Design Informatics | 2022

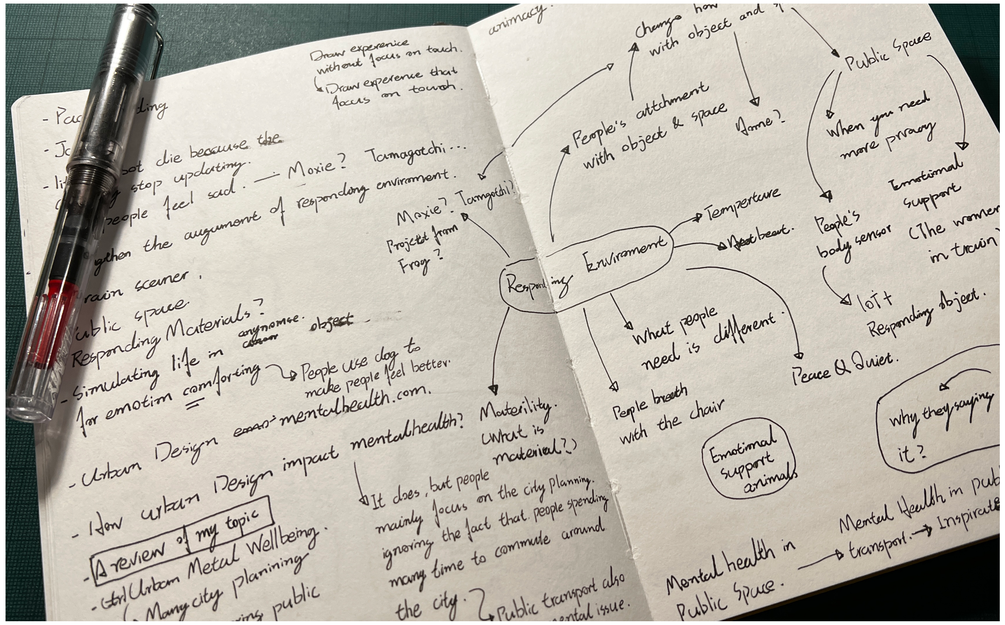
Portfolio

Haili Wu

Kicking Off

Design sprint is a self-direct project in the design informatics, which allows me to work on anything that I am interested at.
The start of a self-direct project can be often overwhelming because there are no limitations. Therefore, I kick off my project through conversation with peers; the topic covers what we observe in everyday life to the complex social problem we care about, which is helpful to narrow down my focus. This time, the conversation dragged me into mental well-being in urban public transport space, as we realised that there are not many people looking happy on the London Underground service.

The mind map I did at the begining of the project



People alook frustrating on train

01

Discover

Problems
Studys
Current Solutions
Under explore Areas

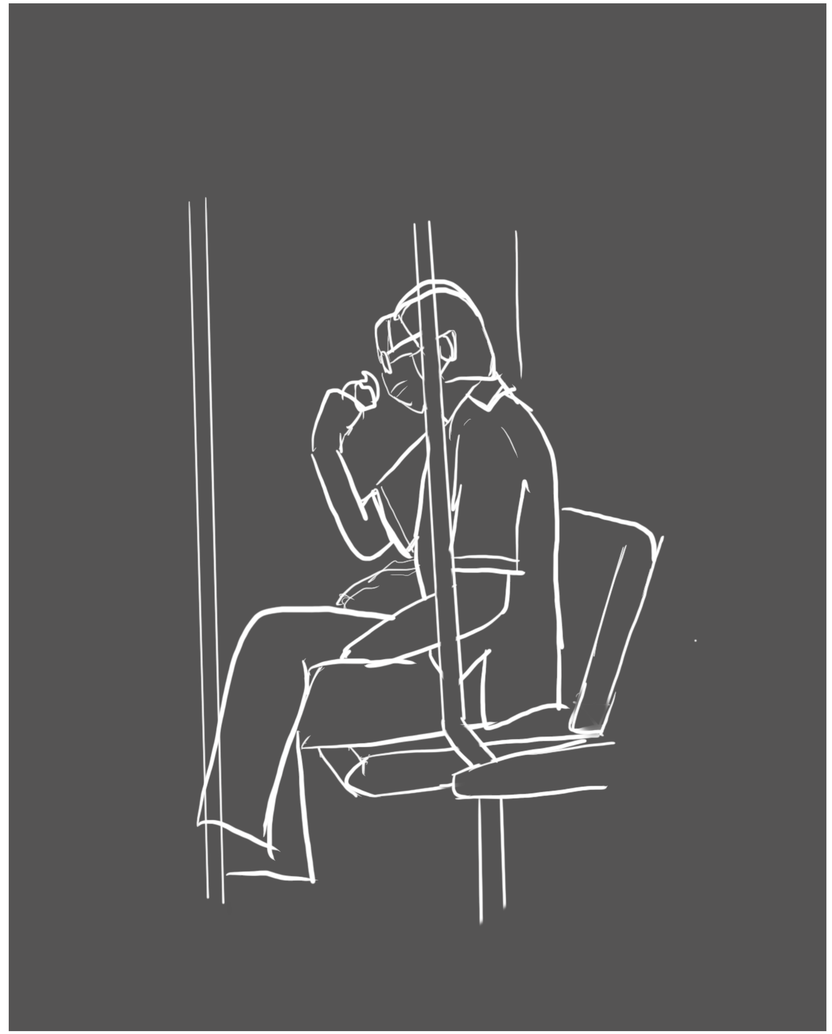
Discover

My interest in mental health problems drives me to do more in-depth research. My research shows that although mental health issues in urban environments have been discussed broadly over the past decades [1], most of the study is focused on exploring how city planning, modifying landscape or other geo-based urban design can improve the mental wellbeing of dwellers [2]. The experience within public transportation, on the other hand, is often ignored, despite the growing evidence to show it has a significant impact on mental wellbeing [3]. As an indispensable part of urban living, there is a constantly growing demand for public transport. However, public transport has seen little or no expansion of rail capacity [4], Resulting in overcrowded spaces, long commuting times and harmful environments that increase anxiety and stress on arrival at home or workplace [3] [5].

Therefore, I aim to use this project as an opportunity to explore how the HCI community can bring better experience within the underground train to support mental wellbeing?

It was not very ethical to take a photo on the train, so I drew what I observed on the train while doing the desk research, which helped me bring the problem I wanted to work on to life.

How can the HCI community brings better experience within the public transport to support mental wellbeing?



I illustrate what I observed from the train in London, most people feels unhappy. There was even a mid age lady crying there.

02

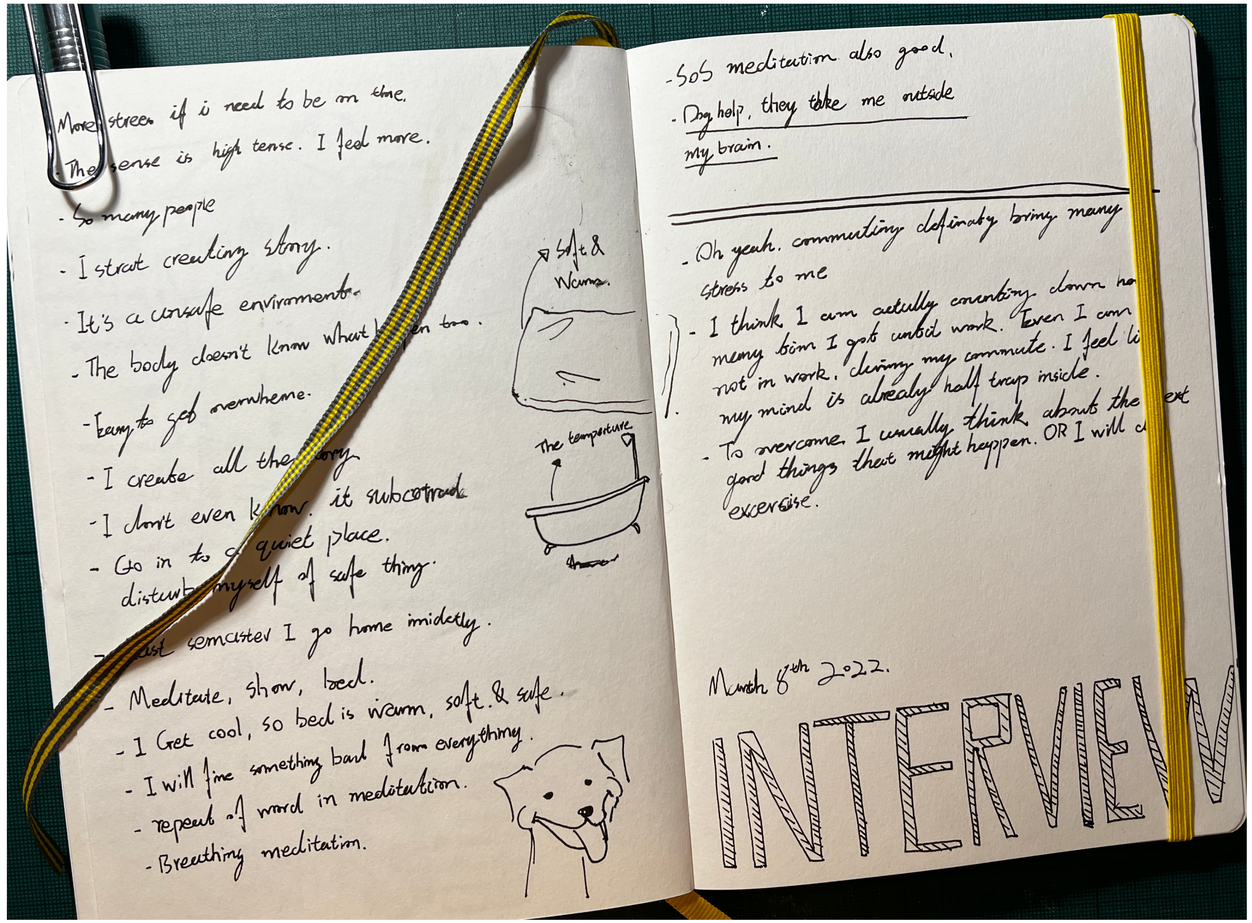
Define

User
Design Moment
Design Opportunites

Define User

During my initial desk research, I reraised many studies that mentioned what is costing stress on public transport, but lack of understanding of how is the current experience brings stress to people and how people cope with it on a personal level. Although the project has limited time and no ethical approval from the school, I still decided to do some informal interviews with peers in class or people I know who experienced commuting, gathering some qualitative data that help me to understand what people might feel on the train.

The informal interview with people provides me with many helpful insights. Firstly, all the people I talked with feel stress during a commute, bringing issues I saw from my desk research to life. Secondly, the conversation plus previous studies [3]suggest lack of personal space in crowded spaces is the trigger of raising heartbeats and stress; it is how our body gets ready for danger. Thirdly, the pressure usually pushes people to think more negative things that could happen, making them feel more anxious and demotivated, like rolling a snowball. Fourthly, people think of familiar things, such as 'home', 'bed' or 'pet' or other things they own when they feel stressed. A deeper conversation following this insight makes me realise that the personal attachment with an object, material's 'softness', 'temperature' and 'movement' make them feel safe and help them meditate and distract their mind from thinking negative things. One of the participants mentioned how her dog could handle stress and distract her from overthinking by asking for petting, which attracted my attention.



Notes and insight I got during the informal persentation

"The fact that I need to go to somewhere on time stress me and drive me to think negatively, like all the bad things that could happen. I know I make the story, but it is hard to stop thinking about it. Pet, home and meditation help me to overcome stress, but it is not easy to have these to support me on the public transport"

"I think I am naturally counting down for how many time I got until work. My mind just trap inside and it really stress me out. The crowed train makes everying even worse.
To over come stress, I usually mediate or try to think of good things that is going to happen"

Design Direction

By reviewing the relationship between animals and mental wellbeing, I learned that responding to interaction and 'life' feelings of some animals can effectively reduce heartbeats and stress [6] [7], which has been used for reducing stress in anxiety for many years, named as animal therapy. San Francisco international airport [8]and a university in Florida [9] even brought therapy animals into public spaces to reduce stress and anxiety. However, it is nearly impossible to get animals on a crowded train considering the animal's health and safety and ethical problem, so I turned to the HCI community to see if there is an alternative approach. Lucky, there are already studies that took inspiration from animals, which set the tone of my design direction: Can animacy human-technology interaction increase the psychological attachment that reduces people's stress in public transport?

Name:
Jenny Smith

Age:
26

Occupation:
Junior Analyst

Living location:
Share Flat

Nationality, Original From:
London. UK

Bio:

Jenny is one of the thousand commuters in the city who need to spend 72 mins commuting every day. She doesn't have mental health issues but is mentally fragile and sensitive to the environment. She often overthinks and feel anxious and stressed easily. The commuting experience in her everyday life increased her stress level significantly, affecting her health and wellbeing. She recently started to seek for solution for herself.

Personal Demand:

- She hopes to put more effort into her work and get a promotion in the near future.
- Achieve an excellent work-life balance, enjoy her everyday life, make more friends, and exercise in her spare time. Even develop some personal hobbies.

Sustainability Barriers:

- Commuting takes away too much energy every day, making her constantly feel unsafe, stressed and worried about all the bad things that may happen.

Personality:

EXTROVERTED — INTROVERTED

INTUITIVE — OBSERVANT

THINKING — FEELING

JUDGING — PROSPECTING

Quote:

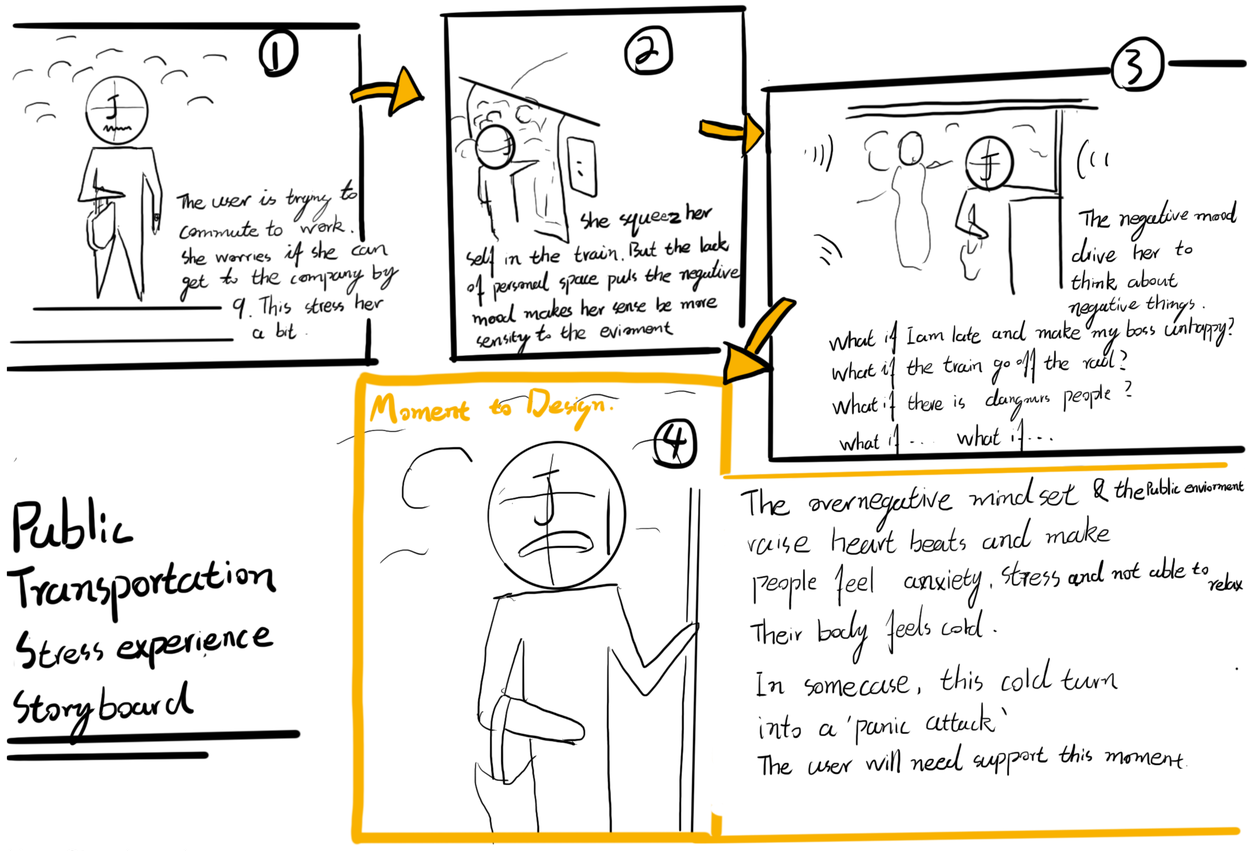
"THE UNSAFE ENVIROMENT MAKES ME STRESSFUL. ON ONE ONE SIDE I KNOW I AM THE ONE COME UP WITH ALL THE STORY, BUT ON THE OTHER SIDE I ALSO COULDN'T STOP THINKING ABOUT TERRIBLE THINGS THAT MIGHT HAPPEN TO ME."

Persona:

Based on my interview, I created a simple user persona to help me to focus my user in my future development process.

Design Moment

I also use a storyboard to bring the current experience to life and highlight the moment I can design for. The method helps me to narrowing my focus and scenario down and help me to come up with the better concept.

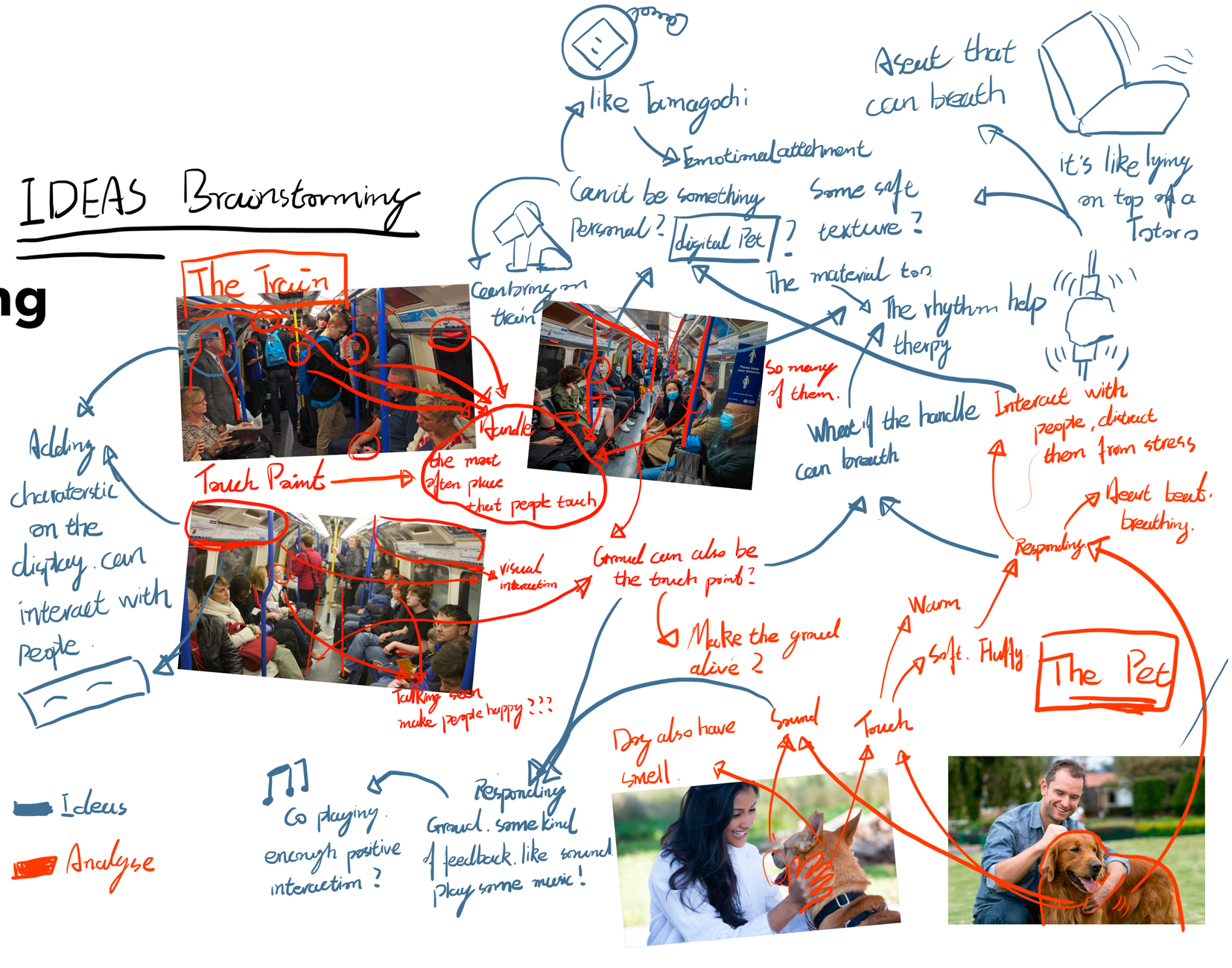


User Storyboard

A user persona based on the conversation and literature reading, help me to have a better focus on user and scenario.

Brainstorming

To develop my concepts, I looked at how people interact with the space in the train and how people interact with the animal and do a brainstorming section based on that, helping me come up with multiple ideas. I Then picked some of the opinions that I think are interesting for further development.



03

Develop

Concept

Prototype

User Testing

Refine

Concepts Feedback

During the user feedback section, most feedback shows they are interested in concept four, which allow them to interact with the design less visible, they believe is essential for reducing stress.

The concept three is also popular, but is more visible, considering the user doesn't not want too much attention when they use the method, I choose concept four for further development.

Concept 1:

The concept looking at putting an interactable screen on the train, which can react to people and the environment with different facial expression. Use friendly interaction to reduce stress.

Concept 2:

Based on concept four but with different touchpoint and design

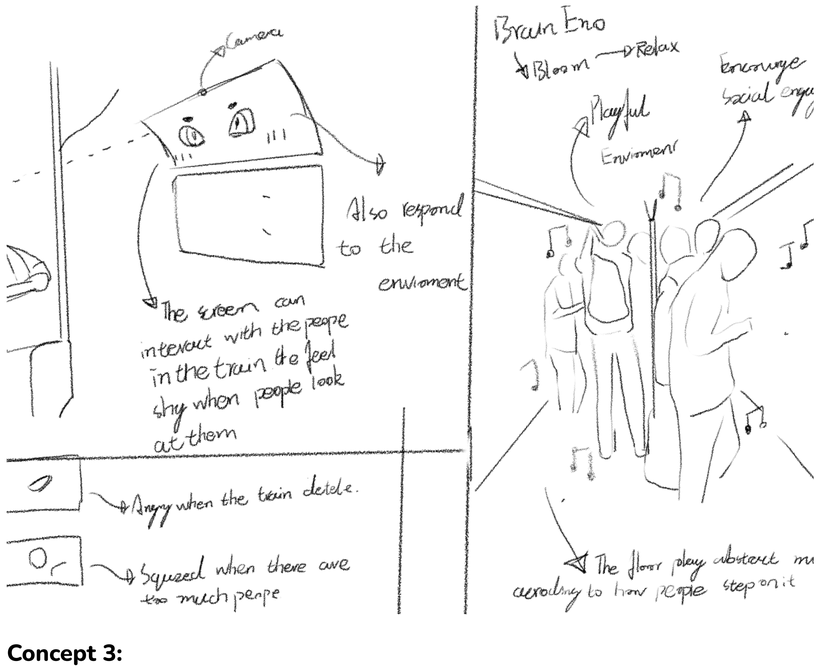
Concept 3:

The concept is inspired by Takashi Omori's study on animacy robotic [15], highlighting that reaction and moment are the keys to creating characteristics for the robot, allowing the user to attach emotion to it. In this concept, I make a robot that can attached to people's shoulder like a bird, asking for petting when it detects stress. The robot can also communicate with another robot like what dogs do in the park, which dirves conversation between their owners.

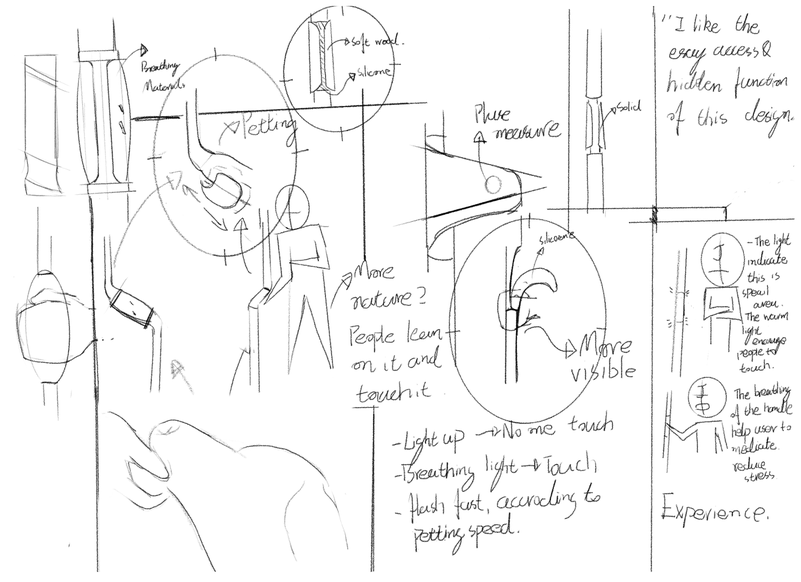
Concept 4:

The concept is inspired by Regina Bernhaupt's study on embodied interaction [13] and Jan's study on touch with mental health [14], aiming to encourage user interaction based on people's natural behaviour and using the sense of touch to reduce stress. In the concepts, I animacy some frequent touchpoints on the train, such as handle and chair, making them react like animals breathing when people touch them. Allowing people to access them naturally and help the user to do meditation to reduce stress on public space without unnecessary attention.

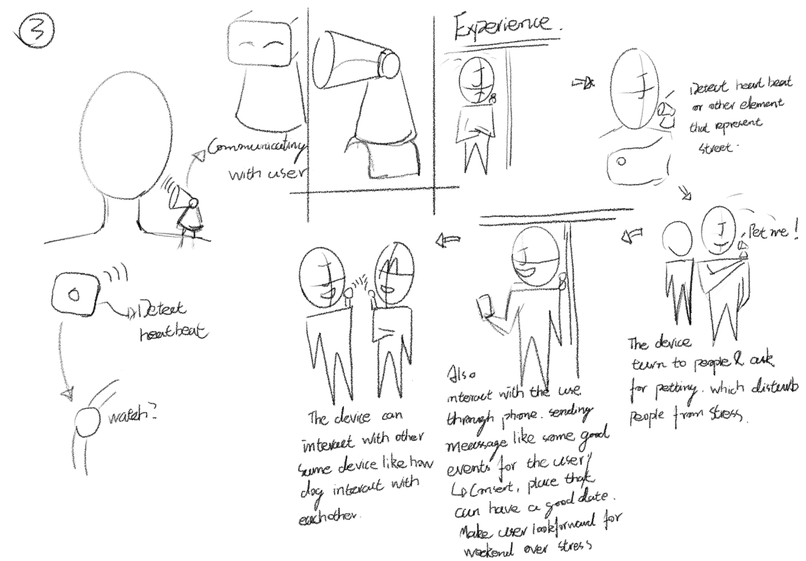
Concept 1:



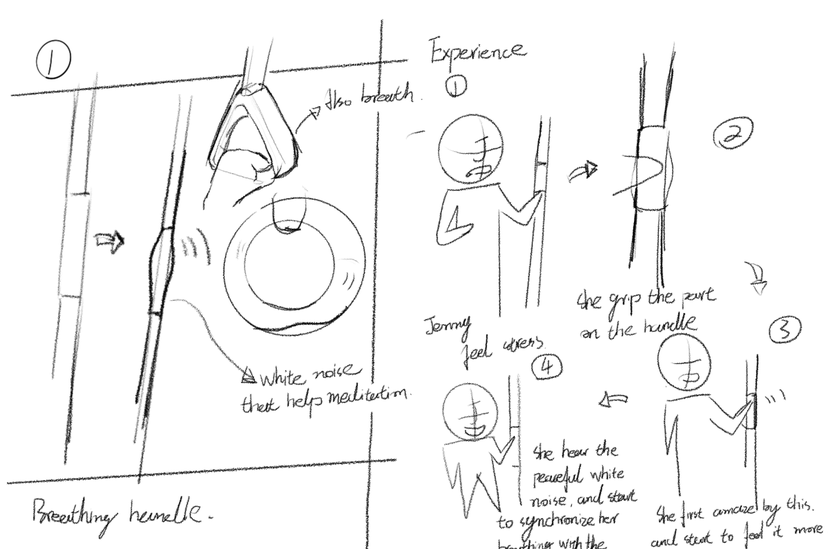
Concept 2:



Concept 3:



Concept 4:



Interaction Prototype Testing

After deciding to take which concept for further development, I started using the prototype to bring the concept from paper to life, giving opportunity for me to test the experience, size and materials and slowly bring the project to life. Considering participant may try to say something that can make me happy rather than points out the problem, I tried to use the language that could pass the Mom Test [13], avoiding asking a question that suggested the direction of the answer.

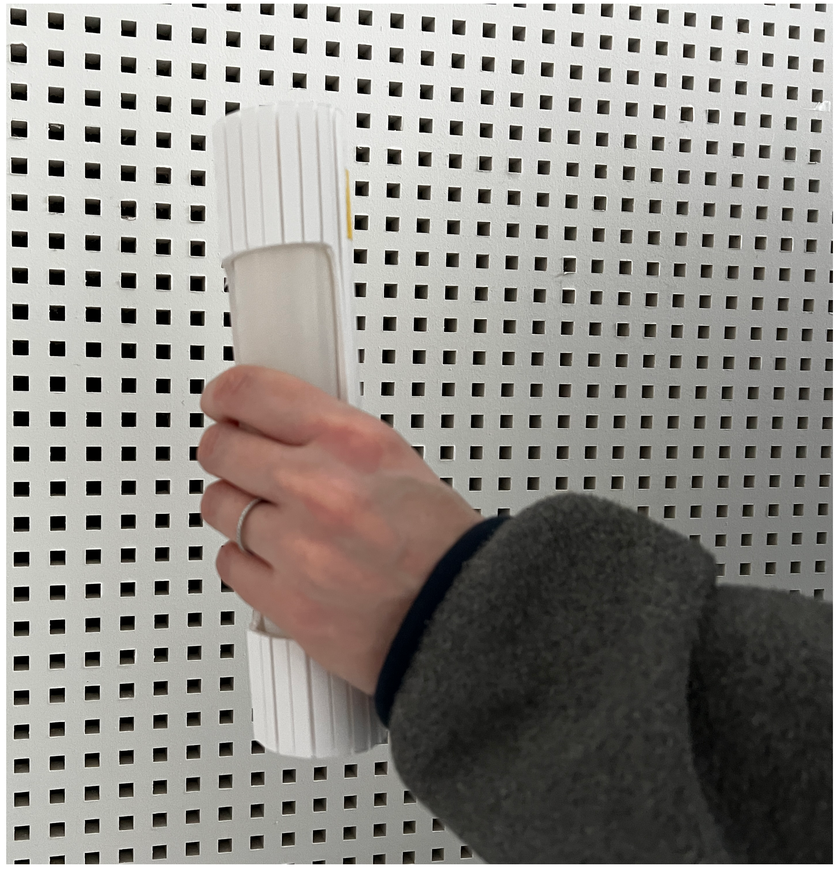
In the first test with a physical prototype, there was concern about the soft materials; some people felt that the soft material was disturbing and made them scared. The technician who helped me with the project also pointed out that the soft materials and the inflation design could cost maintenance problems on the public transport, easy to break down, and the noise from the air pump creates a negative experience.

Initial Prototype

I made different forms and shape with various materials to test my concepts

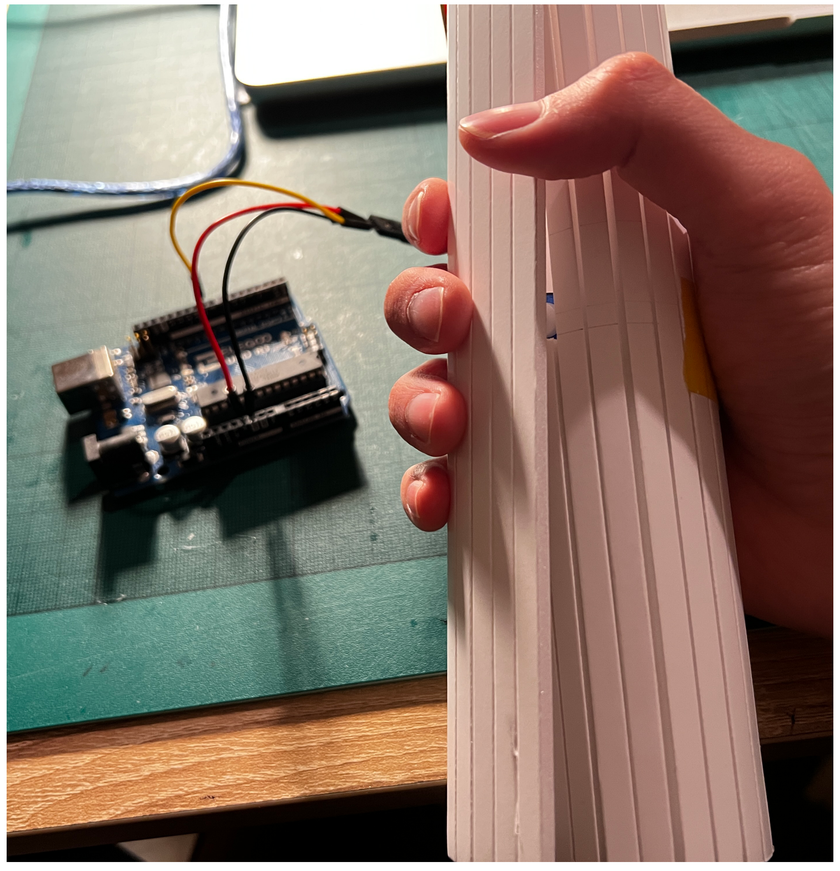
Design Sprint

Although the soft material and inflation technical approach are interesting, I choose to make the ‘breathing handle’ with a mixture of rigid material and soft materials. The handle will be based on a mechanical structure and surrounded by a softcover. The mechanical structure is more acceptable and appropriate in the real-world environment I am designing for. The soft material adds a ‘life’ surface to the interaction, making a good balance. As a designer, it is critical to make a good balance between ideological concepts and real-world situations to explore issues or create experience thoughtfully. Interestingly during the test of my’ alternative solution’ the mixture of solid structure and soft material provided a more appropriate experience for the user than the inflation concept. Most people believe the design make them feel more comfortable on unstable transport.



The inflation design

This prototype is based on a inflate-deflate strucuture, the softness of the handle offer user a unique sensual experience when people holding it.

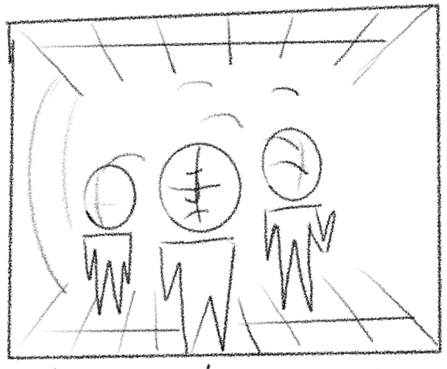


Machnical Structure Design

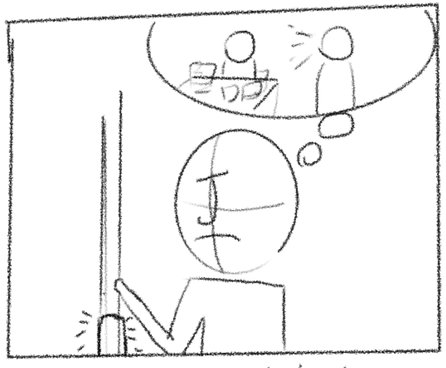
This prototype is based on a machincal strucuture, the ‘breathing’ is power by a motor. The design provide a solid surface for people to grip and easier for maintainance.

Mix Structure Design

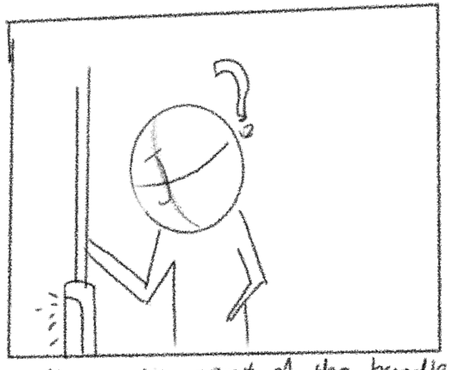
This prototype is based on the mixture of soft and hard material. The machincal structure is realiable and easy to maintain and the soft cover brings a sense of ‘life’ feeling into the experience.



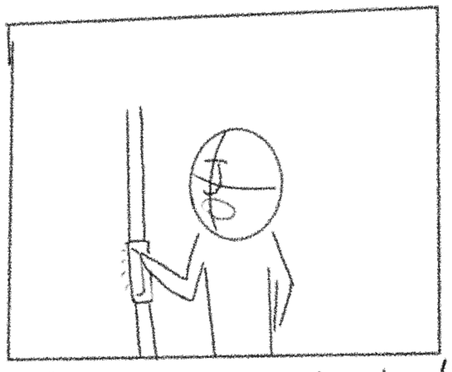
- Jenny need to commut to work by underground. The crowed space makes her feel nervs.



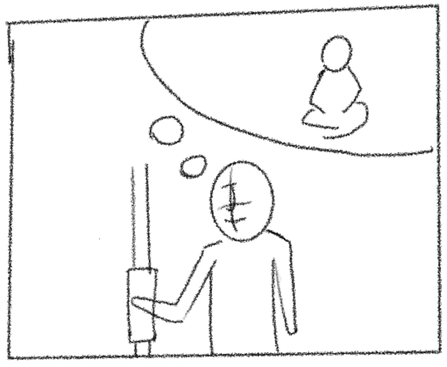
- She start to think about her work which make her stress more. She start to think nagatively



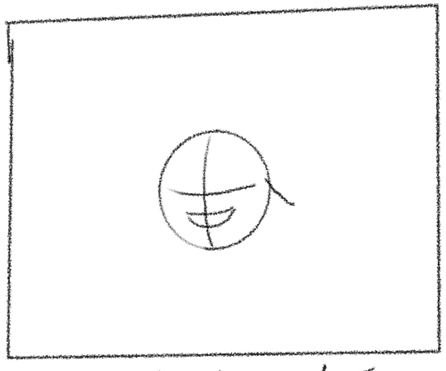
- She notice apart of the handle look slytly different. the soft & warm light on that section is welcoming Jenny to touch it.



- Once Jenny grip that handle she immiditely feels the handle is breathing, and the temperture. It feels like a living things. which supprise Jenny. the handle is also comfortable to hold.



- Jenny's heart beat slow down a bit. because she start attched her emotion on it. The handle help her to do meditation on a public spase. in a way that will not catch too much attention, which distrub her to think negativly.



- In the end, Jenny feels much less stress after commuting & feel freash when arrive work

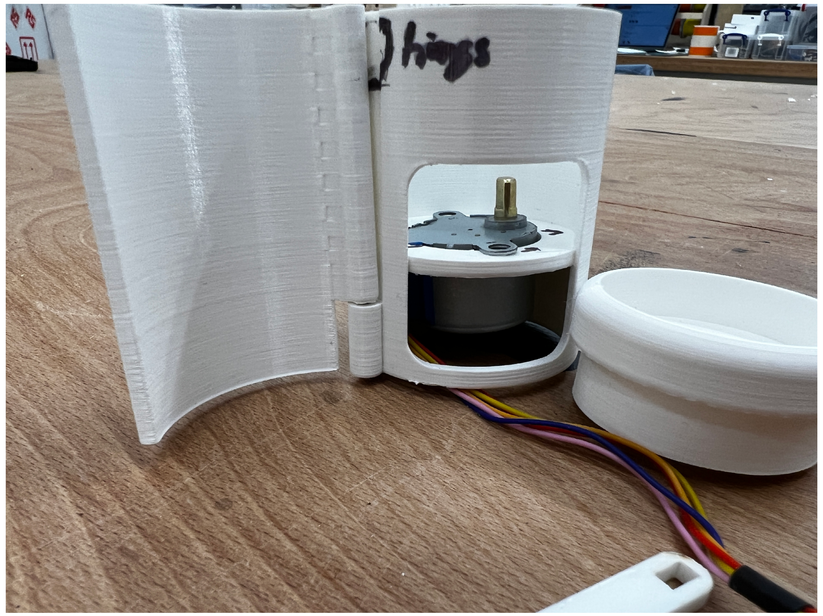
Concept Refinement

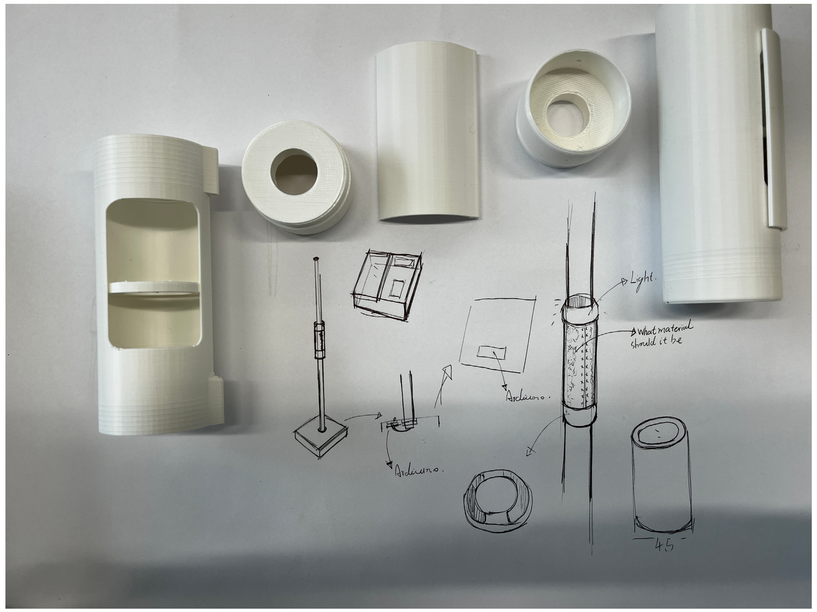
While refining the user journey, I also start to think of how to encourage engagement and improve the experience. I refined the interaction by adding a breathing LED light, which breath alongside the handle, attracting people for interaction when it's not in use and providing a visual reference to focus on when it is in use.

Develop & Making

After having a clear direction, we began to bring my concept to life. I first start to work on the machinal structure of the design and identify all the hardware I need to use. Then I turn my technical drawing into a CAD model, which provides a high resolution of my design.

I use 3D printing to print out a prototype based on different sizes and structures and then test them to find the one that works the best. In the first print, I realised a few problems immediately.





First Print

Firstly, the diameter of the handle is too big because I was trying to give more space for the motor, resulting in it being less comfortable for people. Second, although I found the smallest motor that I could get my hands on, the motor still affects the handle's size. Thirdly, the breath movement depends on a push bar powered by the motor, but the limitation of the inner space resulting the push bar is not long enough to push the breathing structure out enough.

Second Print

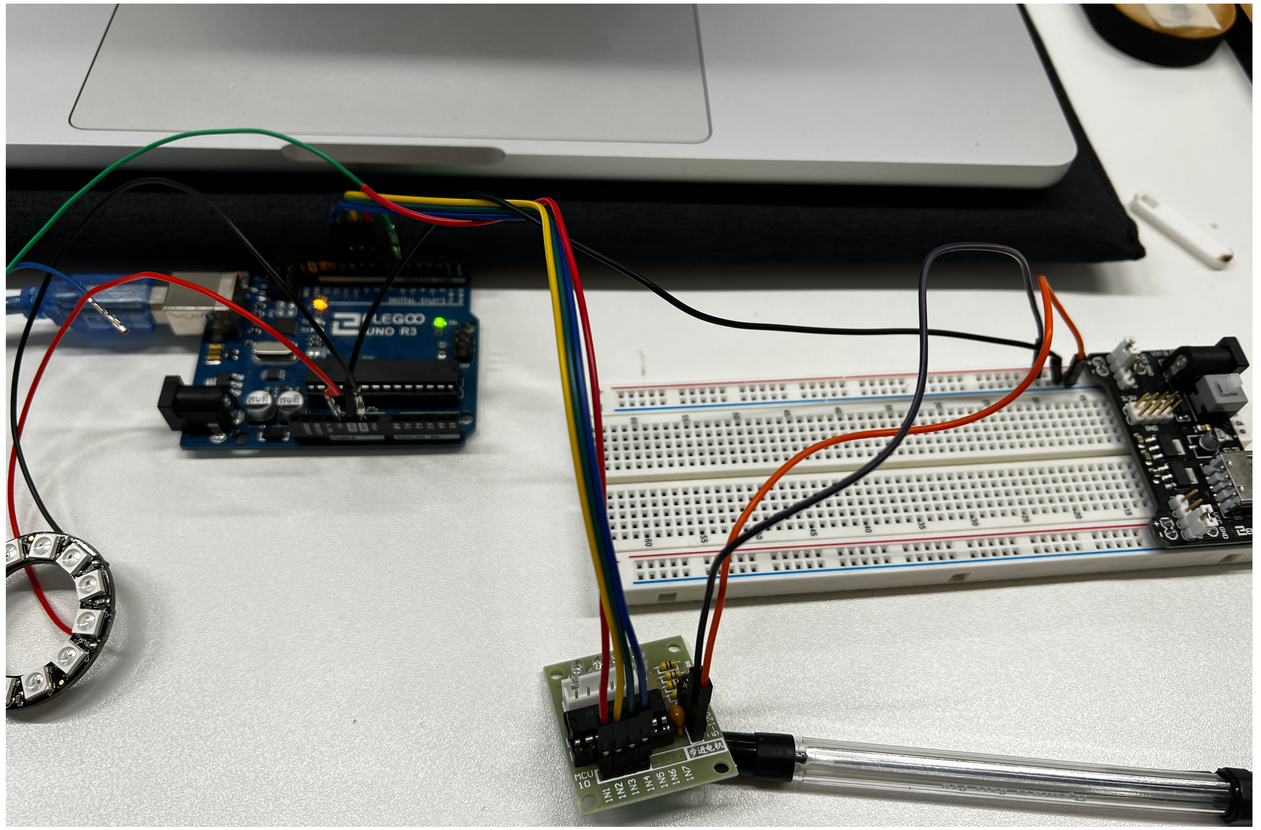
In the second prototype, I refined my design based on the problem I found. Firstly, I cannot change the size of the motor, so I make everything smaller to test if the 3D printer can handle it. Secondly, I redesign the push bar into an 'L' shape so that it can push the berthing structure further out. Third, I used a thread structure to connect the main handle and the LED parts for the first time to give easy access to all the components. However, the result shows that my modification is too extreme, making the handle too fragile. Some parts were just damaged while I tried to clean the support material after the 3D print.

Third Print

Therefore, I tried to make the structure stronger in the third refinement of my design. I balanced the first and second designs, so the third design got a comfortable size and better structure.

Interaction Programming

I also worked with the software alongside the hardware development. I chose to work with Arduino, using it to power my motor for the breathing structure and a LED light that also breaths in the same rhythm. As a person who has never used Arduino before, it is tricky for me. Therefore, I break the function I want into two individual parts and start exploring it with online tutorials and a function library. I soon finished the first step; both functions work fine individually; however, things become complicated when I try to combine the process. Arduino is a single processor, which means it cannot run multiple items simultaneously. To achieve what I want, I need to deconstruct the movement. I also try to make the programme match the rhythm with our meditation breathing speed, which can help to lower the heartbeats.

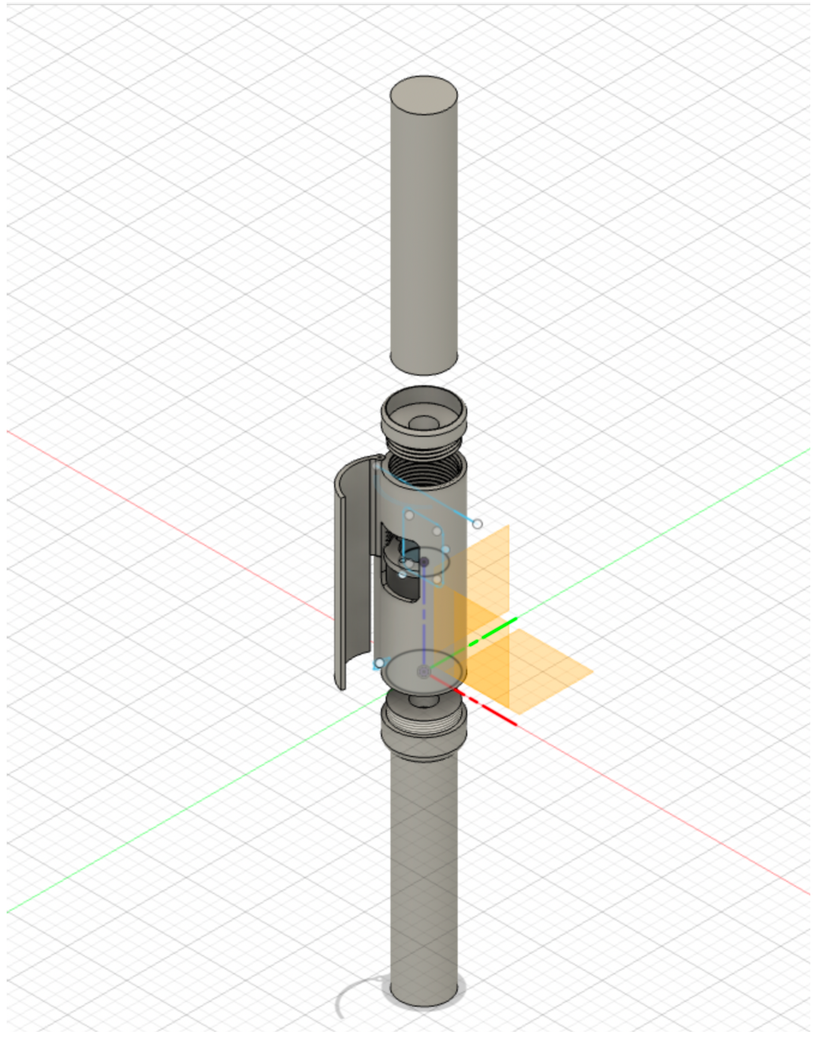


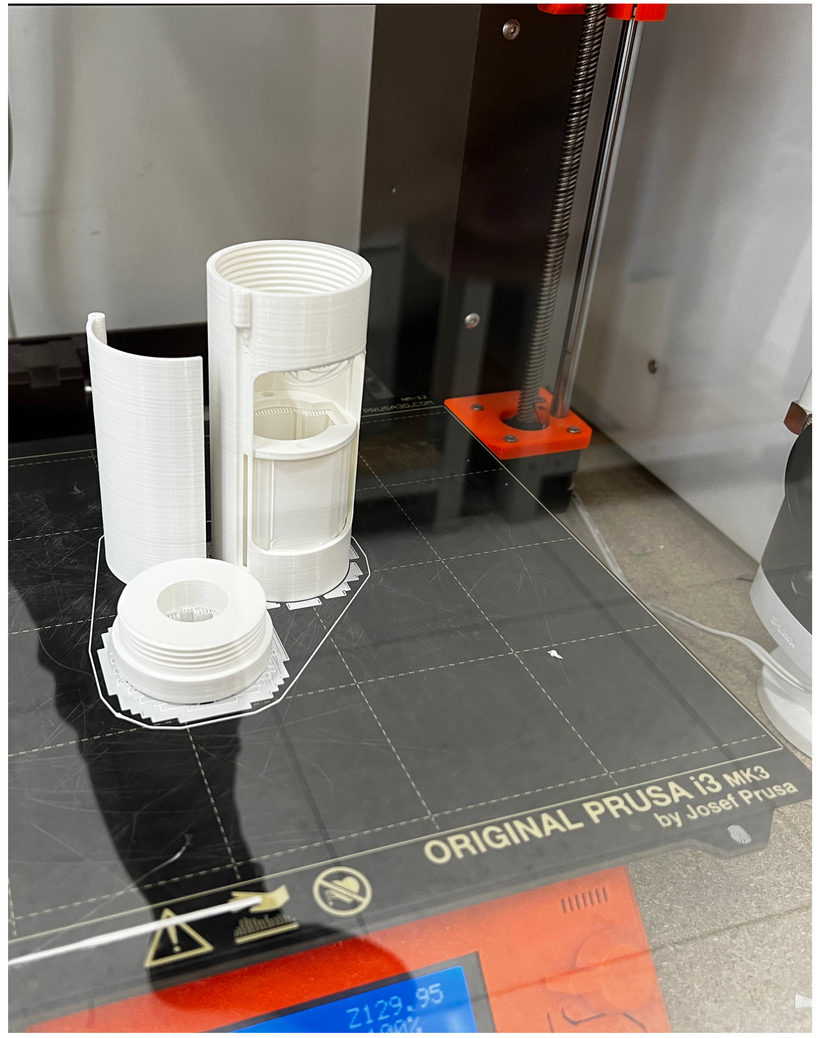

```
for(int PWM=0;PWM<=171;PWM++)
{
    LED_State(PWM,PWM,PWM);
    clockwise(1);
    delay(15);
}

for(int PWM=171;PWM>=0;PWM--)
{
    LED_State(PWM,PWM,PWM);
    anticlockwise(1);
    delay(20);
}
```

3D Making

I used Fusion 360 for building the CAD file and did a few 3D print to test each design. The process help me to keep refine my design and find the best balance of my concept and using enviroment.
It involved more thinking process than I thought.





The technology that can meassure people’s emotion through the MIT media lab.

Discover Input

The output of my design worked fine, but I realised there is lacking an input. Therefore, I went to do more research to explore what could be used as input. Research from the MIT media lab shows that we can measure people’s emotions by measuring the current on their skin [14] [15], identifying emotions such as anger, stress and anxiety. It inspired me to use such technology as an input in my design, which allows the handle to provide a smoothie user experience. There is no button to press; the handle will detect and respond to the user according to the user’s emotion.

04

Deliver

Final Experience

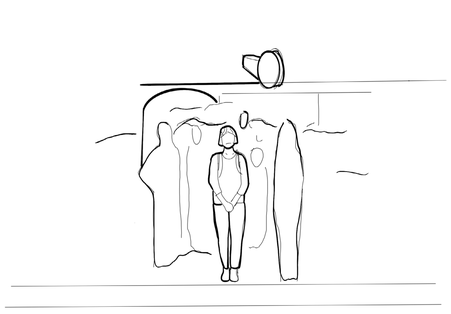
Design

Physical Outcome

Render Images

Final Storyboard

After knowing the input and output, I used a high-resolution storyboard to refine and communicate the experience I design.

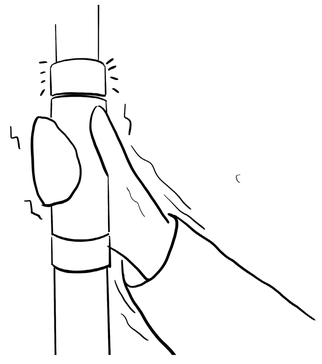


Commuting

The user arrived at the crowded train station, which make her feel nervous.

Stress

The user feels stress on the train which pushes her to think of more negative things. But the breathing light on the handle attracts her attention. The warm breathing light and the soft material on the handle encourage the user to interact with it.



Detect Emotion

The handle detects the user is under stress by measuring the current on the user's body and starts to do the breathing movement.

Reducing Stress

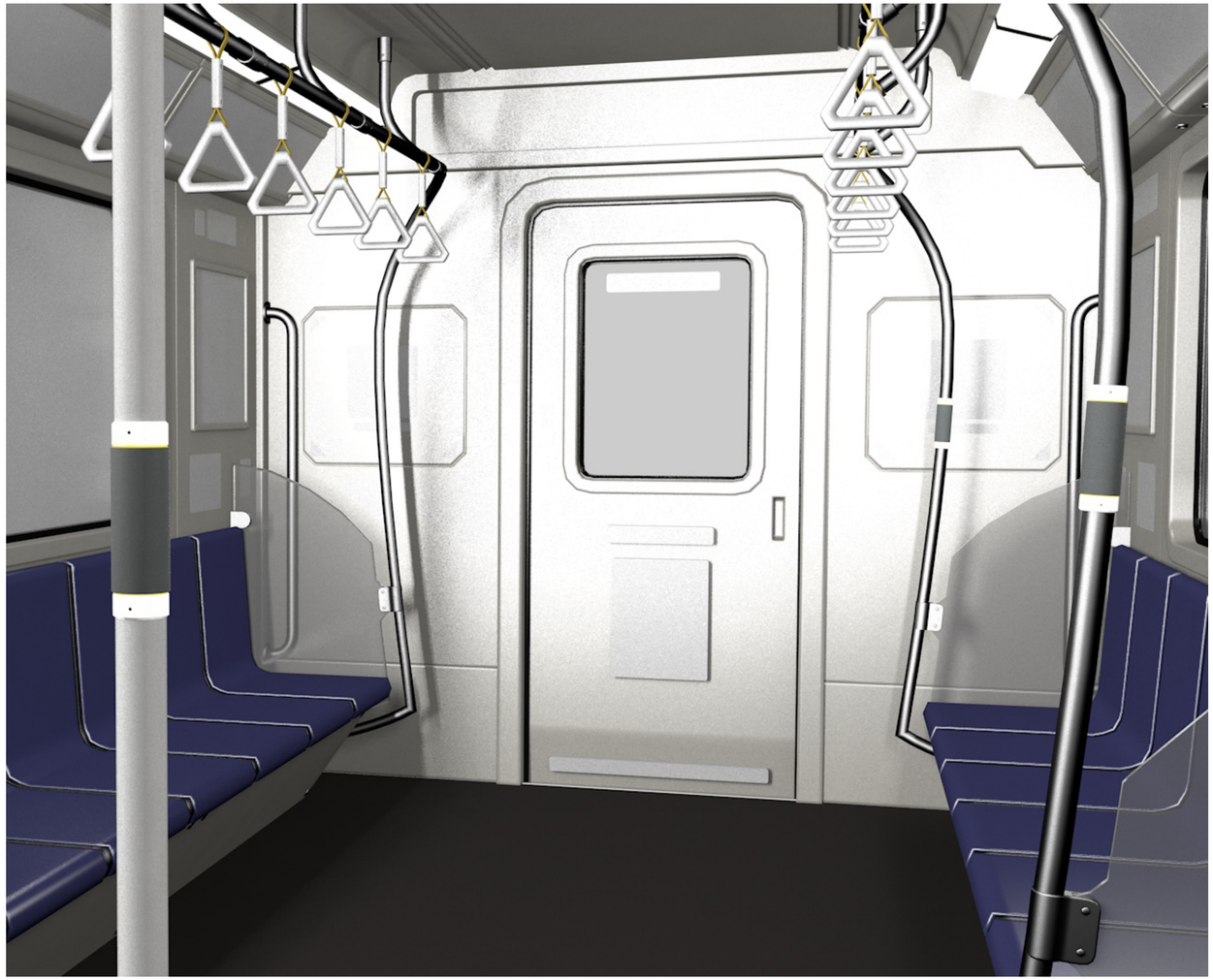
The breathing movement disturbs the user from stress and helps her to mediate unconsciously. The low-profile design keeps the interaction out of other people's attention. The handle is located in a different location on the public transport, so the passenger has access to them easily

Arrive work with good mood

With the help of the handle, the user feels much better and arrives at the workplace in a better mood.

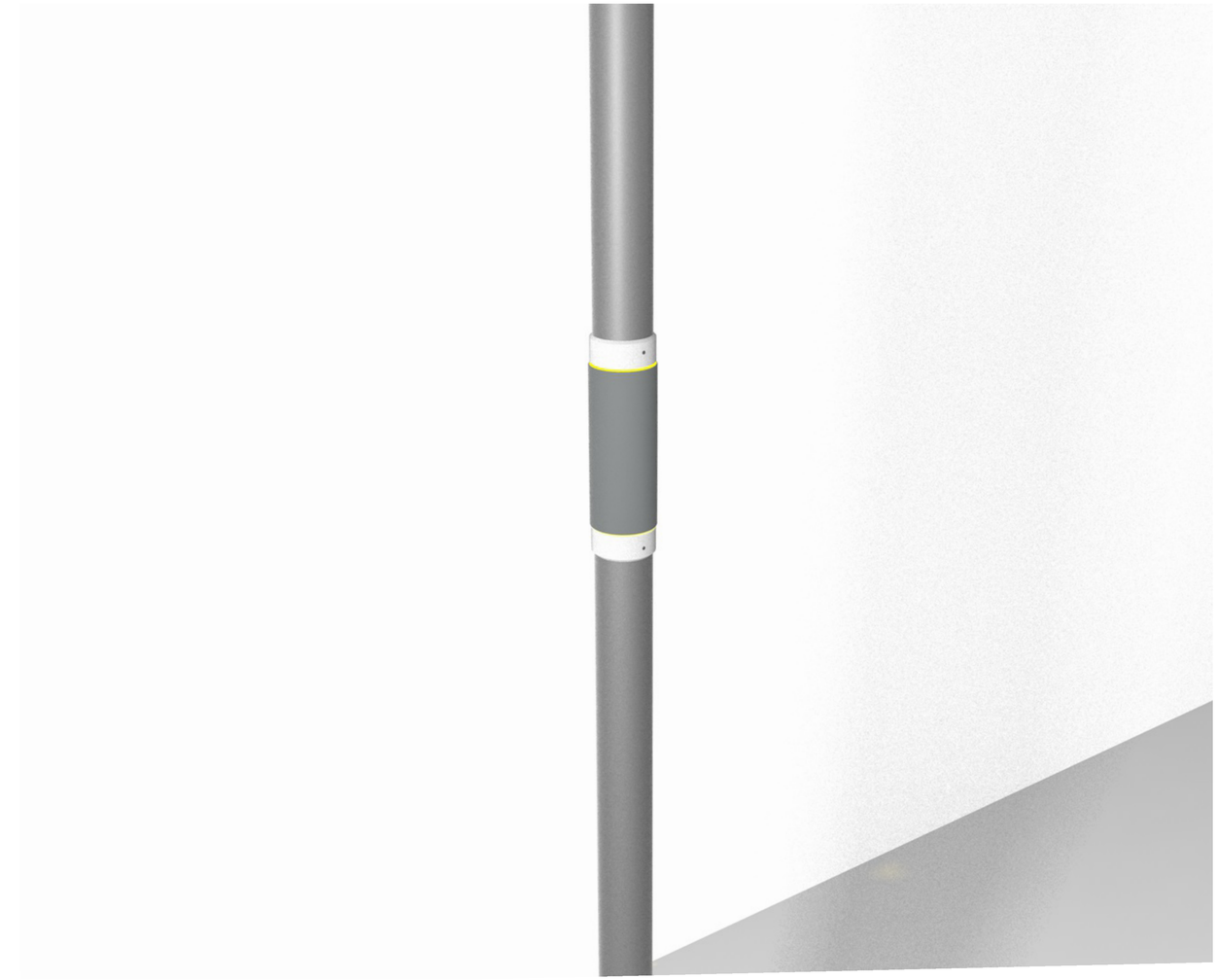
Render Image

Render Image can communicate my concepts with high resolution media, which shows people my design in its ideology way.



Product within the public transport space

The image show how the space in the public transport would looks like when the handle is installed.



Product Materials

The materials on the handle enable easy maintain. The low-profile design also make the experience more hiden.

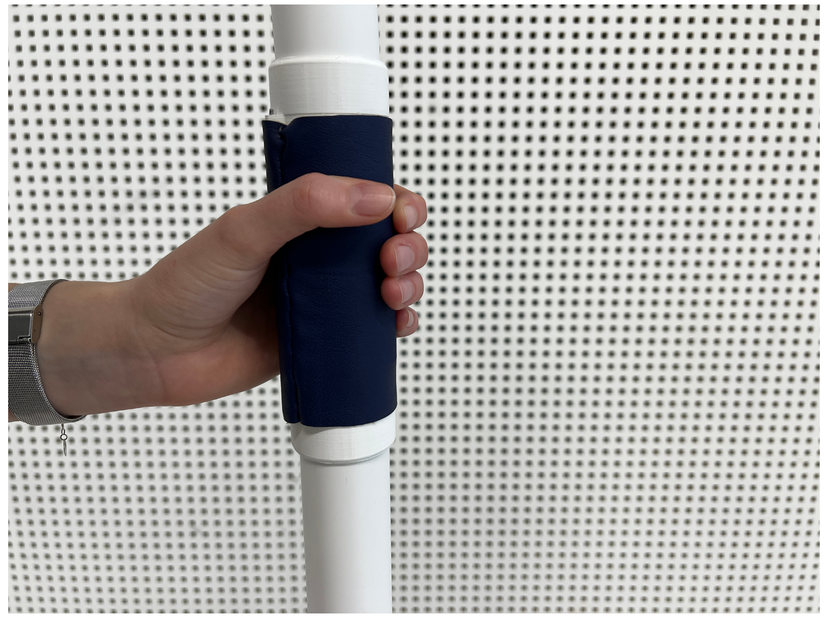
Physical Prototype

Breathing Light

The breathing light works with the motor, provide a visual reference during the interaction

Griping Experience

The soft material provide a comfortable experience, hiding the mechanical structure and feeling from the users.



Hiden experience

It will not be obvious when people is holding and using it.

Places To Improve

There are also a few things that I would like to change, or I can do better. Firstly, the user research in this project is informal because there is no ethical approval from the school. I should get an ethical form and do proper user research to analyse the problem. Secondly, the input, which added to the experience at the end of the project, is not in the physical prototype; I should try to make it work with the prototype. Thirdly, I should refine the design by finding more suitable motors and materials. Fourthly, at the end of the project, I should observe how people use it and get feedback for further research.

Bibliography

[1] R. Toms, ”Designing good mental health into cities: the next frontier for urban design,” [Online]. Available: https://www.designcouncil.org.uk/news-opinion/designing-good-mental-health-cities-next-frontier-urban-design. [Accessed 28 2 2022].
[2] L. E. Jackson, ”The relationship of urban design to human health and conditin,” 15 8 2003. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S016920460200230X?casa_token=J3joQjkwiVIAAAAA:s425GmHQR2fRs1ZXblpiPFOZrXj_DcAYYk73Gz2HGxiUdurw-DGyptTuS6nrTYKGs-Awkf1ukrQ. [Accessed 28 2 2022].
[3] S. Cramer, ”Health in a hurry,” Royal Society of Public Health, 2016.
[4] T. Cox, ”Rail passenger crowding, stress, health and safety in Britain,” 3 2006. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S096585640500100X?casa_token=K131QwNDqw0AAAAA:Owr-aVom9gNCDEAUhvcxHMLU88YL0WI4d5odUu-A3K7xSKIcoep7ad3WL1ioybCQ52WyiGtTaLs. [Accessed 28 2 2022].
[5] A. Künn-Nelen, ”Does Commuting Affect Health?,” 4 2015. [Online]. Available: https://ftp.iza.org/dp9031.pdf. [Accessed 28 2 2022].
[6] ”The Power of Pets,” 2 2018. [Online]. Available: https://newsinhealth.nih.gov/2018/02/power-pets. [Accessed 1 3 2022].
[7] N. Ein, ”The effect of pet therapy on the physiological and subjective stress response: A meta-analysis,” 12 2018. [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/29882342/. [Accessed 1 3 2022].
[8] M. Wells, ”Flight delayed at SFO? The Wag Brigade is on the way,” 19 10 2021. [Online]. Available: https://www.sfgate.com/travel/article/SFO-therapy-dogs-animals-pig-airport-wag-brigade-14121957.php. [Accessed 1 3 2022].
[9] C. Grove, ”Therapy dogs can help reduce student stress, anxiety and improve school attendance,” 9 3 2018. [Online]. Available: https://theconversation.com/therapy-dogs-can-help-reduce-student-stress-anxiety-and-improve-school-attendance-93073. [Accessed 1 3 2022].
[10] R. Bernhaupt, ”Move Your Body: Engaging Museum Visitors with Human-Data Interaction,” 23 4 2020. [Online]. Available: https://dl.acm.org/doi/10.1145/3313831.3376186. [Accessed 10 3 2022].
[11] J. B. F. v. Erp, ”Social Touch in Human–Computer Interaction,” 27 5 2015. [Online]. Available: https://www.frontiersin.org/articles/10.3389/fdigh.2015.00002/full. [Accessed 10 3 2022].
[12] T. Omori, ”Perception of Animacy by the Linear Motion of a Group of Robots,” 4 10 2016. [Online]. Available: https://dl.acm.org/doi/10.1145/2974804.2974806. [Accessed 10 3 2022].
[13] R. Fitzpatrick, The Mom Test, CreateSpace Independent Publishing Platform; 1st edition (10 Sept. 2013), 2013.
[14] R. W. Picard, ”The Galvactivator: A glove that senses and communicates skin conductivity,” [Online]. Available: https://affect.media.mit.edu/pdfs/TR-542/TR-542.pdf. [Accessed 28 3 2022].
[15] G. I. Christopoulos, ”The Body and the Brain: Measuring Skin Conductance Responses to Understand the Emotional Experience,” [Online]. Available: https://journals.sagepub.com/doi/full/10.1177/1094428116681073. [Accessed 28 3 2022].
[16] T. Omori, ”Perception of Animacy by the Linear Motion of a Group of Robots,” 4 10 2016. [Online]. Available: https://dl.acm.org/doi/10.1145/2974804.2974806. [Accessed 10 3 2022].