overall, I assumed we would meet many difficulties during the whole semester, but I'm still willing to overcome those confidently, one by one, with my teammates and the whole teaching team.

A PLAN FOR COMPLETION OF THE PROJECT

Based on the current understanding of our project, I have made a rough plan that includes major expected milestones below:

Date	Expected outcome	Required resources
2020/4/12	Basic understanding of Arduino Kit	Arduino Kit
2020/4/19	Approach to use pressure sensor to capture data in the first prototype Use SMS to do user research	Arduino Kit, pressure sensor
2020/4/26	If the first prototype works, consider additional input type including gravity and gyroscope sensors on cellphone/ small scale of user testing	Smart phone, Arduino Kit
2020/5/3	Prototype demonstration through video/ attempt to collect heart rate data either through smart band or DIY heart rate detector	Fitness band
2020/5/10	Connect to teammate's component, transfer the data to Tianyi's part, he will use these data to generate music/ prototype iteration	Need to consider either wire or wireless connection from hardware to software
2020/5/17	Explainer video/ prototype iteration	
2020/5/24	First attempt to combine our group work into one product/ prototype iteration	Arduino Kit, smart phone, projector other hardware support

2020/5/31	Prototype iteration based on feedback	Arduino Kit, smart phone, projector other hardware support
2020/6/7	Final product submission	

For each week, I would expect to spend 4 hours a day, 6 days a week on this course, the separation of individual/ team-base tasks would be 6:4. Also, considering the isolation, most activities in the plan would be worked individually and remotely, team-based tasks would be cooperated online by using Zoom and Miro, or offline contact in pairs to maintain social distance.

SHANE WEI

INTRODUCTION

In this project, I assume the role of team leader. Although my original idea was not the current domain, I was also very interested in the topic of musical matrix. My strength lies in the following points. First of all, I am good at communication and coordination. This is very important in teamwork. Therefore, I can efficiently and quickly deal with the different opinions of team members, so that the group work is more efficient. Secondly, I can often come up with novel ideas, whether in my own design or in teamwork. Just like in this project, I put forward a new idea of adding visual images, so that users can not only listen to music but also see some graphical images that are helpful for the movement. Finally, I have some experience in designing music-related interactive devices. Because in the Design Thinking course, I also led a team to make a music-related interactive installation, which received a lot of praise during the exhibition.

At the same time, I also have some weaknesses. I have never been good at programming. Therefore, even in this case, I always hope that our team project can continue. Because my team members can help me learn and write some needed programs. In addition, I am not good at some production methods such as welding. So, in this course, I'm looking forward to learning about programming and hardware production. And I hope that in the production of this project, I will learn more complicated methods of using Arduino and how to collect data by sensors.

During the production of the project, my main tasks are designing all graphic images, connecting them with the program which generates the music, and helping my team members purchase materials and make installations. Therefore, my work involves images, code, and physical installations. In my plan, the delivery method of my project is divided into two parts. The first part is the designed images and codes. The second part is a video of the test setup. The support I need from the team is divided into the

following areas. Initially, we need to design related questions about user research together and collect and analyze survey data after conducting online interviews with users. Secondly, we need to summarize each person's weekly results, make prototypes for testing, and analyze the test results to improve the prototype.

Focus

Because of the particularity of this project, I will explain the direction and content of my focuses in the project from two parts. First of all, during the writing of the proposal report, I focused on the relationship between music and exercise. After reading relevant literature, I came to the conclusion that adding music in the process of exercise can promote people's muscles and heart, which is beneficial to increase people's exercise time and recovery speed. These theories provide theoretical foundation and data support for our research and prove the rationality of our project design.

During the entire project, my main work direction is to design the appearance of the device and output graphic images generated by the data and provide hardware equipment to support the production of the project. I think these are very important parts in our project production. Although, the core function of our device is to generate music based on data to attract users. However, there is no doubt that a dynamic image with a reasonable structure and meeting people's aesthetic standards is more conducive to attracting the interest of the target user in our device, and can also increase the user's use of the device we design.

RESPONSE TO FEEDBACK

Initially, our vision is just to put some sensors on a plane and generate some music based on the vibration of the user's movement. According to feedback, we believe that more interactive methods should be added to this project.

First, on the device, we changed the plane to a platform of about 10cm. In this way, we can add more electronic devices to the platform, making our interaction effects more complex and diverse.

In the form of expression, we have added image display. While the user is moving, music and images will change according to the user's movement. So as to bring users more fun to use.

In the form of sports, we provide some sports modes. Users can get different music and image feedback whether they are skipping rope or yoga.

DISCOVERY

As of now, our project is still in its infancy. In the exploration of the project, we still have some problems to be solved. First, I think the most important thing is that I need to continue to look for the relationship between various exercise and music. This includes the influence of music rhythm and music genre on various exercise. Obviously, yoga and rope skipping should not use the same musical rhythm and type. In view of this problem, I think it is necessary to continue reading the literature. I need to find theoretical and experimental data suitable for our project from the research results of more researchers.

Secondly, I also need to study the relationship between image and exercise. This is something that was not covered in our group discussion. Therefore, in the research of this content, I not only need to read the literature, but also need to design some questions for interviews and research.

PROJECT CONSTRAINTS

After our discussion, I found that in the process of the project we need to face some constraints. First, we must overcome technical difficulties. Although every member of our group has received Arduino Kits, we still need to learn how to use these tools. According to the specific situation of our project, I think we need to use Arduino Kits to achieve more complex functions. Therefore, we need time and tutorials for more in-depth study.

Secondly, we still lack a lot of materials in production. I don't know where to go to make the frame structure of Fitlody. Among them, we need acrylic plates, glue and other materials. Although we can use a mobile phone as a pressure sensor, we still need a vibration sensor. I browsed some online shopping sites and found that these sensors are very expensive, and we cannot afford them. Moreover, I have purchased a projector for this project, which is an unplanned expenditure.

A PLAN FOR COMPLETION OF THE PROJECT

Because of the special situation of this semester, we are forced to study at home. This adds a lot of difficulties to the production of our project. Therefore, I have formulated a more detailed plan so that the project can be completed more smoothly.

The following is my personal work. In the next two weeks, first I will design the structure of the device and make an image. Then, I will design the output dynamic images and study how to connect these images to the output system of the device. At the same time, I will continue to look for reading literature related to various music genres and sports. After two weeks, I think our team can combine the results of these two weeks to complete the first version of the prototype for testing.

In terms of teamwork, I will continue to communicate and negotiate with my team members and design a questionnaire before testing the prototype. I think that in mid-May we can complete the production of the second version of the prototype. I hope that COVID-19 can be ended as soon as possible, so that our project can proceed more smoothly. I have been looking forward to the exhibition for this course for a year, and I really feel sorry to cancel it now.

I believe that I need to take at least 4 hours a day, 5 days a week to study on this course. Although all of us stay in home, I still think this course requires me to study more seriously. Because whether it is the application of Arduino or the design of the entire project, it will play a very important role in my future work and development.

Date	Expected outcome	Required resources
2020/4/12	Basic understanding of Arduino Kit	Arduino Kit
2020/4/19	Finish designing the images using in the first prototype Use SMS to do user research	Adobe Photoshop, Adobe Flash
2020/4/26	Analyze the data from first user testing. Finding music for the second prototype.	Miro, Music applications
2020/5/10	Connect the projector to the data from the sensors.	Projector, Arduino Kits
2020/5/17	Explainer video/ prototype iteration	
2020/5/31	Prototype iteration based on feedback	Arduino Kit, smart phone, projector other hardware support
2020/6/7	Final product submission	