



# Interactive Stress-Free Toy Design for Students Studying Overseas

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**Abstract.** The aim of this project is to create a relaxing product to release East-Asian international students' stress in order to be in a better health. The direction of this project focuses on handling the students' negative emotions produced by stress to avoid negative consequences happening such as depression. This project begins in secondary research about stress followed by case studies of the existing products along with an interview with the target users. The case studies use the KJ method to find the design elements of existing relaxing products. Moreover, there is deeply understanding of the students' stress and the effective method of releasing the students' stress through the interview of East-Asian international students. After the research, the author transfers the information from research into design rationales and decides the design direction of this project with the design rationales. The design direction of this project is to design an interactive robot to increase the interaction between the students and their family to achieve the goal of relaxation. There is an initial focus group to gain the user's feedback from after the initial design, and a redesign with the feedback. Finally, there is a final focus group to evaluate the final design and the final design uses the user's feedback as the reference to amend and develop in the future.

**Keywords:** Stress-free · Interactive design

## 1 Introduction

### 1.1 Background and Motivation

With the development of economy and growing technology, human lifestyles are changing rapidly and people receive more information every day. However, these events also bring stress to people because people need to adapt to the changes rapidly and to deal with the massive information. Although certain kinds of stress would make people grow stronger, overloaded stress lowers people's work efficiency and even causes negative impacts on people's physical and mental health. Besides, these overload stresses cause negative emotions to people and then people would have the negative reactions such as depression and nervousness. However, different stresses are from different events for different people, so how to handle stress becomes a vital issue of modern life. Moreover, the negative reactions from the stress might be the root causes of some social problems, of which suicide is an example. According to World Health Organization [16]

report, “Major depression is linked to suicide. Most people who commit suicide are also clinically depressed.” Also, this report also shows that depression is predicted to become the second-leading cause of global disability burden by 2020. Therefore, releasing stress has been an important issue to the modern society.

Nowadays, Students also have more stresses because need to learn and understand more from school and absorb more knowledge from the generation of information explosion. Especially, international students would meet more difficulties in school life because of different language, strange surroundings, and culture wall. Thus, stress for international students might be stronger than local students and the overload stress might have the negative impact on the international students’ health to both physical level and mental level. The author of this project is also a case because the author, Taiwanese, has heavy stress while studying in the UK due to the language barrier and low academic performance. The author used to release the stress through eating more and consequently gains 10 KG within three months. The stress has influenced the author’s physical and mental health seriously. This situation is also a reason why the author tries to find a way to release the international students’ stress to be better health in physical level and mental level.

## 1.2 Aims and Objectives

The aim of this project is to analyse the stress that has the negative impact on the mental and physical health of international students who study in the UK and the author try to design a relaxing product for the international students to vent the negative emotions and to be in a better health. In order to achieve these aims, there are eight objectives in this project as follows:

- (1) To review related and relevant literature, including understanding the system of stress, interaction design, and robotics.
- (2) To do an analysis of existing products, including relaxing methods and the important elements of relaxing products
- (3) To interview international students to find out their stress and what methods make them relax
- (4) To integrate information from research into design rationales
- (5) To develop concept with design rationales
- (6) To conduct the prototype
- (7) To evaluate final design (focus group)

## 1.3 Related Research Works

With the technology growing, there are more communication media and interaction methods invented and these technological products minimize distance between people. The international students can contact their family and friends with smartphones, communication software, social media, and Apps. However, the interactions of these solid products and software are limited in 2D world; for example, texting in Facebook, Face time in the iPhones’ screen, emoticons and stickers in social Apps. Thus, this

project tries to create a 3D solid product to bring a new interaction experience for people like face-to-face and make the international students have a better interaction with their family and friends. Moreover, the product vents the students' negative emotions to reach the effect of relaxing with increasing interaction between the international students, family and friends.

#### **1.4 Limitation**

The target group of this project focuses on East-Asian international students who study in the UK. The first reason is that stress is a complex system because people have different cognition as people meet the same event. The impact factors of people's cognitions include different backgrounds, cultures, environments, and personality traits. Hence, the target users are minimized into East-Asian international students to decrease the complexity of the impact factors because of the similar background and culture. The second reason is that the author of this project is studying in the UK, so finding international students who study in the UK to be interviewed is easier than other countries and the information would be more accurate for this project. After all, the academic year is just one year, so the author needs to find an effective research manner for this project.

## **2 Secondary Studies**

The purpose of this project is to create a relaxing product for releasing East-Asian international students' stress, so the first step is to understand what stress is and the system of stress. The literature review of stress helps the researcher understand the process of stress produced and which stage of the stress system may be a suitable opportunity to deal with. Since the final direction of this project is to create a relaxing interaction robot, the range of the literature review is extended to interaction design and robotics. Interaction design might be helpful to create a better interaction experience between the robot and the users. Besides, the robotics is an important knowledge for designing and setting this toy interactively.

### **2.1 Stress Definition**

There were many specialists trying to define stress with different approaches and one of the famous specialists in this field of stress research was Richard Lazarus who was a psychologist. Lazarus has done stress research for nearly 50 years and indicated that the meaning of stress is a whole factors relating with interaction between the stressor and reaction, including stimulus, cognitive appraisal of threat, and response. The stressor meant a stimulus with a potential for activating the stress response and had a threat of personal security [6, 7]. Moreover, Lazarus declared that the psychological operation system was not stimulus-response models (S-R) and was stimulus-organism-response models (S-O-R) since people have individual motivations and cognitions [4]. Thus, different people with the same stressor might produce different results and even there is no stress reaction. However, Greenberg [6, 7] supposed that the range of Richard

Lazarus's definition in stress is too broad for the management of stress, and Greenberg [6, 7] assumed that the term "stress" contains a stressor and stress reaction. Furthermore, if the two factors do not exist together, there is no stress as the stressor just has a potential for activating the stress reaction. For instance, if two people are redundant from their jobs, and the event that the first person is a stressor, then he starts to worry how to be employed again to support his family after the event. So, people experience stress because of the stress reactivity. On contrast with the first people's reaction, the second one wants to change the job before being redundant and s/he gets a vacation to rest, thus, s/he does not feel stressful on this event because there is no stress reaction.

The above two definition of stress explained that stress produced need to reach two conditions, including stressor and stress reactivity. Moreover, there are a lot of factors influencing the generation of stress between stressor and stress reactivity, because these factors have influence on people's cognition. These factors include personal experience, individual motivation, and so on.

## 2.2 Interaction Design and User Experience

Interaction design is like a bridge connecting people and products. The purpose of interaction design is to create a better interaction between people and products. By interaction design, Rogers et al. [14] expressed "designing interactive products to support the way people communicate and interact in their everyday and working lives." Saffer [15] viewed that interaction design as "the art of facilitating interactions between humans through products and services". Therefore, the result of interaction design might be not only an interactive product but also a service. Moreover, designing an interaction between human and products needs other fields to support, so the range of interaction design is wide.

Rogers et al. [14] pointed out that "Designers need to know many different things about the users, technologies, and interactions among them in order to create effective user experiences." The central of interactive design is user experience (UX) because a good interaction design depends on the feeling of use. User experience means how a product works and is used by people in the real world. Another definition of user experience from Nielsen and Norman [12] is "all aspects of end-user's interaction with the company, its services, and its products." When someone uses every product, there is a user experience produced [5]. Therefore, user experience happened in people's life every day and contained all interactions among users, products, and services.

## 2.3 Interaction Design Process

Rogers et al. [14] indicated that there were four basic activities in the process of interaction design and that were shown in follow:

- (1) Establishing requirements
- (2) Designing alternatives
- (3) Prototyping
- (4) Evaluating

The four activities is a repeating cycle and inform one another. The evaluating step is a heart of interaction design because designers can know what has been built and ensure the interactive product is appropriate. There are many different approaches to achieve the evaluation, including interviews, and observing users and focus group. These approaches make products more user-centred and close people's requirements.

In the process of developing an interactive product, the objectives can be divided into two types in terms of usability and user experience goals to be clearer, though the two types affect each other. Since the usability has influence on the quality of user experience and, in contrast, user experience is associated with how usable the product is [14]. The usability goals more focus on products and more objectives such as efficiency to use. On the other hand, user experience goals are subjective qualities and concerned how users experience the interactive product from user's viewpoint; for instance, satisfying and enjoyable. Thus, a good interactive product not only achieves the usability goals but also the user experience goals.

## 2.4 Emotional Interaction

People have personal emotions, as there is an interaction with products. Emotional interaction is about what makes people produce emotions such as happiness, angry, nervousness, and so on, and using the knowledge to inform the design of user experience [14]. However, there are a lot of reasons that might affect people's mood and feelings, which might be the weather or winning a game. Designers, therefore, need to research how the users express the emotion and how the users read other people's expressions to understand how user's emotions and behaviours affect each other. [13] suggests that the positive emotion of mind can make people more creative and less focus. In contrast, the negative emotion of mind makes people to be less tolerant.

## 2.5 Robotics and Balance System of Robots

Balance plays an essential role in movement and performance of a robot. Generally, the balance system of robot consists of sensors and actuators to lead a complex system [8]. Today, the three common sensors are gyroscopes, accelerometers, and tilt switches. Although tilt sensor is the cheapest, the sensor does not have higher accuracy and a lower frequency response.

**Accelerometer Sensor.** In 2013, Goodrich [9] explained that "an accelerometer is an electromechanical device used to measure acceleration forces. Such forces may be static, like the continuous force of gravity or, as is the case with many mobile devices, dynamic to sense movement or vibrations". Today, accelerometer is popularly used in compass Apps and other mobile devices to identify orientation. In addition, the accelerometer measures the amount of static acceleration due to gravity, and then the users can find out the angle the device is tilted at with respect to the earth. Thus, through the accelerometer sensing the amount of acceleration, the users can understand and analyse how the device is moving. Therefore, this type sensor can measure a robot's movement and assist the robot to keep in a balance. However, the accelerometer can measure the

orientation of a stationary object with relation to Earth's surface but senses the rotation. As accelerating in a specific direction, an accelerometer is unable to classify between the acceleration and the acceleration from Earth's gravitational pull.

**Gyroscope.** A gyroscope is a device that is used to determine orientation by Earth's gravity. The structure of a gyroscope consists of a freely-rotating disk on a spinning axis in the centre of a larger and more stable wheel. As the axis turns, the freely-rotating disk stays stationary to show the central gravitational pull [9]. Hence, the gyroscope is able to measure the rate of rotation around a particular axis and the technology also use in balancing robots.

## 2.6 Connection Function

**Teleoperation.** Teleoperation is a kind of remote interaction system between human and robots and indicates the operation of a machine at a distance [1]. Moreover, the technique is commonly associated with robotics and mobile robots. The structure of teleoperation is shown in Fig. 1 and people can use electronic devices to control a robot from a distance through the Internet and get the feedback from the robot.

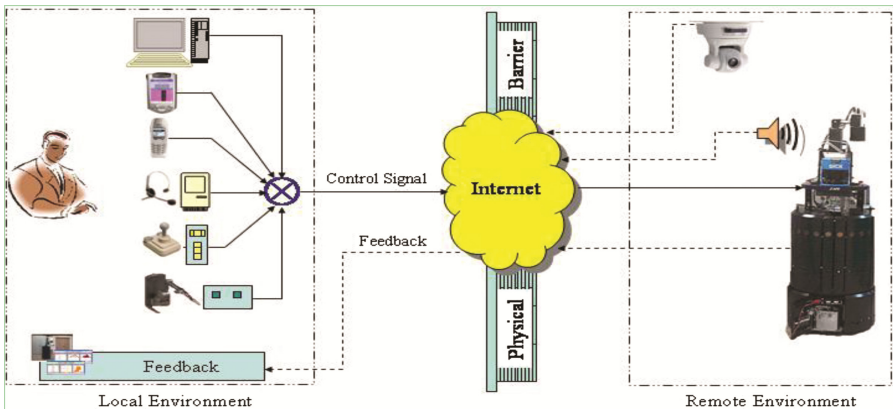


Fig. 1. Remote interaction system (Salichs 2014)

**Bluetooth.** Bluetooth technology is the global wireless standard enabling the Internet of Things and created in 1994. This technology was seen as a wireless alternative to data cables by exchanging data using radio transmissions [2]. In the past, Bluetooth had a limitation that the rate of data transfer is about 3 megabits per second this is lower than Wi-Fi. But, now the rate of data transfer has reached 24 megabits per second combining with Wi-Fi [11]. Although the rate of data transfer is still lower than Wi-Fi, it is enough to play music and receive single for robots. However, there is still a limitation of Bluetooth technology in terms of distance limitations because the best effective distance between Bluetooth devices is less than 10 m.

## 2.7 Design Rationales for Releasing Stress

### Design Rationales

S1: experience emotion before the physical arousal and the negative consequence might an effective approach.

S2: good interactive product focuses on not only usability but also user experience.

S3: emotion and behaviour affect each other.

S4: anthropomorphism might be an effective method to increase interaction between people and interactive products.

S5: combination of Gyroscope and Accelerometer sensors has a more accurate measurement and a better balance in robots.

S6: use teleoperation technology to solve the problem that controlling robots in a long distance.

## 3 Case Studies

### 3.1 Introduction

The purpose of this case study is to analyse the existing products' features to find out design elements and to rank these elements to discover the important elements, moreover, these relaxing methods and design elements are used into the questions for interview survey. In order to achieve the aims, there are a series of objectives as follows: (1) To make a research plan, (2) To collect twenty kinds of existing relaxing products from shops and websites, (3) To find the features and relaxing methods of these products with KJ method, (4) To integrate the features of these products into simple elements, (5) To compare these elements with Intra-action analysis (Matrix-A), (6) To conclude important elements for design rationales and transfer these information into the options of the interview questions.

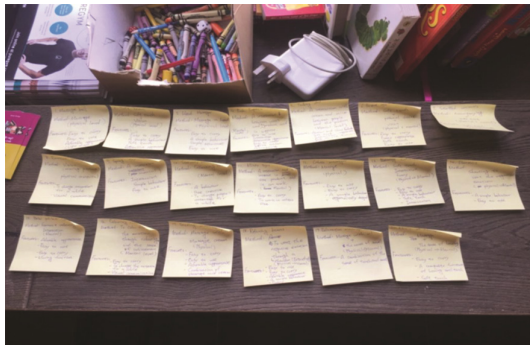
### 3.2 Methods Used in This Case Studies

**KJ (Kawakita Jiro) Method.** KJ method was a research method, which was used in organizing massive information into a few groups in a certain field to find key points and the trends quickly, and Kawakita Jiro, Japanese anthropologist, introduced his KJ method in 1960s [10]. There are 5 main steps in KJ methods, i.e. (1) decide the topic, (2) collect information or products, (3) write down every piece of information that you need to organize onto a separate sticky note, (4) sort all sticky notes into groups as the notes are similar, and (5) find main trends and relationships between these groups.

**Intra-action Analysis (Matrix-A) Analysis.** The Matrix-A is to compare each element with itself and every other inside element to find the importance of each pair of those relationships, moreover, the purpose of the matrix-A chart method for design research is designed to permit a systematic search for connections between the elements (of an aimed product) involved within a design research problem [3]. Therefore, there is an

Intra-action analysis in this project to find the importance of design elements of the existing relaxing products.

**Existing Products Analysis.** There are twenties relaxing products chosen to explore the features, both physical level and mental level, and these features were transferred into design rationales through KJ method and Matrix-A analysis. The researcher followed the KJ method to find the relaxing manners and common design points of current products. First of all, the researcher wrote down the relaxing method and the features of these existing products on the sticky notes, one product for one sticky note as showed in Fig. 2. This method is helpful to find out the each relaxing method because some products include more than one type of relaxing methods; for instance, the stuffed animals with two relaxing elements: accompanying and soft touch. Furthermore, the research can discover the common design elements from these sticky notes.



**Fig. 2.** Sticky notes

After analysing these sticky notes, the researcher made a list of the various relaxing approaches (see Table 1) that were found on these sticky notes and grouped these relaxing method in two groups i.e. physical level and mental level.

Then, the researcher grouped these relaxing methods into mental level and physical level showing in Fig. 3. There was a finding that most of these relaxing methods had the relaxing effect of the mental level so people might require relaxation mentally and physically.

Besides, there are some common elements from these relaxing products as the follows: (1) Easy to use, (2) Easy to carry, (3) Attractive appearance (e.g. Adorable, Delicate, and beautiful). After the analysis of existing relaxing products in KJ method, the researcher separated 10 design elements from these relaxing products, and compared the 10 design elements to rank a priority of these products using the Intra-action analysis (Matrix-A) shown in Fig. 4.



**Table 1.** List of relaxing methods.

<b>Massage</b> (e.g. Shaking, Rolling, and scratching)	Massage is a kind of physical methods in releasing stress and makes people feel comfortable quickly. Moreover, more and more additional functions are combined into the massage function such as playing music
<b>Soft touch</b> (e.g. Stuffed dolls)	Soft touch is also a kind of physical ways making people relax through the sense of touch. The most common relaxing products with soft touch are stuffed dolls. When people are hugging the stuffed doll, people feel comfortable even expressing sentiments
<b>Interaction</b> (e.g. actions feedback, voice feedback, and move function)	The interaction means the behaviour between the users and the products. For instance, people press the button of the TED 2 and then the TED 2 has a response to people, and the process is an interaction. There are a lot of types of interactions in relaxing products and this element is often combined with other relaxing methods such as changing people's attention
<b>Music</b>	Music is a common relaxing method today because people have a change of the mood in listening to music. According to a journal of Psychology of Music shows that one of many functions for music, as it is an emotional expression, so music is an approach to for people to vent their negative emotions
<b>Smell</b> (e.g. Essential oil)	This way is to make people relax physically through the sense of smell such as perfume
<b>Accompanying</b>	People usually have the sense of insecurity facing strange surroundings and changes in the life, and the negative sense affects people physically and psychologically, including the negative thinking and nervousness. However, accompanying is a kind of mental senses that makes people feel safe and have a stable emotion, so accompanying is helpful to solve problems of insecurity
<b>Visual communication</b>	Vision is also a way to change people's emotion and then makes people relax. The factors that affect people's emotions directly through vision including colour, shape, moving, and still
<b>A simple behaviour</b> (e.g. Shouting and rubbing)	Some simple behaviour has impacts on human's emotional and sometimes the impact occurred in cognitive system or from people's instinct. For example, some people feel relaxed in shouting because the behaviour makes people relax the body with a good mood
<b>To satisfy personal desire</b> (e.g. famous products and collecting)	Most people have personal desires and satisfying personal desire usually makes people have a delightful feeling. However, a control of personal desire is necessary because wants are unlimited

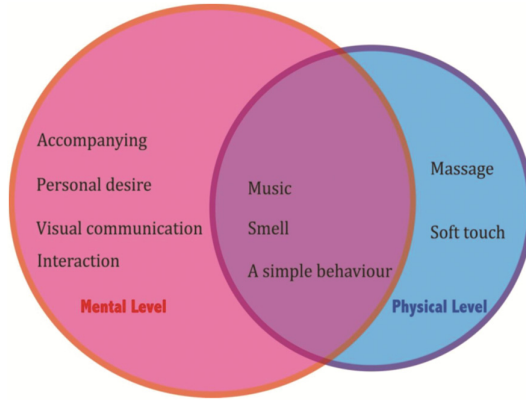


Fig. 3. A relationship of the relaxing methods

Elements	The effect of relaxing	Colour	Grip	Texture	Interaction	Easy to use	Exterior	Funny	Easy to carry	Massage	2	1	Total
The effect of relaxing		1		2	2	2	1	2	1	2	10	3	13
Colour	1			1	1		2				2	3	5
Grip				2	1	2	1		2	1	6	3	9
Texture	2	1	2		2			2		2	10	1	11
Interaction	2			2		2	1	2	1	1	8	3	11
Easy to use	2		2		2			1	2	1	8	2	10
Exterior	1	2	1		1	1		2	1	1	4	6	10
Funny	2			2	2		2				8	0	8
Easy to carry	1		2		1	1	1			2	4	4	8
Massage	2		1	2	1	2	1		2		8	3	11
2	Direct connection												
1	Indirect connection												

Fig. 4. Intra-action analysis of relaxing products

The 10 design elements included the effect of relaxing, colour, grip, texture, interaction, easy to use, exterior, funny, easy to carry, and massage. Then, these elements were compared with other elements to gain a score in the relationship of the connection. If the two elements having a direct connection, the score was 2, showing in the blank. If the two elements have an indirect connection, the score is 1, showing in the blank. However, if there is no connection between the two elements, the blank is empty. The final step sums up all scores and there is a total score for each element. After that, the researcher gained a rank of the connectional relationship from the total score for each element. The highest priority is the effect of relaxing, so this element is still the most important element for designing a relaxing product. Besides, the elements, including interaction, texture, massage, easy to use, and exterior also gain the high priority.

### 3.3 Summary and Design Rationales

The authors found out the relaxing approaches and some common points in these relaxing products. Another finding is that most effects of these relaxing approaches are to release stress in mental level. Hence, people might feel stressed in mental level more than physical level or release the stress in mental level might avoid the stress from occurring in physical level. Besides, the researcher evaluated design elements of the

relaxing products in the connectional relationship and had a priority of the importance for these design elements. Finally, the researcher integrated these findings from the case studies into design rationales as follows, C1: Interaction, C2: Easy to use, C3: Music, C4: A simple behaviour, C5: Massage, C6: Funny, C7: Attractive appearance, C8: Easy to carry, C9: Accompanying, C10: Soft touch, C11: To change attention.

## **4 Interview Studies**

This chapter was to obtain the in-deep information from East-Asian international students through an interview, and the information included the causes of the students' stress, how the students deal with these stresses, and which relaxing method the students feel a good effect in releasing the stress. Besides, the design rationales that are from case studies are also used in the questions of the interviews, and there is a rank of the effect of releasing the stress depending on the interviewees' choices. Therefore, the researcher can get accurate and realistic problems the students meet today and a direction of the possible solution with analysing the information that contained the interviewees' thinking, opinions, and feeling. The purpose of this interview is to understand the potential root causes of the students' stresses from the interviewees' responses and gain the possible solutions based on the analysis of the interviewees' feedback.

### **4.1 Subjects' Selection**

There were 8 interviewees in this interview and all of these students were East-Asian international students who are studying in the UK. Moreover, these students' native language is not English. The 8 interviewees contained 5 female students and 3 male students, which all interviewees' experience of studying abroad under two years except the fourth interviewee, and the ages of all interviewees are during 20–30 years old.

### **4.2 The Questions**

The researcher created the questions from the target users' thinking since the researcher is also in the target group of this project and has studied in the UK over one year. Thus, the author of this project created the possible issues the target users might meet when the questions through personal experience and used a calculation to find the main causes that made the students feel stress and there was a negative impact on the student's health.

Before the author started to ask questions to the interviewees, the interviewee needed to sign a consent form. The purpose of the consent form is to confirm that the interviewee understood the purpose of this interview and the researcher's basic information. The most important of this consent form is that the interviewer needs to get the agreement from the interviewee if the researcher would like to use the interviewee's feedback in this project. Besides, the interview is conducted face-to-face with an audio record, so that it also needs the interviewee's consent. The questions of this interview sheet was designed in step by step, the first part of the questions is personal information, after that the interviewee was asked the questions about what aspects the interviewee cannot adapt

to during studying abroad. The reasons of this question are that the stress occurred was made in life situations, including changes, troubles, and threats in people's life [6, 7]. When people met a change in life, people began to adapt the new situation. However, people felt stressed during the process of adapting the new situation and even more stress, as people cannot adapt the change. Thus the first step was to understand the issues of the students' adaption and the issues might be the root cause of the students' stress. Then, the second step is to ask the interviewee whether the situation the student cannot adapt to cause the negative reactions of the student's health in mental level and physical level. Afterward, the interviewee was asked how improve and deal with the situation that make the interview feel stress. The next question listed relaxing methods for the interviewee to evaluate the effect of relaxing each method and these relaxing methods were collected from the case studies. Finally, the researcher can get possible problems the students met with these questions and have a direction of the initial idea through this interview.

### 4.3 Summary and Design Rationales

According to the interviewees' feedback of this interview, the root causes of the students' stress were focused on a worry for academic performance, family expectation, self-expectation and communication problems due to the language barrier and culture difference. These issues had the negative impacts on the students' mental reactions, including the negative emotions and thinking. Then these mental reactions caused the students to have the negative physical reactions such as depression, a difficulty in concentrating, and insomnia. For instance, the student met the life situation: studying abroad, and then the adaption issues happened. If the student perceives the adaption issues as stress, there were the negative emotions happening. Moreover, the physical reactions happened resulting from the negative emotion is not released, and even the worst consequence is the disease such as the depression. However, the two key points needed to be considered. The first point was the cognition stage of stress because the different cognitions are produced different people met the same life situation. For example, the two interviewees did not perceive that academic performance caused the stress due to the fact that the two interviewees' English was better than other interviewees. The second point was that the stress has not only negative influences but also positive influences and people just need to handle the excessive stress. The non-excessive stress made the growth of people. For instance, the stress of language issue also made the students have an effort of learning English to reach a better English level. It is not necessary to remove these stressors because the stressors stimulate the East-Asian international students to be more mature.

Therefore, to handle the stress of East Asian international students in the stage of emotional arousal, which is between the stage of physical arousal and perceiving as stress, might be a possible solution. The root causes of the stress are complex as different cognitions so that the stress produced is not easy to control. Moreover, to deal with the negative emotions before the excessive negative emotions become physiological arousal is simpler than the control of the stress produced. To sum up the evaluation of relaxing methods from the eight interviewees and gain a final rank are shown in Table 1. All relaxing methods from the case studies got score, so the situation expressed that these

methods all had value to be design rationales. An interaction with people was scored the highest rank and these students all felt that chatting and an interaction with friends and family were helpful to relax and vent the emotion. Therefore, increasing interaction between the East Asian international students to vent the students' negative emotions became the design direction of this project. Most of these summaries were transferred into the design rationales (i.e. I1: for handling the students' stress in the emotion stage of the stress model; and I2: for increasing interaction with friends and family).

## 5 Design Development

The initial design was to develop the idea from the author's conceptual development and design rationales that are from secondary research and primary research. After that, there was a testing step, including a 3D modelling of the initial design and an initial focus group using this 3D model. Then, the designer redesigned the initial design according to the user's feedback of the initial focus group, and did detail design to complete the final design. Finally, there was a final focus group to evaluate the final design.

Today, there were many contact ways between people such as texting, calling, and video. Moreover, the contact media was also multifarious, including smart phones, webcams, and projectors; however, these contact approaches were limited in a 2D world or just an image. The author, therefore, tried to combine contact ways and medias with robots as shown Fig. 5 and created an interactive robot with contact function to increase the students' interaction with friends and family.



Fig. 5. Mood board



Fig. 6. Concepts/ideas

Figure 6 showed the concept development of this project, including the two design elements. The first one was a personal feature and this idea was from a Japanese comic. The snails were telephones that showed different personal features as different people called and expressed the emotion with the calling people's moods. The second factor was to create an action figure that can express the emotion like a 3D emotional sticker. This idea was from the emotional sticker because the process of the sticker development was from still stickers to animation stickers with voice. Hence, the author thought that a vivid solid sticker might attract people to have interactions with it. Finally, the concept

is to create an action figure that can show personal features as different people are calling and the action figure can express different emotions people choose like a solid sticker, and further to use the action figure to increase students' interactions with family and friends.

Figure 7 showed the concept sketch and the prototype of this robot that is from one of the author's colleagues, Miss Sue, so the author named this robot with Robot (Sue v1.0).

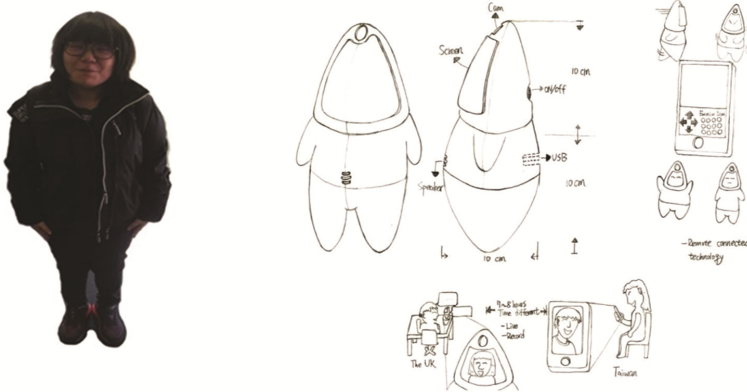


Fig. 7. Concept sketch

### 5.1 Initial 3D Printed CAD Model for Testing

The Figs. 8 and 9 showed the first step was to create a 3D model of Robot Sue v1.0 using Rhino and the semi-finished model.

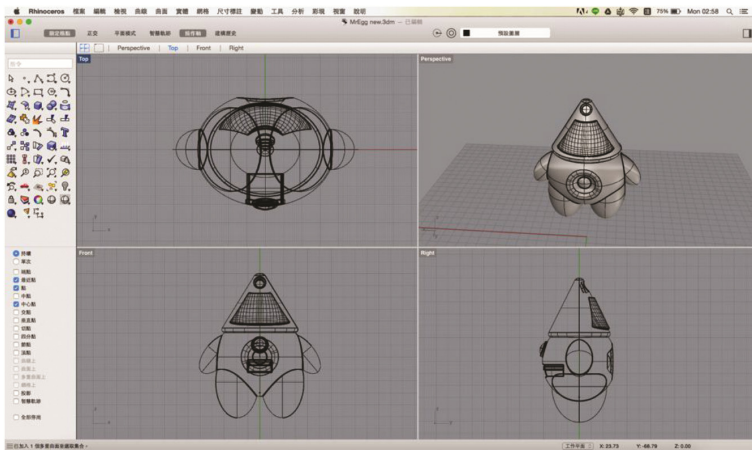


Fig. 8. 3D modelling (Robot Sue v1.0 in Rhino)

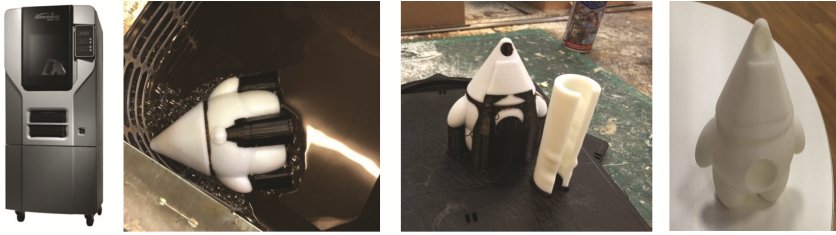


Fig. 9. Semi-finished 3D modelling

## 5.2 Focus Group Testing

In order to understand the users' feelings, the researcher did the initial focus group with the target users and these students were same as the interviewees. The following information is the feedback from the focus group:

**Advantage.** (a) The appearance makes the users feel friendly and funny, (b) It is effective way to increase interactions with family and friends, (c) The feeling of using this robot is stronger than 2D stickers, (d) The half size is easy to carry.

**Improvements.** (a) The size of the screen is too small, (b) To add move function makes family and friends see the students' surroundings more, (c) Additional functions: clock...etc.

The designer confirmed that the initial design achieved the main design rationales that to increase the student's interaction with family and friends through this focus group. However, there were some issues to improve, including the size of the screen is too small, a requirement of moving function, and more additional functions.

## 6 Final Design

### 6.1 Balance System

Robot Sue v2.0 uses a combination of gyroscope and accelerometer to keep the body in balance.

### 6.2 Connect Function

Robot Sue v2.0 uses the two connection functions, including teleoperation technology and Bluetooth. If the distance between users and the robot is over 10 m, the user needs to connect the robot via the network. For instance, the parents want to connect the student's robot and the parents need to connect via the network. In contrast, if the distance less than 10 m, the user can use Bluetooth.

### 6.3 Charging

Figure 10 showed that Robot Sue v2.0 uses wireless charging technology and choose Wireless Power Consortium (Qi) standard because this standard is the most common today. Moreover, if the user's smartphone supports this standard, the smartphone also can be charged using this wireless charger.

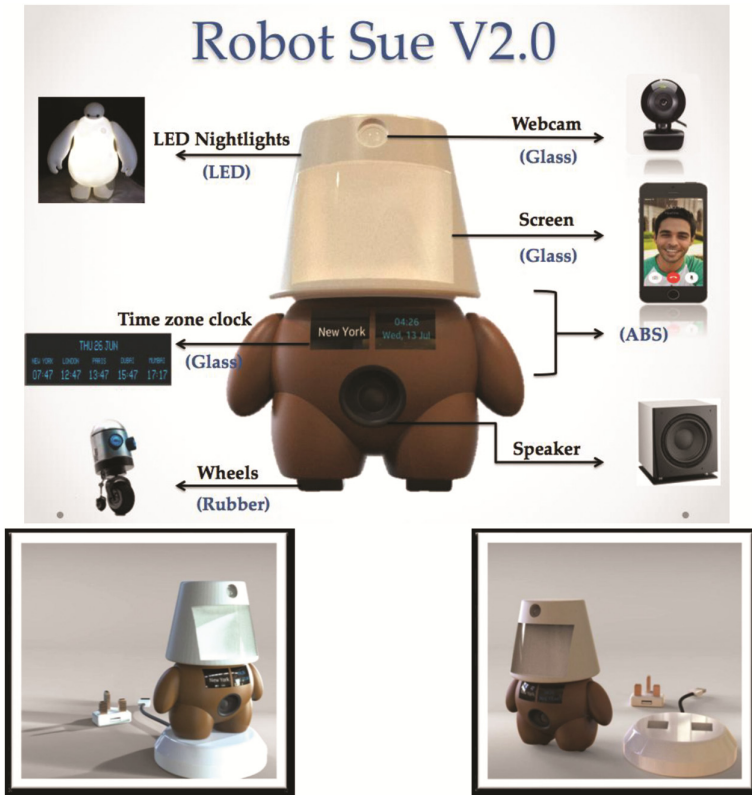
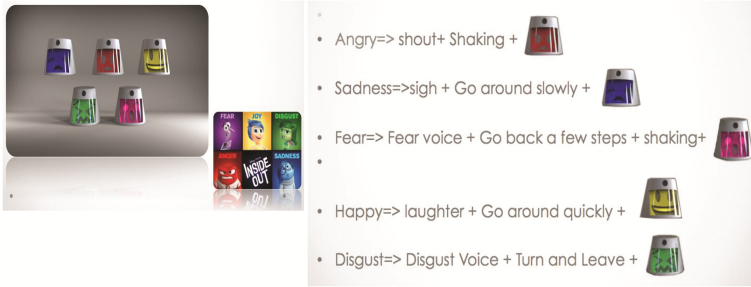


Fig. 10. Introduction to Robot Sue v2.0

### 6.4 Emotion Performance

Robot Sue expresses emotions through expressions, actions, and voice. The designer adds colour factor into expressions to enhance feelings of emotions and the idea is from a popular movie “Inside out”. Figure 11 showed the different expressions with different emotion colours; for instance, angry expression comes with red colour.

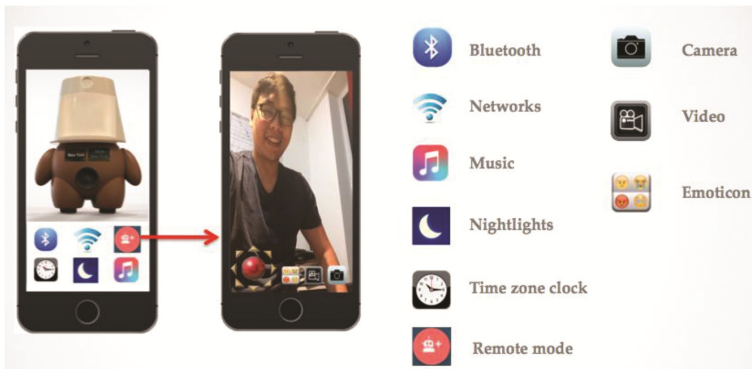




**Fig. 11.** Emotional colour and performance (Color figure online)

## 6.5 User Interface in App

Figure 12 showed the user interface in App of Robot Sue. The functions of the App include Bluetooth, Network, play music, nightlights, time zone clock, remote mode, camera, video, and emoticon. As the user enters the App, the user needs to choose Bluetooth or Network to connect the robot. After connecting the robot, the user can click remote mode, and then the screen will show the control surface. The user can move the robot through the virtual joystick and take photos, record videos, and send emoticons. When the user clicks the emoticons, the robot will have emotion performance, where the most important step is to choose connect approaches depend on the distance between the smartphone and the robot.



**Fig. 12.** User interface (App)

## 7 Discussions

With technology development, people received much more information unconsciously everyday than past and this situation also caused overload on people's body. Moreover, there were more new things people needed to adapt to rapidly and challenge and these changes caused people to feel stressed both mentally and physically. This situation was

also the possible reason why more mental diseases and society problems have been occurring. International students also met the difficulties, including adaption of new surroundings and different language. The author of this project was also a Taiwanese international student and has been studying in the U.K., so the author can understand the stress on studying abroad. The stress caused the author gained 10 kg within three months, so the author decided to choose this topic and understand deeply the causes of the stress.

Through the secondary research, the author found that stress system is complex because of personal cognition. There were a lot of factors influencing people's cognition, including culture background, family background, and personality traits. Different people had different responses while meeting the same life situation, so this increasing situation made it more difficult to find the root causes of the student's stress. Therefore, the author minimized the range of target group into East-Asian international students to decrease the complexity and did an interview to understand the stress of the student and tried to find the possible solution. However, the result of the interview showed that there were different causes of the student's stress and different stress reactions even if the students met the same situation. Although the most of the root causes were collected in academic performance, culture shock, family expectation, and self-expectation, the stressful level was different in the students.

Besides, the author found that these root causes of the students' stress also made the students grow up, so the direction might be amended to just handle the excessive stress and not remove all stress. Thus, the author thought that if it is impossible to control the students' cognition; however, to vent the emotion after the stress happened and before the negative physical arousal and the ensued consequences might be a possible direction.

After that, the researcher found a method in which all the interviewees had a relaxation, and this method is interacting with friends and family. Moreover, the researcher understood that behaviours and emotions affected each other from the research of interaction design, so positive behaviours can give people positive mood such as happiness. Moreover, Anthropomorphism is an effective way to attract people to have an interaction with the product. Thus, the researcher decided to design an interactive robot and this robot can increase interaction between the students and family to vent the emotions further in order to achieve the aim of relaxation. However, the researcher met some difficulties in designing the interactive robot. Firstly, the author is strange to robotics and the limitation of the academic period, so the author just can design a conceptual model and combine it with the generally existed technology. Secondly, there is no design background for the author, so the author dealt with a lot of design in the first time, including user interface design of Robot Sue's App and the use of materials.

Although the interactive robot is in a concept stage, the result of the final evaluation showed that Robot Sue is effective to increase the students' interaction with family and friends, and has the effect of venting the students' emotion. Thus, continuing to develop this project with this concept, Robot Sue might be manufactured in real products and a solution for releasing the East-Asian international students' stress.

## 8 Conclusions and Recommendations

### 8.1 Conclusions

With the development of civilization and information delivering rapidly, people's life became more convenience and to replace old things also became fast. However, this situation also caused the people to have heavy stress and increased mental illness. Thus, to release the stress has become an important issue today. International students also had heavy stress resulting from adaption problems of oversea life. The author of this project was also an international student who studied in the UK, so the author had the stress experience. Moreover, the stress made the author to gain 10 kg in three months and had the negative impact on the author's health. Thus, the author decided to research this topic and tried to find the solution to improve this situation.

### 8.2 Recommendations

Due to the limited academic period, the final design is just a concept model and shows a general structure with functions. In the future, the robot can be developed more to be customized using 3D printing technology and divided into assembly parts. Besides, the author just set five basic emotion performances in the final design, so it is not enough. It is possible to attract the users as the more emotion performances developed, including more types of actions, expressions, and a wider range of voice. For environmental friendly, a service design of replaceable assembly parts and a recycle of ABS plastic can reduce the waste.

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