<Breathe for Wellness>

PROPOSAL REPORT

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Physical Computing & Interaction Design Studio proposal

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Introduction

We are team Mobody, our team is committed to exploring the possibility of taking the breath as controller for human-computer interaction to improve wellbeing through breathing training. The team now has 4 members, each member will choose a different direction to explore using breath as part of the body controller to solve our problem space. In this proposal, we will discuss in detail the topic we are going to explore, the recent development of this area and the intended experience we are aiming to achieve. In the second part, each of us will discuss their specific exploration directions in this problem space, specific implementation and the plan of the project will be carried out.

The Team Domain

Our team's chosen domain is "Body as controller", in which users' whole body or part of their body will serve as controller or trigger when they interact with a system. That means the body is no longer just used to control interactions, but has become part of interactions themselves. After generating initial ideas, receiving feedback and conducting some research, our team has narrowed down this domain to a specific problem space: "Breathing for Wellness".

First, we chose to focus on breathing since it is an indispensable part in our daily life. Breathing is something everyone does all the time, and people are born with the most basic breathing methods, so it will be interesting to explore some novel interactions by considering something that seems simple and common in our everyday life. Moreover, the way of breathing is required in different situations, such as exercise, stress relieving, singing songs or curing respiratory diseases, also varies. That means we can explore the problem space by putting it in various contexts and targeting at different user groups, so as to find some possible playful and open-ended interactions to help people learn and practice different breathing patterns to meet their different needs.

As mentioned above, people will choose different breathing methods for different purposes. For example, people breathe differently when they sleep than when practicing yoga or sing songs. When people sleep, they will use their chest to breathe, while practicing yoga or sing songs,

they will use their belly to breathe. According to Fig 1(Airofit, 2019), we can identify when people use different breathing methods in doing different activities, the parts of the body used for breathing are different. Therefore, our team intends to help different user groups to learn the breathing style they need through some novel and playful interactions.

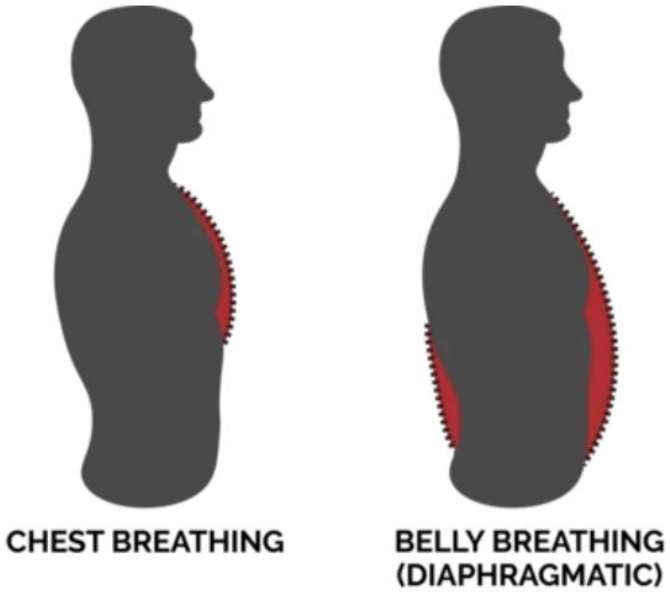

Fig 1. Chest breathing vs. Belly breathing

For this design project, our team problem space will serve as an umbrella to enable each team member to explore different solutions. The specific design and exploration direction will be further demonstrated in each member's individual part. We intend to take human values into consideration when designing each members' concept, so we identified three common guidelines of human values for our team. First, intuitive learning of breathing methods, as we want to make the learning process be more acceptable and intuitive for users and reduce their cognitive loads when learning these methods. Also, playful and engaging interactions, which is an effective way to enhance users' motivation and also a part of the requirements of the course project. Moreover, we focus on users' health, that is due to the fact that proper breathing is beneficial to people's physical and mental health, and we try to enhance their awareness of health through teaching them different breathing methods through open-ended interactions.

Response to Feedback

Our initial concept was about designing a gesture-controlled plane shooting game, and after we presented this initial concept to our peers and the teaching team, we received a lot of valuable and constructive feedback, which was useful for our team to refine our problem space and make some necessary changes of our concept. The critical summary of all the feedback is

divided into two parts: some positive ones and actionable ones, so as our team are able to get a better understanding of which aspects we did well and which aspects we can make further improvement and adjustment.

For the positive ones, most people believe using human's body as controller makes interactions engaging and intuitive, and the interaction process will also become more acceptable and operational. That means people are interested in making their body as a part of the interaction, so we can further this aspect by taking different parts of the body when we design our individual solutions. Furthermore, some critiques present that providing users with freedom of controls and interactions can be playful for them, as they are able to use their innate physical skills to be better involved in interactions between them and systems. As a response to this feedback, we are planning to try to give users the freedom of control over their interactions as much as possible, so that they can be better engaged in this process.

For actionable and constructive ones, some responses point out we should take avoiding making users feel fatigued into consideration when we focus on the 'body as controller' domain. That made us realise that since users no longer have a physical controller, we need to avoid making the user do large and exhausting movements when designing the body control part. Another three noteworthy feedbacks are going beyond the screen-based output, translating into a non-game space will be more worth exploring and considering combining that with educational content. Therefore, when we specify our problem space and change our concept, we decided to consider providing more interesting outputs for user, like lights, sounds and colours and applying this domain to some other contexts, like our final problem space shows, combining health with some educational content to teach different target audience to learn different breathing methods and breathe for a better life. Moreover, some critiques suggest our team can explore other parts of the body as controllers rather than just focusing on hands and we can pay more attention to the everyday objects. So, as a response, our team chose to explore the possibility of integrating other parts of the body into the interaction process, like chest, mouth, belly and so on, and also decided to put this domain into a day-to-day environment and the activity everyone will do in their daily base, which is breathing. Finally, there is also a critique around reducing users' cognitive and memory loads when learning how to interact. Thus, our team considers minimising users' cognitive load and the needs of working memory, so as to enhance the learnability of each individual's projects.

Related Work

Existing product

Foundation of Yoga - Yoga with Adriene

This is a Youtube video series that teaches the audience different Yoga techniques from beginner to expert level. These videos describe Yoga as an activity that combines breathing

techniques and body movement to achieve better physical and mental health, which is consistent with our group theme: Using body as controller to enhance users' health and wellbeing. Our project mainly focuses on using breathing techniques to achieve specific purposes.

Breathing is one of the most frequent movements generated by our body, which happens 12 times in average per minute. Without considering the physical capacity and limitation, we can control the length and the depth of our breath.The foundation of Yoga introduces multiple breathing techniques that bring different impacts to our body. To dig deeper into the breathing techniques, our group has discovered that the 4-7-8 breathing technique can help patients who suffer from insomnia improve their sleep quality; Patients who have chronic obstructive pulmonary can relate their body status by practicing diaphragmatic breathing technique. In general, this video series lay the foundation of our project proposal.

Calm

According to the official website, Calm is an meditation application designed for reducing anxiety and stress, developing gratitude, increasing happiness, improving performance and sleep quality, and building self-esteem. This application guides users to breathe and plays music to calm their emotion. Consistent with the body as controller, calm uses hearing as a receiver and breathing as a controller to regulate body status. This application uses slow music to bring a calming effect to the users, and applies breathing techniques to slow down heart beats and even lose the constricted blood vessels. This is a fabulous example that integrates breathing techniques, environmental aids with health. As an extension of our project, adding more environmental aids, for example an essential oil will provide a better calming effect.

This application allows users to practice meditation without considering time and location. These characteristics should be well applied on future physical computing devices. We can anticipate that a small in size and functional breathe technique teaching device is suitable for everyday use. They can gradually develop and master breathing techniques that bring positive impact to their health and well being.

Breathing game

Breath game is a physical device that encourages users to practice pursed lip breathing technique. This device is designed for those who suffer from asthma and pulmonary illnesses. The designer has turned this breathing practice into different games to increase users' motivation which is effective on young children. They are not willing to practice boring breathing tasks daily, but integrating this task with TV programs and video games turns the ordinary act into an interesting adventure. As a short conclusion, gamification elements are effective on young user groups, which can be applied on future physical computing projects.

Moreover, it is effective to examine the accuracy and correctness of the breathing practice due to the gaming mechanism. The user can not start the next level before doing the task correctly. Similar to other physical computing devices, these machines are portable and light which are

built for daily usage. They are in different forms such as glasses, bracelets, and necklaces. These are the important insights that we will be referring to in the group project.

Literature Review

Breathing is not only a topic being concerned in the market area, in fact, research about effect and training is also valued by academia.

The effect of breathing training on wellbeing has been confirmed by multiple studies, including improving self-relaxation level under stress(Wuyts et al., 2017), chronic heart failure(Drozdz et al., 2016), rehabilitating from respiratory diseases(Dong et al., 2016), and reducing children 's anxiety and controlling asthma symptoms(Chiang et al., 2009). Some of these researches(Chiang et al., 2009; Drozdz et al., 2016; Kawecka-Jaszcz et al., 2017) also use digital supports including sensor detection and screen feedback for participants in training to improve health to enhance the training effect. Specifically, Wuyts et al.(2017) used a commercial therapy device RESPeRATE to support participants in slow breathing training. RESPeRATE(RESPeRATE, 2020) uses a waist belt as a sensor to detect the user's breathing data, and provide feedback and guide users by a simple display screen. Chiang et al.(2009) used electromyogram and self-assessment scale to collect data on children's relaxation effects.

In addition to medical exploration, there are also studies(Dong et al., 2016; Zhang et al., 2019) on breathing training interactive devices for family use scenarios.

In order to reduce the cost of disabled persons in breathing training equipment, Zhang et al.(2019) explored a more intuitive way of human-computer interaction. They used Triboelectric nanogenerators (TENGs) as sensors to detect the user's breathing signals. When the person's breath passes through the thin film of TENGs, an electrical signal will be generated on the film as an input part of the interaction. This article discussed an application example, that is, integrating TENGs on the face mask to directly receive the user's breathing signal to control other household devices. But the study discusses mainly the technology of the sensor rather than explore in depth the possibilities of interaction. We think this research provides us with an unusual example for hardware exploration, but the method itself has higher technical requirements. We believe that it can have more interesting performance in exploring new interactive fields.

And another study(Dong et al., 2016) on the family-use scenario involved different input modes. The study uses sound signals as the input method of breathing, and uses MatLab to analyse the audio signal to detect the user's breathing state. Compared with Zhang(2019)'s research, this study uses lower cost and more portable hardware. They also explored more implementations at the interactive level. The researchers used a gamified design to allow participants to use breathing to control the rise and fall of the balloon, thereby enhancing participants' engagement. We think this is also an interesting attempt, but the author did not mention in detail in the study whether the game settings will change due to everyone's personal status and whether it will dynamically adjust the user's training. We think that there is still a lot to

explore, especially the training itself may require more guidance and feedback, rather than score of the game.

Audience & Intended Experience

Our team will be working under the same problem space which is improving people's wellness through breathing. We aim to engage our audience to practise different breathing methods to improve their health conditions and their capabilities to complete certain activities that need specific breathing techniques to enhance their performance effectively. In general, our audience should have open-minded and tech-savvy characteristics. Their attitudes towards engaging new technology with their everyday life must be positive and enthusiastic. For our team, our target audience will be university students and working adults between 20 to 40 years old where doing some breathing exercises should not be a big challenge to the majority of them and have their own quiet personal space to execute the exercises when needed.

We aim to provide our audience a meaningful, easy-to-use and highly interactive experience by producing different audio and visual effects that react accordingly to our audience's way of breathing. During the interactions, different effects displayed or heard will allow the audience to have proper guidance, prompt corrections and motivations to make sure they are learning the breathing techniques effectively. With sensors that can detect human motions and humidity in a distance, our audience will also be able to enjoy the exercise without wearing anything on them during the interactions. To greatly benefit from the breathing exercises, our audience needs to do the exercises in a quiet space to minimise distractions and interruptions. Overall, we hope our audience to experience a healthier lifestyle and better wellbeing by learning and utilising different breathing methods according to their needs and situations. A detailed description of target audience and specific intended experience for each of our concepts will be listed in our individual report. Please refer to the focus section in our individual report for details.

Relevance to Theme

In general, our group aims to design a playful and interactive physical computing device that uses the body as controller to practice different breathing techniques that maintain or improve our health and wellbeing daily. Our group members will be focusing on different users groups which target a specific problem space. For example, some are developing projects to help people who suffer from insomnia to enhance the quality of sleep; some are building devices to help people who suffer from chronic respiratory disease or panic phobia to practice some breathing techniques that regulate their body abnormality. Although the design and implementation of our individual project is unique, all the projects are following the same theme and domain.

Individual Sections

Paula Lin

Introduction

I am Paula. My team domain space is “Body as controller” and our problem space is improving one’s wellbeing through breathing. My strengths are proficient in user-centered design, user testing and some coding experiences in the front and back-ends. My weaknesses are lack of experience in Arduino and electrical engineering related things. I am not a very handy person. Before the induction and soldering workshops, I have never done any wood cutting and soldering before. Therefore, my aims for the course are to improve my hands-on skills, learning how to build a physical product from scratch and code to make it as functional as possible. My approach to the project delivery will be starting with research about different breathing techniques and their benefits, then choose one of the most effective breathing techniques for my target audience, then brainstorm on various interactions and effects for the audience to choose the most appealing one for future development and testing. With the team, I can provide support when they need testers to test their prototypes and provide valuable feedback and suggestions for them to improve on their prototypes. I will be able to gain the same kind of supports from my three other teammates to evaluate my design.

Focus

Our team domain space is “Body as Controller” and our problem space is “Breathe for Wellness”. The problem space “Breathe for Wellness” originated from my pitch idea The BIBO light. It was a light that educate people on how to do the 478 breathing technique to reduce anxiety and improve sleeping quality. We will each develop our individual concept and attend to different user groups. My focus will be designing a device that can improve conditions of people with chronic lung disease through specific breathing techniques. My device will train people to practise some breathing exercises to improve their breathing patterns, relieve the shortness of breath and promote relaxation. The exercise can be carried out in quiet space to avoid distractions. Breathing can be detected using either the air blowing out through mouth or chest movements. This fits our team domain “Body as Controller” as my audience will need to use their breath during the breathing exercise to interact with my design. Through my exploration, I aim to achieve in maximising interactions between my design and audience through visual and audio effects. These effects will also act as a guidance to train the audience to execute the breathing exercise properly. Meanwhile, I hope to also achieve in making my design more appealing and motivating to encourage my target audience in utilizing it so that their breathing problems and quality of life can be improved.

Discovery

In the early stages of the project, there are still many unknown on how to build and develop my concept into a physical product.

Currently, there are some key concerns that include:

1. What type of sensors should I use? Temperature/Humidity/Wind sensor?

2. How to make the design more appealing? Adding animations or personifying the product?

3. Alternative components to make the product work efficiently

4. What if my sensors or Arduino broke down unexpectedly

I am not very concerned about the feasibility because I believe as long as I can get the right resources, things will work with codes implemented correctly. Also, if soldering or machines are needed, the university workshop is open. Methods and approaches to my concerns will definitely be doing plenty of research online about existing breathing app and devices to investigate how they motivate and teach people the breathing techniques. In addition, reporting back weekly to the tutors on my progress and collecting feedbacks will definitely help in my Arduino work and purchase of the right components. Consultation with tutors will also help when I encounter technical issues. I will also discuss with team members and our course mates to make the most appropriate design choice and produce prototype for testing and feedbacks. For product defects or breakdown, I think having extras will solve the issues if they are not too costly.

Project Constraints

The project's intention is to allow the audience to use part of their body as a controller to interact with my product. In my project, user's breathing patterns will be used as the controller. To ensure the intended experience and outcome of the project will be successful, a working sensors, correct coding and functional Arduino are the essentials.

Possible Constraints	Discovery alleviation
1. Product deficiency	Regular testing of prototype and extra purchase as backup
2. Purchase not delivered on time/undelivered/wrong delivery	Check seller reviews and rating before purchase
3. Cost	Discuss with course coordinator and tutors if the purchase is necessary but too costly

4. Limited access to target audience (lung disease patient)	The breathing exercise benefits people without lung disease too, testing can still be done and check how people feel after doing the exercise
5. Need to practise the breathing exercise regularly and correctly for a period of time to see results in breathing and quality of life improve.	Breathing exercise can be done even without the prototype. Testing can start early for a period of time to record how people feel after doing the exercise.
6. User experience: Usability and learnability of the design	Conduct testing with course mates and obtain feedbacks for refinement

Plan for completion

Milestone	Key steps	Resources	Deliverables
1. Planning for prototype (20-30 Apr)	Individual report back to studio and discuss concepts and queries with tutors. 23 Apr: Finalised prototype planning and start building 27 Apr: Technical support session with tutor on prototype 3 May: Upload prototype video and documentation to MIRO	1. Cash to buy components for building the prototype. I need to get sensors. 2. 4 hours per day to work on project and team support	4 May: Video and document added to MIRO 8 May: Team-based appraisals of allocated concepts as comments on Miro board

2. Concept refinement (9-31 May)	Review feedbacks and refine concept. Report back to studio. 9 May: Review prototype feedbacks and improve concept 17 May: Upload explainer video to MIRO for review and feedback 24 May: Finalised refinement and gain support if necessary in studio and continue working on the prototype	1. Cash to purchase any missing or necessary components for improving prototype 2. 4 hours per day to work on project and team support	19 May: Explainer video to MIRO
3. Exhibition preparation (1-9 Jun)	Final touch up and fine tuning the prototype for exhibition. Queries and support will be communicated through slack with tutors if necessary	1. 4 hours per day to work on refinement and team support	9 Jun: Virtual exhibit

John Cheung

Introduction

Due to the coronavirus, our team goal switches from building a hand controller game to working on individual projects under the same domain, which is using breathing techniques to enhance well beings and improve health. For self-introduction, my name is John. My strengths are User Interface Design, User Experience research and making animation; My weaknesses are electrical engineering, and the lack of experience in software building for an electronic gadget. My aim for this course is to build a physical product that can guide people who suffer from panic disorder to breathe correctly which reduces their tension and anxiety.

There will be three stages in my project development, including Concept and Research Sketch and Prototype, Implementation and testing. This product will be built step by step with the support from tutors and my team members. Although our group members are building different products, our main theme is the same. We will have regular group meetings to update our progress. Since we are all researching the impact of different breathing techniques. we will inform the other members when we find something useful. Furthermore, some of our team members are not good at programming, we will help them to solve the challenging coding questions.

My Focus

The target audience of my project is the people who suffer from a panic phobia. They may experience trembling, breath shortness which can trigger other serious illnesses, such as heart attack. Performing breathing techniques can save their life at critical moments because it reduces heart rates and blood pressure in a short period. The product I want to build is a breathing skill trainer which allows the target audience to use their breath as a physical controller to practice breathing techniques daily when there is a sudden rise in heart rate. It will gradually generate classical conditioning when a panic attack happens. Eventually, this body reaction can lower the risk of having a heart attack, reduce fear and anxiety.

To build a portable physical computing device, the material used should be light, durable and safe to use. The low weight allows users to bring the device along with them anywhere every day which matches the project theme. The hardness ensures the device functionality working in a good condition even after some minor damage… As this device will be worn on the user's neck, the material used to build this project should be allergy-proof and not sensitive to skin.

The accuracy of sensors is the utmost important element in this project, it will generate signals to inform users to check their current body status and send feedback to remind them of the necessity of breathing techniques practice. Also, I will do more research on providing environmental aids to enhance the user experience, for example adding lavender oil and slow music to calm them. but it will not be discussed in the following paragraph due to the uncertainty.

Discovery

There are two key questions that I discovered during my concept development. Firstly, it is difficult to reach my target audience. I have online interviewed one person who suffered from the panic phobia, but it would not be sufficient to determine their needs. To dig deeper into this topic, I would watch more videos that described their phobia experience, read journal articles about the treatment and the guidelines from psychologists. Moreover, it is very difficult to do user testing. Due to the coronavirus, it is unsafe to reuse the breathing technique trainer, which may limit the number of testers. To solve this problem, I may use an alternative way to conduct the test, such as a prototype made of wood, paper. Or create the device with a separated breath receiver, which is removable for hygiene and multiple testing.

Secondly, it is costly and inefficient to determine what materials should be selected to provide a better user experience. There are three key elements in this project: light, durable and safe. Since safety is the most important component in this project, I will first consider the materials that are allergy-proof and safe to use and select the best material that can balance the cost, weight, and hardness. Also, I will do further investigation on the user experience when people are wearing necklaces in different weights.

Project Constraints

Theoretical Constraints - Assumed restriction

This product will be built in the form of a necklace that is portable, light, and small. These features are theoretical constraints in my project. Compared to most of the demo Arduino tutorials shown in school and Youtube, the size of my product is very small, approximately 10 cm in length, 5 cm in width and 3 cm in height. It is difficult to compress all the essential parts into a small volume like this. To solve this question, In my discovery, some devices are good in function, but easy to carry. For example, the breathing game in related work allows users to practice breathing by holding it on their ears with lightweight, unlike the traditional lip breathing machine which is bulky and unportable. Theoretically, I can either expand the size of the container while keeping it durable and light or limit the size of the electric board to fit in the small container. Or do both if I have more budget, it will be (Further discussed in practical constraints).

Practical Constraints - Cost of production

'Durable' and 'Light' are the two major elements I would consider for this product. In my production plan, acrylic will be used to build the structure and appearance as a backup plan due to the hardness and light in weight, but bulky for a necklace. I am still looking for some materials that are cheap, light, thin and hard; Also, the volume of the product is too small to hold the sensor and the electric board provided by the faculty. I may spend extra money on purchasing these in a suitable size, with about 25 UD - 100 AUD depending on the function and size of boards and sensors. The cost of production is not predictable at this stage, future research needs to be conducted to estimate the cost of production.

Methodological Constraints - Access to the audience for evaluation

Due to the coronavirus, people avoid physical contact and maintain a safe social distance, it would be difficult to invite the audience for product evaluation. Also, this product requires users to breathe in and breathe out, which is a medium of infection. It is not safe to recruit more than one person to test the product, the cost of producing more than one device is too high. Considering the constraints, I will send a paper prototype to the other audience for testing which follows the same procedures to simulate the actual testing scenario.

Plan

Milestone 1: Concept and Research(Week 4 - Week 6)

Goal:

- Conduct user research to generate user story and persona
- Finalized the key features and functionality
- Estimate the cost of production

Time:

- 5 hours on team-based task each week (Report Writing, Group meeting)
- 10 hours on individual task(User Research, Trending product, Academic research article)

Budget

- Free Arduino kit provided by the faculty

Milestone 2: Sketch and Prototype: (Week 7 - Week 10)

Goal:

- Sketch the physical appearance of the product
- Sketch the user interface of the product
- Build the product in UQ Maker Space
- Build the function of the product through Arduino
- Finalize the prototype

Time:

- Team appraisal
- Not less than 20 hours on individual task (Sketch, Build the project, Prototype Demonstration)

Budget

- Depending on the material I use to build the product (Laser cutting and 3D printing (Optional))
- Laser Cutting trial
- Extra Arduino sensor no more than 50 AUD
- Video Recording (Borrow Camera and video editing software)

Milestone 3: Implementation and testing (Week 11 - Week 13)

Goal:

- Finalize the product
- User testing
- Improve product functionality and design

- Finish Documentation

Time:

- 10 hours on team-based task each week(Final Delivery Report, Group meeting)
- 15 hours on individual task(Final Delivery (Individual), Testing, Critical Reflection)

Budget

- Depending on the user feedback after testing (No more than 50 AUD)

Sicheng

Introduction

I am Sicheng and I am currently in my last semester of Master of Interaction Design program. I have learned several interaction design skills, including user research methods, design principles and prototyping skills, which allows me to carry out my project in a more organised manner. Now I have mastered several technical skills, such as web development and Unity development. These skills allow me and my teammates to implement our ideas as close to our concept as possible. Also, I have been trained in criticism, so hopefully I can provide practical suggestions for improvement to my teammates.

My current weakness is that I am not very familiar with hardware, especially using sensors properly and making analog circuits. But according to the current situation, I may need to learn it myself seriously and solve specific problems by learning from my teammates. The other weakness is my time management ability. I have been coping well by benefiting from the group pressure before, but the current situation of isolation at home leads me to rely more on myself. Hopefully, communicating with teammates and discussing the progress would help me catch up the progress.

My Focus

In the group's related work research, we found many existing breathing training and even some interactive devices for breathing training. But I found that they mainly focus on the slow breathing training when users sit down. On the other hand, there is also some evidence(Airofit, 2019; Kuzma, 2019; Natmessnig, 2018) that maintaining a scientific breathing rate in sports is also helpful for health. These articles have similar skills, such as using abdominal breathing, and slowing down when breathing is not keeping up. But it is not an easy thing to keep people thinking during exercise. And breathing as a relatively abstract activity so that joggers might have difficulty understanding whether they are doing it correctly. So I think it will be a meaningful and interesting topic to design equipment for them and let them interact with the equipment through breathing. Therefore, I will focus on exploring devices that provide breathing training feedback to the jogging group.

What I want to achieve through the semester is to make a prototype with relatively complete functions. I may not expect pleasing shapes because I don’t have much resources so far to make one. But I want it to be solid enough to allow people to conduct outdoor tests. So in the course I want to learn how to use electrical signals to achieve complex functions, how to combine software and hardware and further learn how to design user-centred non-traditional interaction modes.

The advantage of our team is that everyone has achieved the agreement in a unified direction, that is, using breathing as controller and gaining health. Therefore, I can share the information I collected with my teammates. At present, we have a team Miro board, a team Zotero library and a team Google drive that allow us to share resources efficiently. From a personal project perspective, I need to explore sensors that detect breathing and how to use breathing to

interact. These are the key factors under this domain. So I think these are the parts that are worth sharing among the teams .

Discovery

My focus will be on exploring training feedback devices that use breath control when the user is exercising outdoors. Outdoor exercise has a more complex environment than indoor training, including the noise of people and the environment. Therefore, my focus will be portability of the device, anti-interference, and one of the most important, exploring how to best interact with people who are focused on sports. I want to explore a way to provide them with enough feedback without interfering with their sports. interactive mode.

As I mentioned in the previous section, the content explored by our group so far mainly covers sitting-down breathing training and some HCI devices that provide breathing feedback, and also found some breathing training modes proposed for exercise. I therefore proposed the direction of my focus. But so far I have not found a device for this field, so I want to further explore related work specific to my area. Or the reason for lacking related products in this field.

Another concern is that I currently lack user research data. This concept is actually based on assumptions obtained from secondary research, but we have not yet carried out user research yet. Therefore, the specific needs of users are still uncertain. Based on the current situation, outdoor exercise alone is allowed, so I still have the conditions to collect users exercising observation data through the wearable camera and conduct evaluation later on. Alternatively, we can have a culture probe for participants to note the feelings and thoughts practicing breath training when they are exercising. But this also depends on whether the situation will keep steady in the next few weeks.

I also need to do more explorations in terms of hardware, such as how to use sensors to receive user input. My initial idea is to use a microphone for analysing users' breathing sound, but we cannot be sure whether there is a difference between the sounds of abdominal breathing and non-abdominal breathing? Otherwise, I need to consider if I need to replace the sensor.

Project Constraints

The indented experience of this project is to provide users with an unburdened breath-controlled interactive device to guide them to use more scientific breathing methods to improve their exercise efficiency and obtain health.

Theoretical Constraints

The first theoretical constraint will be the effect of training, because such training may be a relatively long-term process, and it is difficult to show it in short-term user evaluation. Therefore, it is difficult to determine whether such a design is effective. The first alternative solution can be learning from existing research to gain more theoretical data to provide background support for the training model we provided. Of course, it is also worth further researching on how to evaluate the short-term or single breath training effect evaluation.

Another limitation is the context under the group problem space, because the rest of our group is almost all breathing training projects for users remaining in the same place, but I am looking for moving users. But I still want to be consistent with the team in the problem space to provide more team support within the group. So I need to review my progress from time to time to make sure that I and the team are in the same context.

Practical Constraints

One of the practical constraints is that my project requires a sufficiently portable and solid device for users to carry and detect their breathing. Therefore, the shape will be a focus of the design. The design of the shape will require more equipment supporting, such as cutting machines and other equipment. This may require the support of the campus innovation center. Of course, the outlook design also needs additional evaluation from users before we carry out the final prototype.

Sensors are also the focus of this topic. At present, this project intends to use a microphone as the sensor. Using a microphone can potentially reduce the cost of the project because it's popularity. But if the microphone cannot achieve the expected effect, this constraint may need to be re-evaluated.

On the other hand, because this is expected to be an outdoor device, it needs to be solid enough for evaluation. Therefore, I also need some more professional fixing methods than breadboard prototypes, such as using electric welding and other methods. Prototype packaging. This may also bring additional costs, such as component losses. Of course, a potential alternative solution is that users test on the treadmill or run in place, so that we can place the prototype on the table and use only wires to connect the sensor.

Project Plan

Milestone 1: User research and ideation (Week 6 - Week 7)

Task:

- Conduct user research, including online interview and probe / wearable cam observation
- Analysing user research data
- Settle down the key interaction method and input/output method
- Draft and concept map for prototype

Time allocation:

- 10 hours on user research data collecting
- 3 hours on analysing user research data
- 2 hours on creating concept map and draft
- 2 hours on reflection
- 1 hours on group meeting
- 2 hours on learning Arduino skills

Material:

- Finding a wearable camera if available, otherwise using probe ($20 maximum)

Milestone 2: Prototyping and evaluation (Week 8 - Week 10)

Task:

- Design the outlook for the device
- Test out sensor
- Test out output method
- Making the prototype of device shell
- Assembling the prototype
- Conducting evaluation using video

Time:

- 8 hours per week on prototyping / Evaluation
- 5 hours per week on group meeting and resources sharing
- 3 hours per week on learning Arduino
- 1 hours on reflection
- 1 hours on documenting the work

Material:

- Graphic design tool (owned)
- Camera (owned)
- Video editing tool (owned)
- ~$70 on sensor purchasing
- ~$30 on shell material and making
- Equipment from campus workshop

Milestone 3: Further development and finalising (Week 11- Week 13)

Task:

- Improving the outlook and interaction of prototype based on feedback
- Conducting evaluation using video
- Preparing for exhibition
- Documenting the work had done

Time:

- 7 hours per week on developing prototype
- 5 hours per week on documenting the prototype
- 5 hours per week on group meeting and resources sharing
- 2 hours per week (before week 13) on reflecting
- 1 hours per week (before week 13) on creating extra material (e.g. digital brooches)
- 3 hours on week 13 preparing for exhibition

Material:

- Graphic design tool (owned)
- ~$50 on further electronic devices purchasing
- ~$30 on further shell material
- Equipment from campus workshop

Menghao

Introduction

Hi, this is Menghao. Although we will work in a team manner but focus more on the individual part, we can still contribute to each other's individual part by providing and using support of the whole team. My strengths are user research, user-centred design principles, graphic design, evaluation methods, etc., and my weaknesses are programming, hardware building and so on. So, I will support our team in terms of helping them conduct user research and evaluation methods remotely, providing suggestions around applying design principles in the individual project, and supporting their graphic design. I will make use of the team supports by seeking advice and help for coping with some coding and hardware building challenges. Furthermore, our team will hold weekly meetings to maintain effective communication and coordination, and update each one's design process. We will also draw on some collaboration tools, like Miro, to help us share useful resources and inspirations during the design process.

As for the aim of this course, I am looking forward to gaining a better understanding of physical computing and learning how to better integrate the digital world with the physical world by coming up with some novel interaction means. At the same time, I also want to acquire some new skills, such as creating circuit boards and hardware and hope to expand my skill sets. Finally, I also want to use this opportunity to consider more about human value when designing for everyday life. In terms of my approach to the final delivery, I will allocate my time reasonably and complete that according to three proposed design phases: Concept generating & Prototyping planning; Concept drafting & Prototyping making, and Concept refinement & Prototyping making.

My focus

Our team problem space is 'Breathing for wellness', which aims to enable users to acquire different breathing techniques through some playful and intuitive exercise visualisation ways to meet their varied personal needs, such as relieving stress, doing sports, singing songs, and curing respiratory diseases. Therefore, it will be worth exploring to choose a particular breathing method and explore how to combine it with physical computing. So, my personal focus is about teaching and motivating those who are interested in singing how to master the 'Belly Breathing' (also known as 'Diaphragmatic Breathing') method through some interesting and interactive exercises.

The target audience of my individual project are young singing-lovers who want to acquire the breathing technique used for singing but find common existing breathing exercises are boring and do not motivate them to practice. First of all, this user group is more receptive to new things, so they are more willing to learn a new breathing technique to meet their needs. Secondly, they tend to use some engaging and novel technologies to help them achieve their goals.

My aim is exploring how to practice belly breathing correctly and interestingly. To be more specific, combining the seemingly abstract activity, practicing breathing, with human-computer interaction and physical computing to provide learners with a clearer feedback of practicing, i.e. a more practice visualisation of their practice outcomes. To achieve that, I intend to offer users a multi-dimensional way to get multi-sensory feedback, such as visual, auditory and haptic feedback, so as to better practice and master the belly breathing technique. By focusing on that, our team domain can not only have an interesting combination with the music field, but can be deeply explored on a specific breathing technique.

Response to feedback

After the pitch critique session, our team received a great amount of valuable and actionable feedback, and based on that, we have made major changes to our team's problem space, target audience and initial concept. Accordingly, my personal focus and research direction have also amended to some extent.

First of all, our previous design space was about exploring gesture-controlled video games under the 'Body as controller' domain. According to the received feedback, many people held the opinion that focusing on video games may limit us to only focus on the screen-based outputs and using other parts of the body as controller will be worth exploring for us. Therefore, we decided to remove our reliance on screens and move our focus from on hand gestures to more playful inputs. My personal responses are focusing on multi-dimensional feedback instead of only using screens, and considering other parts of the body to trigger interactions, like users' abdomen, mouth and nose.

Furthermore, some feedback suggested us to explore a non-game space and put the domain into a more day-to-day environment, so our team considered to change our initial concept by combining this domain with users' daily life and putting the domain into other contexts. Therefore, our problem space changed from gesture-controlled video games to breathing for wellness, which is a day-to-day context. My personal responses are exploring one specific breathing technique, and using interactive and novel ways to help users practice that. In addition, due to the amendment of the concept, our team's and individual's target audience also changed. Team's target audience are those who believe common breathing practice ways are too boring and hard to follow, and the more specific target audience of my individual exploration are youngsters who enjoy singing and want to acquire the singing breathing technique through novel practice ways.

Discovery

As mentioned above, my initial idea is exploring a solution that can help target users to learn and practice belly breathing technique through playful and intuitive interactions. So, my first key concern is how to ensure interactions will be playful and intuitive to my target audience. I focus on designing for young singing-lovers and because they have been exposed to various interactions, they are more demanding about the novelty of interactions. Therefore, interaction ways should be explored and designed to meet their preferences and be attractive to them. Also, designing some playful and open-ended interactions is also an essential requirement of

the studio theme. So, for this unknown, I will further investigate it by conducting user research, reviewing literature, and taking a look at others' projects to get more inspirations about that. Especially for the user research part, I read some articles to find some online user research techniques that can be used during the epidemic, like VoIP (Voice over Internet Protocol) technologies (such as Skype, Zoom, etc.). That will enable me to conduct interviews with participants by using online voice synchronous connection.

The second concern is about how to choose appropriate materials when implementing and manifesting my concept. First, as the context we are designing for is around the day-to-day environment and it is also a part of the studio theme, how to better integrate the proposed system into daily life requires a clearer understanding of available materials. Second, since our team theme is 'body controller', it is important to choose the appropriate materials to enable the body to be part of interactions. Innovative use of materials can only be achieved by selecting and using appropriate materials to create open-ended interactive forms. So, for this unknown, I will further investigate it by getting familiar with all the materials of the Arduino beginner toolkits and searching online to find other useful materials in the Arduino family, so as to determine what are useful to build my prototype. I will also try to get some suggestions and approval from the teaching team in terms of choosing materials.

Project constraints

When delivering the intended experience of my project, there will be some constraints and some pre-planned approaches can be proposed to cope with them. First, some theoretical constraints can be identified. Since my current initial idea is using users' abdomen, mouth and nose as parts of interactions to help them practice the belly breathing method, it might be complicated for the system to detect the parameters of different parts of the interaction. In order to cope with that, as I mentioned in the previous session, I will conduct more research around the materials and resources I can draw on, so as to choose some effective sensors for my system. Another theoretical constraint is how to use sensed parameters to provide users with clearer visualisations of their practice outcomes. For addressing this, I will get inspirations from others' data visualisation projects and use some health-related online website resources (Healthline, HealthCentral, etc.) to get to know some of the ways to help users practice breathing techniques.

Other noteworthy constraints are around the methodologies for contextual inquiry and user evaluation. Because of the rapidly evolving situation of COVID-19, it is impossible for us to conduct face-to-face interviews, observations, and user testing. Alternatively, I will conduct some online user research by using some online research methods, like VoIP (Voice over Internet Protocol) to gather the qualitative and quantitative data in a synchronous manner, or I can use the cultural probe method to collect data. Also, since the prototype is going to be the combination of physical and digital parts and is going to be tested by asking users to do some breathing exercise, it is not cost-effective if I create more than one final product to ensure each participant has one to test. Therefore, I will try to use Unmoderated Remote Usability Testing (URUT) methods to do the evaluation part, or I could try to evaluate with one person one time and keep the social distance according to the latest government guidance for social gathering.

Moreover, there are also some practical constraints when it comes to the budget of building this project. I hope to use different sensors to detect the data of different parts of the body, so purchasing some sensors may be expensive to me. Besides, I will also need to buy some other materials to build the physical parts of my prototype. For example, purchasing some fastening magic straps to attach sensors to users' belly, and purchasing some wood to create a sensing area for users' mouth and nose breathing. By addressing these constraints, I will first try to find more alternative and cheaper resources and materials online, and then seek help from my friends or the teaching team to inquire whether they are able to provide me with that.

Project plan

Milestone 1: Concept generating & Prototyping planning (Week 6 – Week 7)

Key steps:

- Exploring technologies and resources can be used for individual project
- Conducting desk research and user research
- Creating conceptual model of finalised concept

Resources needed:

- Preparing online consent forms for participants
- Setting up online interview meeting/chatting
- Allocating 10 hours to conduct research and data analysis parts
- Allocating 5 hours to explore technical resources and sharing with the team
- Allocating 5 hours to integrate resources and data to form project concept

Milestone 2: Concept drafting & Prototyping making (Week 7 – Week 10)

Key steps:

- Drafting the concept and preparing needed materials for prototyping
- Making the core features of initial prototype
- Filming interactions of initial prototype to gather feedback

Resources needed:

- Budgeting 50-100 dollars to purchase both physical and electronic materials
- Allocating 15 hours (per week) to make the initial prototype
- Allocating 2 hours (per week) to explore useful resources and sharing with the team
- Allocating 3 hours (per week) to support and get help from the team
- Allocating 2 hours (week 9) to film and edit the demonstration video
- Sparing some addition hours to complete the key steps

Milestone 3: Concept refinement & Prototyping making (Week 10 – Week 14)

Key steps:

- Refining the concept and preparing needed materials for prototyping
- Improving the prototype based on received feedback
- Finalising the proof-of-concept prototype
- Filming interactions of improved prototype to gather feedback
- Improving the prototype based on received feedback
- Preparing for virtual exhibition

Resources needed:

- Budgeting 50-100 dollars to purchase both physical and electronic materials
- Allocating 15 hours (per week) to make and improve the prototype
- Allocating 2 hours (week 10+12) to summarise feedback and refine the concept
- Allocating 2 hours (week11) to film and edit the explanation video
- Allocating 2 hours (per week) to explore useful resources and sharing with the team
- Allocating 3 hours (per week) to support and get help from the team
- Allocating 2 hours (week 14) to prepare the final exhibition
- Sparing some addition hours to complete the key steps

Acknowledgement

The cover artwork is retrieved from Unsplash(Owens, 2018) based on CC0 protocol.

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