

REVERSE JENGA

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Physical Computing & Interaction Design Studio
Reflective Report

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Abstract

Psychological stress from all aspects of life and work has gradually become a daily routine that modern people have to deal with every day. However, even adults have a hard time coping with a variety of stressful situations correctly. Combining the advantages of early education and with the nature of make user learning from playing, reverse Jenga will mostly help people learn how to face and release stress properly. This reflective report will illustrate my journey as a developer and what I have learned from the process.

TABLE OF CONTENTS

| | |
|-------------------------|---|
| INTRODUCTION..... | 1 |
| BACKGROUND SURVEY | 2 |
| DEVELOPMENT..... | 3 |
| EVALUATION | 3 |
| CONCLUSION..... | 4 |
| REFERENCES | 5 |

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Introduction

The rapid evolving of physical computing and interaction under the influence of Information technology world environment. It is a pleasure to participate in the development of physical Computing & interaction Design Studio by taking part in the 3850 courses of this semester. Changing behaviour is the study area for my team. After several iterations and brainstorming, finally set the sights on stress controlling.

Stress is a common occurrence people faced in the daily life. Especially in adult life, people under different pressures every day but some people have no idea how to deal with stress appropriately. To help children experience and learn to overcome stressful situation during the early education, the reverse Jenga provides them an environment they can study during the game. The game plays the same way as regular Jenga, players moving the wood block from each layer and stacking higher. The difference is reverse Jenga provides a new interaction mode by using the Internet of Things technology and pulse sensor to detect and determine whether the player is nervous and make appropriate feedback.

In the next sections of this report will describe the background survey related to the nature of the project, development process, an evaluation with my contribution and also reflection during the whole design and development process. The success criteria and whether they were met will also inform in the conclusion section.

Background Survey

People behaviour is often influenced by the emotion. Frustrated, happy, stressed, despite being different from emotions, the behaviour is strongly influenced by them. According to The Yerkes-Dodson Curve (Yerkes and Dodson, 1908), Moderate levels of pressure will improve our efficiency, but too high levels will reduce our performance.

There are the range of different products on the market to help people relieve stress. The most popular one is the fidget spinners. It is a small device with a ball bearing in the middle that you can spin and rotate with your fingers. The product is marketed to help relieve stress and attention deficit hyperactivity disorder. According to Karlesky and Isbister (2016), The nature of it is distracting the user from the thing stress them. Because of nature they are considered to be a distraction source in class and banned in some schools in America (Katherine Isbister 2018). There is the range of relaxation and stress relief products are based on the same principle of distracting the user. The team believes this is not an effective solution when people under stress. The product needs to teach people how to control stress properly and visualize how the stress affects their work.

According to Play in the Early Years(FLEER, 2017), Children can learn better through the way of playing in early education. The target audience of our product is the children in the early education, through the game way to help them learn from play to face the pressure of the scene and how to deal with.

Development

The process of development was challenging and interesting because I enjoy the fun of problem-solving. In the past few years of my university studying, I focused on design rather than programming. However, coincidentally, at the beginning of this year, I started spending much time on front-end development and very active in learning a variety of programming language. This course gives me an excellent opportunity to learn and use new knowledge to implement the product. As the only programmer in the group, I am free to subdivide the development tasks and master progress. To develop more methodically I differentiated our core features from most straightforward to the most difficult: motor vibration, bpm detection, user stress situation judgment, vibration toggle and wireless control.

In the early prototype, we use wire connected vibration motors with Arduino board. The way multiple motors connect to the Arduino is very confusing and extremely disruptive players interacting with the game. That is when the team decided to give up using the wired connection and looking for the wireless control solution. The early development of bpm detection went well by using an open source project called pulse sensor. It shines light into the capillary tissue such as the fingertip, and the sensor reads the amount of light that bounces back to calculate the BPM. By following the source code documentation, I made the pulse sensor able to work. Given the uniqueness of human body, I have done a lot of repetitive and tedious user testing with my friends, housemates, and colleagues to figure out which finger is more stable to reflect heart beat correctly. However, the result is exciting, because during the exhibition it

did prove that people's middle fingers were the best match for our heartbeat testing instruments. After solving the fundamental detection problems, I focused on how to get the computer determine whether the user is nervous and control the switch on the vibration module. In early studies, we learned that normal people's bpm would be higher than 100 in stressful situations. However, from the user testing result, we know not every user will be over 100 in stressful situations. To solve this particular problem, I rewrote the idea of the algorithm so that the criteria for determining nervous depends on the initial user heartbeat and subsequent changes in amplitude. When the bpm increase was greater than 15 percent, the computer will judge user is nervous and activated the vibration.

The last but also most crucial technic features are the wireless control. As I mentioned before to provide users with a better interactive and gaming experience, the team abandoned the use of the cable vibration module. The biggest challenge I faced is the Arduino UNO board do not support internet feature, the only way to solve that is adding an extra WIFI module on Arduino. Also, we need several signal transceiver inside the different wood block to receive bpm and vibrating. It is complicated regarding technology, cost, and volume of wood. When I was struggling with the wireless solution, the team introduced me to a new platform: Particle photon. The photon can power with the spark fun battery shield and handling the wireless data. This platform gives me a whole new way to solve the wireless problem. I cannot wait to start researching photon and finally found a solution using Node JavaScript, which is an environment that executes JavaScript code server-side. Finally, the Arduino and photon are set up under the same TCP network by using node JS. I have successfully implemented the data transmission between photon and Arduino heartbeat detector.

Evaluation

In this semester I have benefited greatly from programming and design and learned the power of combining these two skills. I have not only learned different programming languages, more importantly, I learned the ways and pleasure of self-learning programming. I used to be a programmer who tends to copy and paste, and rarely spends time reading the source code and documents of a language. However, during this development, I encountered situations where copying and pasting complicated simple problems, and then I realized that doing so would not make me improve. Later in the development process, I took the time to understand and write every single line of code. With the completion of the product, I felt the joy of implementing the conceived product by my code. During the development process, I had a very frustrating time when I thought it was impossible to complete the wireless function. However, with a lot of time learning and programming, and finally, successful implementation of this function, let me feel the effort and spend time on it is worthwhile.

Conclusion

In hindsight, the reverse Jenga only implemented the minimum viable product features. But I still consider the final product was successful because it met most of the following success criteria:

- Some users come back to play several rounds
- The game scene makes users feel under stressed
- Users learn to be calm by playing games and being guided by others
- Users think that visualizing stress will help them understand the status of their psychological stress
- User enjoy the game
- A lot of people spectating when others play, interested in the game and continue to join the game after others play

The one reason reverse Jenga being popular at the exhibition because of Jenga is the traditional and widely known game, people can quickly understand and recognize our product rule and purpose. The product itself does not use very sophisticated technology. Either the previously mentioned heartbeat detection or TCP network transmissions are based on existing technologies. However, using these common technologies that made this unique product, gives people an unprecedented experience of how to deal with stressful situations.

Also, there still have a lot to improve on the functionality. Most users are satisfied with the way to reverse Jenga visualize stress in the form of wood vibration. However, there are still quite a few people who are curious about whose psychological stress is causing the wood block shaking. Although I initially prepared two led that will flash faster with the tension of a particular user. But considering the beauty of the product I gave that up. Another technical area could be improved the pulse sensor, limited by the hardware, the product is not feed-backed bpm 100% accurate. If the budget is adequate, we should test with more advanced pulse equipment or a variety of different devices.

On the whole, I have learned much as a developer and also a team worker in this course. By completing this product, I began to enthusiasm for programming and realize the spend time to keep studying can make a great harvest. I am very optimistic about the future of reverse Jenga in early education if we continue to optimize it from cost and technology.

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