DEVELOPING HEALTHY STUDY HABITS THROUGH POSITIVE RENIFORCMENT

Physical Computing & Interaction Design Studio
Reflective Report

Team Habits
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18th June 2018

This report explores how the design of posture based device focused on positive reinforcement can give impacts to people in terms of developing good study habits to support good posture. By considering key principles in motivating technology, as well as the stress associated with desk work, it examines the design process of translating Fittable from negative reinforcement to positive reinforcement. Specific reference is made to the design consideration of the Fittable and evaluation of its effectiveness to engage user interaction to develop good study habits.

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1.0 Introduction

Fittable project was designed to develop students' good study habits to support good posture through positive reinforcement and physical interaction. The project consists of a smart table top that uses an interactive token system to encourage user to stretch and take active breaks while studying. Through the use of ambient lighting and subtle nudges, students are notified about them sitting in the same position and encouraged to shift their body position or take a break from study.

The following report will discuss a background survey of related research which will explain the main design principles and theories that will be referred throughout the paper. The report will examine the design process and the iterations required to create a product that instructs people to behave in certain way without resulting in negative user experience. I will discuss how my contribution to the project brought this concept into reality and what I have achieved by the end of this project.

2.0 Background Survey

2.1 RESEARCH QUESTIONS

The background studies into project topics were based on the following questions:

- What should team consider when designing motivating technology?
- What are the needs and requirements for designing posture based devices?
- What should team consider when designing product for a desk environment?

2.1.1 MOTIVATING TECHNOLOGY

Our design focus was on reinforcing habits which requires attention to user's behavior and ideal motivation style. Ren at el. (2018) stated that motivation focused technology for non-sedentary behaviour should apply "persuasive strategies that provides people with short-term challenges and rewards to foster their long-term motivation to engage in repeated practice" (Ren at el, 2018, p.6). They also note that to engage user's participation for long term, it is mandatory to let user receives a reward for performing the task, validating their behaviour and reinforcing the task for next time. This research helped the team to understand that the mechanism of motivational technology can be broken down into the three parts of the cue, the routine and the reward. This has also been further supplemented by our understanding that users also need consistent feedback so as to encourage and reinforce good habits and that goals are also incredibly useful motivators for individuals.

Lu, Ham and Midden (2014) stated that "ambient persuasive lighting can have persuasive effects on energy-efficiency behaviour" (Lu, Ham & Midden, 2014, p.167). Through their experiment on colour evaluation assessment among university students, they have discovered that lighting feedback that was strongly associated with energy consumption had stronger persuasive effects than weakly-associated lighting feedback. This research highlights that the persuasive potential of ambient persuasive lighting can be enhanced by making use of pre-existing color associations. This study gives an inspiration to explore how this ambient lighting system is received by the our target audience, how colour affects their understanding, and the extent to which it actually works as a motivational tool in desk environment.

2.1.2 POSTURE BASED DEVICES

In 2018, Ren et al. developed an interactive exercise system named HealthSit which promote office workers in moving more and taking physical breaks. Their research discovered that HealthSit could effectively facilitate the exercises by providing real-time feedback on user's stretching performance through on-screen animation and musical output. The users who were using the system without the real time feedback, found the experience frustrated because they were not sure if their performance was on the right track. This example gave me an insight of implementing real time feedback in our concept. The key point of this study is that if we are rewarding users based on the amount of the effort they put it in the challenge, people could end up giving their full efforts in the last hour or minutes of study. And there is no point of doing postural shifts in the last minute unless you are doing it continuously since the beginning of the study; your joints and muscles are affected already. Therefore, the posture based devices must provide consistent feedback to users based on performance and they should be rewarded on maintaining certain posture or consistent participation.

2.1.3 WORKING IN DESK ENVIORNMENT

Franzblau et al. (1993) states that working in an office environment often affects people unable to stop working because of deadline or anxiety. Working in an office or desk environment often involves important tasks with critical deadlines, meaning that there is a pressure and stress underlying. This study delivers our concept the importance of tone and emotional reaction to make our intended user experience as positive as possible.

A later study that investigated using break notifications to encourage standing up, has raised that people who are under stress are more likely to revert to the old habit of staying seated rather than taking a break at the reminder cue (Cooley & Pederson, 2013). Due to the nature of desk environment, an approach of telling users how to sit or exercise in certain way could result in negative user experience, especially when they are in negative emotional state. This is a design consideration that will need to be addressed in the conception of our project. We have recognised that designing to invoke an emotion from the user interaction with the product would create a greater engagement with the product and motivate continual use.

One of the reason why people choose to work in a desk environment is that they must purely concentrate on their tasks and to be not distracted by other people and

entertainments (Franzblau et al, 1993). Hence, interaction of the technology must not distract user's concentration and its form should fit with the space environment. Instead of surprising our target group with something that is too odd or unfamiliar, the project has to provide the user a method to interact with the concept in a way that augments their everyday reality. Riemann et al.'s (2013) explored the idea of transforming desk spaces intro interaction devices that would not be disturbed by having everyday items placed on top. Though this investigation was not tested with any users, the idea of integrating desk environment based technology with existing everyday objects gave the team an insight of calm computing that encompasses the importance of the periphery and what occurs in our peripheral sight.

3.0 Individual Contribution

During the development of the project “Fittable” I participated in many aspects of the physical design, physical construction and promotional material. Most of the physical construction and content creation was done by me and Rebecca while India and Bruce focused on the research and technical aspects.

3.1 DESIGN

The concept of Fittable started from a smart desk, that detects your leg-crossing habits and reminds you to sit up straight while studying. The initial concept was ideated from my personal brainstorm inspired by a Netflix series called ‘Black Mirror’. In the White Christmas episode, a character uses a smart table to control anything including lights and toaster in her household using the touch screen. As you can see in *Figure 1*, I kept the form of a smart table but designed it in opposite way, which technology takes control of user’s movement to develop good posture habits through sensors and displays.

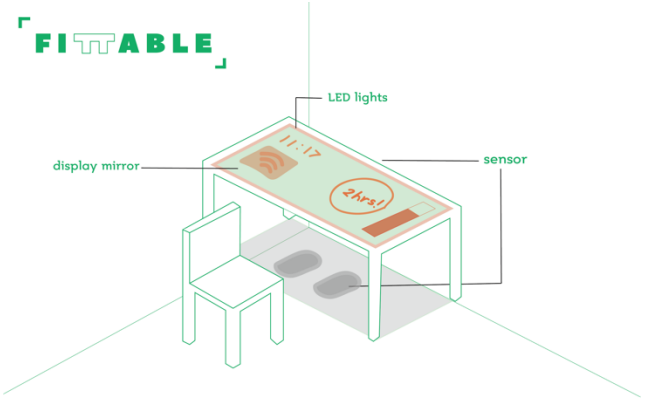

Figure 1: Initial Concept Sketch

However on reflection, following Cooley & Pederson’s theory of the correlation between office worker’s underlying stress and resistance to following instructions, this idea was highly likely to result negative user experience. Concerns around attention awareness and distracting users while doing an important task were raised, as the original LED concept could be considered too overpowering in problem space. Regarding its efficiency of improving posture, the SME (Subject Matter Expert), Genevieve Healy, an Associate Professor in Public Health at The University of Queensland and National Health and Medical Research Council Principal Research Fellow, advised that there is no certain thing as a ‘good posture’ and what really

helps with people's posture is actually a continuous postural shifts and taking active breaks.

Fittable therefore had to ensure that the tone of interaction from the concept is intended to be of a friendly manner while maintaining consistent postural shifts. Hence, we have chosen to positively reinforce good postural positioning and help users to develop good study habits. Its form has been changed to smart table top from a desk due to its portability limits and as we did not have to focus on placing sensors around the whole desk to maintain firm stance. In consideration of Ren at el.'s concept of motivating system, the smart table top achieves its objectives through subtle light displays and polite conversational tone in communication so that users will be positively motivated to correct negative habits and be rewarded for being conscious of their postural health. Multiple design iterations were made during design process, especially when designing the interaction for active breaks. The point of the final concept design was the use of interactive token system and activity meter. As you can see in the *figure 2 and 3*, my personal contribution was that after a team member had drawn up an example of what our team could do on a board, I created the sketches interactively throughout the project to reflect the changes and redefined the user interface and physical design.

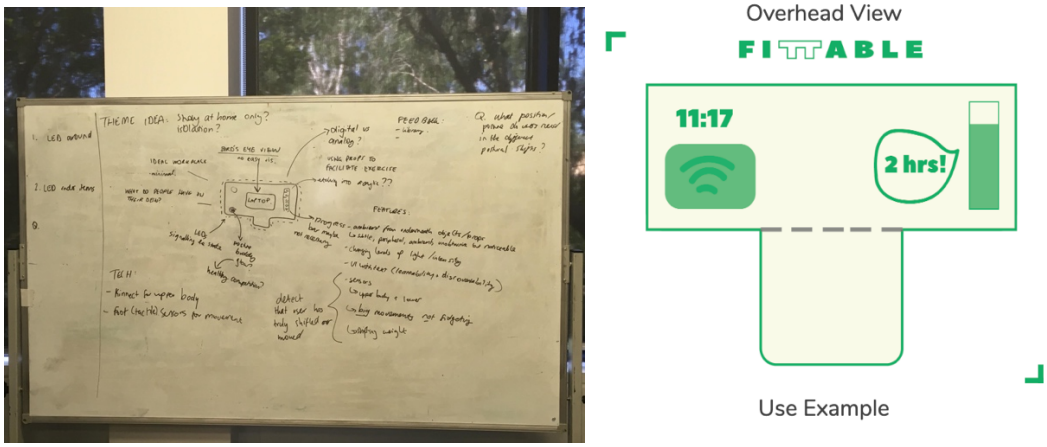

Figure 2: Concept Brainstorming and redefinition

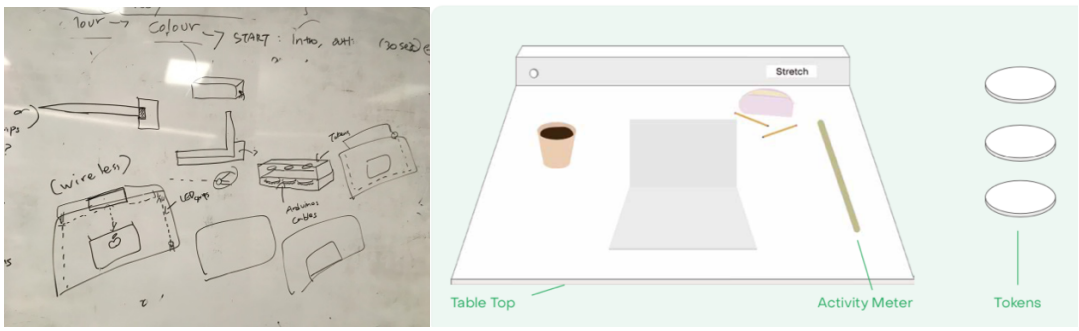

Figure 3: Personal Contribution to final concept design

3.2 DEVELOPMENT OF THE TOKENS AND WOODEN BOX

Through the feedback we received from the prototype presentation, we realised that users are not truly engaging with their peripherals as the existing objects around the study space were limiting their sights. Hence, team decided to include tokens that go on items around the room to 'augment' them visually, which help our project to more fully action the idea of peripheral engagement and calm computing (Riemann et al., 2013). Since its functionality focuses to address motivational technology (ambient lighting), the physical design had to focus largely on relaying a sense of familiarity to the user and allows awareness of the user's surroundings.

During the build of the Fittable I was mainly tasked on the physical design and construction of the tokens and the wooden box that holds all the tokens and required electrics inside. The main purpose of the token system was to encourage users to stretch and take active breaks while studying. Therefore, it had to be designed compact for users to keep around their study space and light enough for users to place & pick them up. It was also important not to create a design that looks too odd in the study space which can disturb user's concentration during work (Franzblau et al, 1993). My original plan was to make them as round and tiny as possible just like acrylic game tokens which people are familiar of and visually appealing. However, as I start constructing the prototype of the tokens, I realised that the total size of the ESP board, Neopixel ring and the battery together was way bigger than I thought - See *Figure 4*.

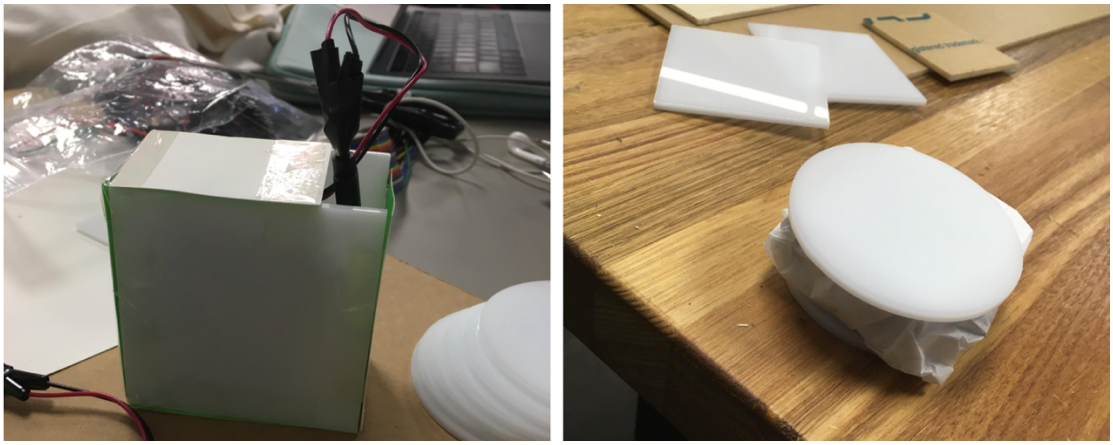

Figure 4: Construction of tokens

Hence, I changed the design of the tokens from a thin-sphere shape to a square ice-cream sandwich shape. This gave a token a bit more space to store all the electrics

and cables inside. Also, this design change has upgraded its usability and portability as the edge of square shape makes it easier for user to pick up and enables them to place token either vertical or horizontal which round shape cannot.

The initial tokens were made with coated papers and sticky tapes which looked alright but crafty. After the shape of prototype is confirmed by other team members, I decided to replace the material with something harder. The choice of the material was one of the important part as user should be able to notice the light glowing through it. Hence, I decided to make the final product using acrylic pieces which added the tokens enough strength to hold the component and polished look. Using hot glue, I connected the acrylic pieces together and made tiny hole at the side to fit the reset button of the battery, which users were supposed to press as pick them up. The outcome looked decent and polished and the light inside the token glowed well through the acrylics – See *Figure 5*. Most importantly, the overall design of tokens really harmonised well with desk surroundings.

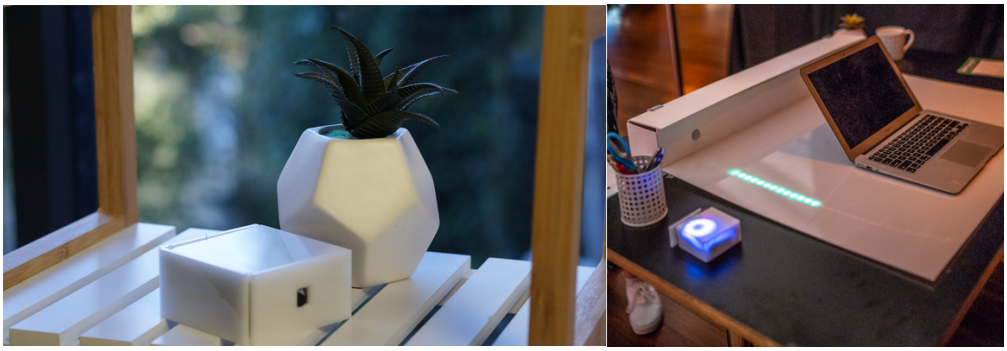

Figure 5: *Finished Product*

The construction of the wooden box was finished before I finish making the tokens. As a team we designed the box to be big and wide enough to fit within the table top. We also decided to add a layer inside the box to separate the space for the tokens and the functional materials. Based on this design, me and Rebecca built a box using 10cm x 10cm wood pieces and hot glue gun. The most time-consuming part of construction was cutting parts of the wood piece with saw. Because the size of the wood pieces were all same we had to cut 2mm off one piece to use as a layer. It was not a complicated but difficult task for beginners like us. After that, we cut additional holes off the box, to fit PIR motion sensor and LCD screens. The last step for the box was to paint with white spray paints which matches the colour of the table top and tokens. The structure of the whole box just perfect, it was a good fit for all of the components – See *Figure 6*.

Figure 6: *Wooden Box*

3.3 EXHIBIT EVALUATION

The final product was displayed at the Edge as a public exhibition. My contribution was creating the majority of supportive materials including the A2 conference poster, flyers, business cards, as well as acting for the explainer video that was played on repeat during the exhibit – See *Figure 7*. I also brought props for our exhibit setting including cushions, textbooks, water bottle, plushies, figurines and lamp; our intention was to create a study room (or bedroom) space that is fancy an Ikea display. By putting those items altogether, we created such pretty, home-like setting which our visitors really loved about. Due to my knowledge of the research and contribution to the design and construction of the concept, I was able to introduce what our project is about and what we have done to bring Fittable in reality.

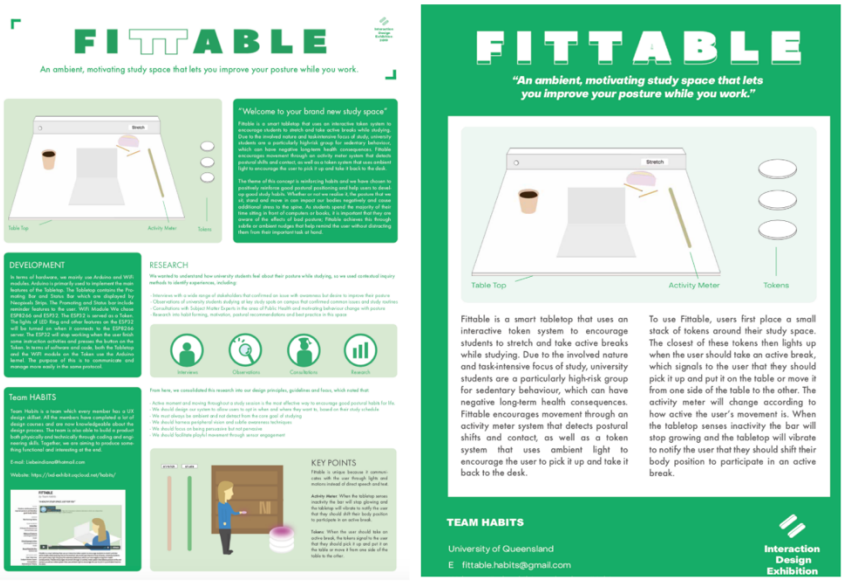

Figure 7: Supportive Materials Examples

Unfortunately, we had some technical difficulties on the day and some of the functions especially the tokens, were not functioning as we planned. Because everything worked perfectly before the exhibit, we could assume that the system has

gone wrong while being transported or the ESP server was getting affected by the public wi-fi at the Edge. Even though the tokens themselves were not fully functioning, it did not detract the interaction between users. What I find interesting was that users really liked the idea of placing the tokens wherever you want. Every time I ask users to place the tokens up, I could observe users simply enjoying the interaction with the tokens such as making decisions whether to place the last token on the bed or shelf. The design of the tokens and exhibit setting created such great synergy, creating a calm and familiar study space for users. Because this part of activity required user to complete before they sit at the desk and begin the study, their emotional state were positive and not pressured at all. I could also discover that giving people the control to place tokens in their own way results in positive user reactions and engagement. As people were notified to take active break through ambient lightings from tokens, they could easily understand how Fittable works; users responded that the tokens promoted them to move around. As stated by Ren et al., the strategy of providing people short term tasks and rewards motivated them to actively participate.

However during the simulation, I could see users not being able to hold all three of tokens at once due to the size. After user place one token to the place they chose, they had to come back to the desk to grab and place the next one. Hence, I felt that downsizing the tokens would definitely make the experience more comfortable for users.

The wooden box succeed to appeal the users with its aesthetics however its usability was questionable. The primary reason of developing it was to hide/store all the technical components inside but also enabling users to store the tokens inside. However during the prototype simulation, users did not show much interest of using it and storing the tokens back in the box. For the team, we found the box very useful to function our prototype in more organized way, however we found the layer in middle annoying as we had to lift it up whenever we tried to reset the system. Hence, for the functional purpose, I should have designed the layer to be vertical instead of horizontal, which still separates the items and it is much easier team and users to handle.

4.0 Conclusion

Through the development of Fittable, I have come to better understand what people really want in terms of correcting their bad habits; the technology that provide options which people can choose to participate or not without feeling guilty and stressed. In designing for the reinforcement domain while considering key principles in calm computing and motivational design, the Fittable effectively engaged audiences and influenced motivation of wellbeing in experience.

Out of the five pre-designated success criteria for Fittable overall, only two were directly related to the design and functionality of the tokens. These were the usability which user is able to engage with the full prototype actively without hesitation and learnability which user is able to describe back to the team about what each setting and light meant. Through thoughtful design of the tokens focused on motivation and positive user experience as well as the high success rate in the area of learnability, both of these criteria were successfully met. I believe the results could be even higher if the tokens were fully functioning.

The next steps for the project would be refining the design and functionality based on user preferences. One of the audience visited the exhibit has suggested adding patterns for the tokens because himself was colour blind. It was such interesting idea which questions the project to consider more diverse user groups. In this case, to cater diversity of both colour-blind and non-colour users, it will be ideal to add a visual cues within the ambient lighting, like a traffic light for pedestrians and bicycles. This approach would require further research and lots of user testing in order to meet the design principles and balance usability and tone of communication.

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