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# /POKEMO

Tactile Emotion Communicator For Long-distance Couples

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## Abstract

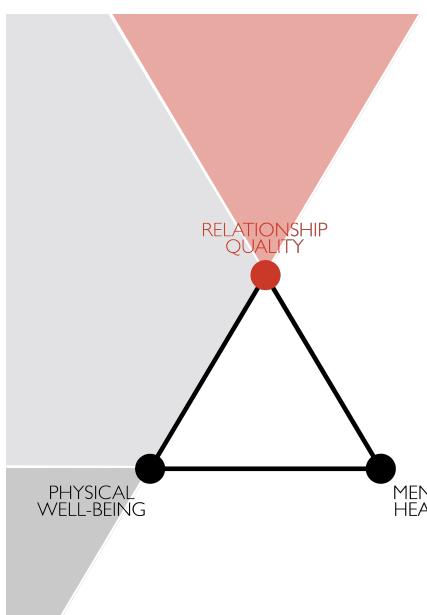
A satisfying relationship is significant for one's life from both physical and mental health point of view. It generates happiness and make a person's life more complete. While the pressure of job or study forces people to travel a lot or live apart from his/her important one, effective emotional communication has become even more essential for couples who live in different places in order to maintain a healthy and delightful relationship.

Therefore, the project aims to find a suitable solution to enhance emotional communication experiences for long-distance couples. /POKEMO is a tactile interactive communication device designed for couples in long distance relationships. /POKEMO not only can sense your mood with embedded sensors, but get to know you and your emotion over time as well, which makes it much easier to share your emotion with your partner. Wearable and convenient, it provides better interaction experience and could strengthen emotion bonds between long distance couples.

In this design project, online survey, interviews and literature review are conducted first to better define and understand the target audience. The report includes competitive analysis, which gives insights about market opportunity and available technology. Design concept is illustrated with graphics and 3d renderings, followed by user testing and evaluation section.

# Chapter 1: Introduction

## 1.1 Design context



Research evidence indicates that healthy relationship, especially romantic relationship tremendously matters to a person's life. It influences physical well-being as well as mental health to some extent.

With the development of the society, it has become a more common situation for couples to live apart, either in short term or in long term. The number of long-distance couples has never dropped in recent decades.

While effective communication between couple is an essential key point to make a long distance relationship work and last longer, keeping certain level of intimacy can be far more difficult, especially comparing to couples who live together. Emotional communication and sharing feelings is one of the most significant activities for keeping effective communication.

Emotional Communication is not about just appearance where the user understands something at a glance. The users should be able to exchange their emotion in the provided context and develop their own personal user experience. Emotional Communication brings personal experiences and motivates users to remember them. It should provide implicit and subtle communication between couple.

The goal of this design is to connect couples in long distance relationships, and to fill the gap of physical and mental distance between them.

## 1.2 Problem Definition

- Physical separations

Most of the long distance couples' conversations rely on Internet telepresence such as IM, video/audio calls, etc. Of which the absence of physical contact lessens communication's intimacy.

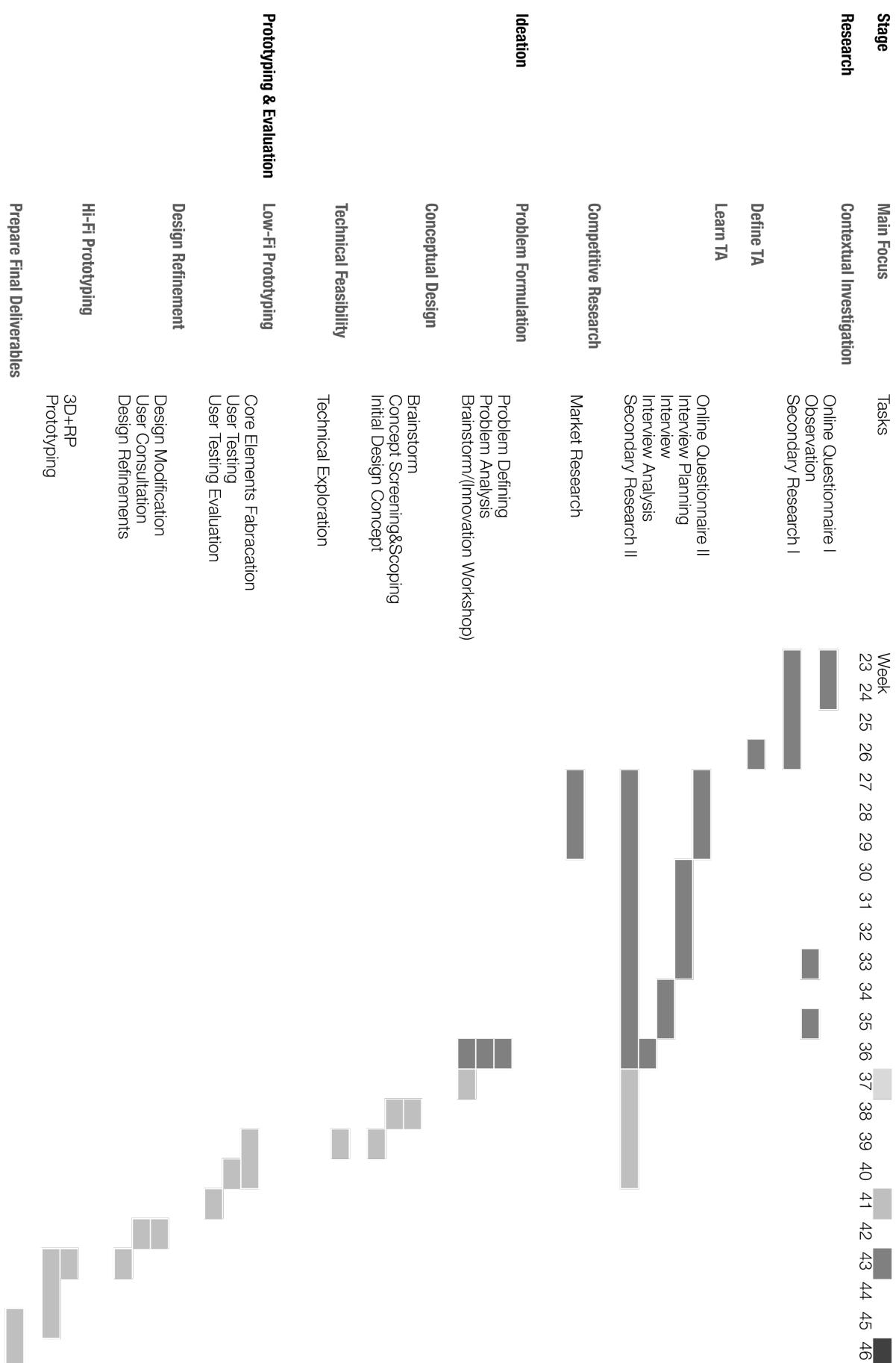
- Schedule Difference

Schedule difference and potentially time difference are considered another obstacle of emotional communications. A more convenient and intuitive approach is preferable.

- Personality variations

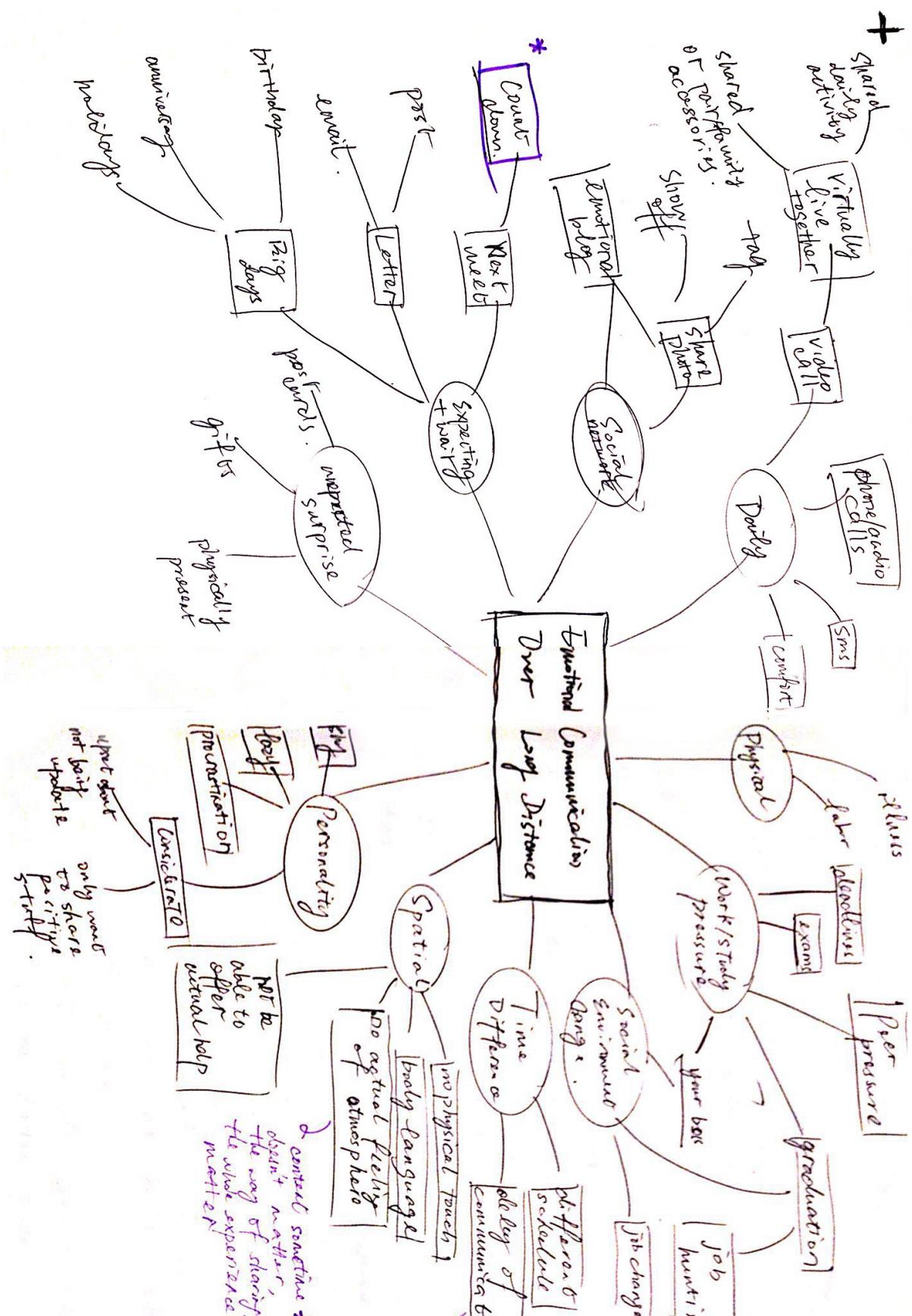
Personality variation and gender difference may lead to misunderstandings. An intelligent device could keep you updated on your partner's mood and more effectively deliver your affection

### 1.3 Gantt Chart



# Chapter 2: Research and Customer Analysis

## 2.1 Mind map



## 2.2 Literature review

A wealth of evidence suggests that love, closeness, and intimacy—in short relatedness—are important for people's psychological well-being. Love and the general feeling of being related to significant others are crucial to people's life satisfaction and happiness.

Sheldon et al. (2001, p. 339) conceptually defined fulfilled relatedness as the “feeling that you have regular intimate contact with people who care about you rather than feeling lonely and uncared for”. While fulfilling the need for relatedness is of prime importance to humans, current developments in lifestyle often render this a challenge. The pressure of the job market and globalization forces employees to travel constantly and even to live apart from their loved ones. The consequence is an increasing number of long-distance relationships. Most available technologies however focus on the transmission of explicit information, which neglects the emotional and subtle communication so typical for close relationships.

Adopting telecommunication technology to stimulate couple's communication over long distance, several facets are of great significance for couples to maintain certain level of intimacy.

| Facet        | Description   |
|--------------|---|
| Awareness    |  <p>Artifacts that create a feeling of cognitive awareness and continuity by sharing different types of (ambient) information about current activities or moods among partners (without a conversation or doing anything together).</p> <p>Substrategies: Display of presence, activity, or mood</p> <p>Psychological principles and key requirements for design: reciprocal self-disclosure, ambiguity, counteraction against idealization</p>                                    |
| Expressivity |  <p>Artifacts that emphasize the affective and emotional aspect of intimacy. They enable partners to express their feelings and emotions in a wide variety of ways, such as developing an own language or to use language in an ambiguous way.</p> <p>Substrategies: on-off, symbol</p> <p>Psychological principles and key requirements for design: enriched expression of emotions, reciprocity, integration in daily routines, open to interpretation, phatic communication</p> |
| Physicalness |  <p>Artifacts that mediate a feeling of physical intimacy. They simulate either secondary effects of physical proximity (e.g., body heat, heartbeat) or meaningful gestures (e.g., hugs, strokes).</p> <p>Subcategories: Physiological parameters, gestures</p> <p>Psychological principles and key requirements for design: Reciprocity, simultaneity, contextual constraints</p>   |

|             |  |
|-------------|--|
| Gift Giving | Artifacts that demonstrate caring and valuing the other person by gift giving. |
|-------------|--|



Psychological principles and key requirements for design: Reflection, effort and appreciation, thoughtfulness and similarity, symbolic communication

|              |  |
|--------------|--|
| Joint Action | Artifacts that allow for carrying out an action together, which usually requires being physically colocated. |
|--------------|--|



Substrategies: Established routines, new routines

Psychological principles and key requirements for design: Activating communication, behavioral interdependence, selection of activities, serendipity

|                     |  |
|---------------------|--|
| Collective Memories | Artifacts that keep records/recall of past activities and special moments of a relationship. |
|---------------------|--|



## 2.3 Target Audience

### 2.3.1 Online questionnaire

Two rounds of online surveys have been conducted. The first survey (Appendix 1) aims to gather information about daily communication habits of average people while the second is more specific. The second survey (Appendix 2) is investigating emotional communication methods, tools and channels for people who are in long distance intimate relationships. To be noticed that the long distance intimate relationship here was not specifying romantic relationship only. It also includes family members who live apart and close friends who are not in the same city/country.

The results indicate that people in different places usually keep contact through phone calls, video calls, text messages, IM, online social platform, etc. When it comes to emotional communication, sharing feelings and moods, the preferences are different. Some may prefer more straight-forward ways like video/audio calls, while there are groups of people that prefer using indirect ways as well (e.g., sending messages).

Analyzing the results of these two surveys, I realized that user needs and wants about emotional communication are widely different comparing couples to family/friends. At this moment, the target audience narrowed down to couples in long-distance relationships.

### 2.3.2 Interviews

Several rounds of interviews were conducted to acquire in-depth opinions about emotional communication habits, methods, needs and unfulfilled expectations from the participants who have long-distance romantic relationship experiences.

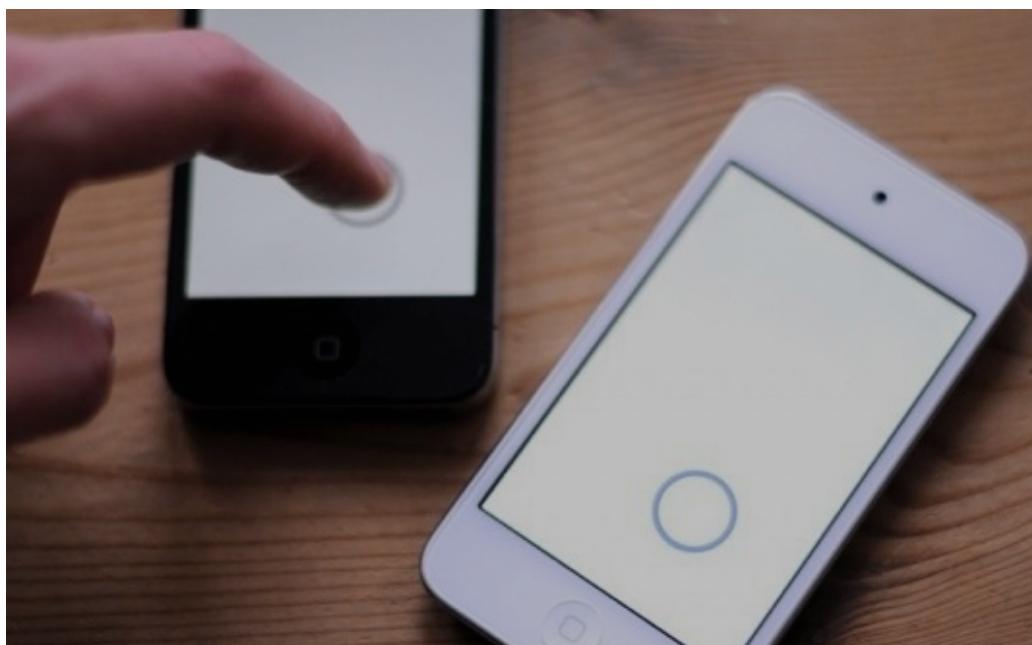
To sum up the insights:

- Telepresence, virtually feel accompanied, feeling of in-time feedback of your emotion is important to long distance romantic relationships.
- Hand-crafted accessories are of unique meanings for couples, which make them enormously personal, emotionally attached, and intimate. Some people may intend to develop certain psychological dependence on those stuff.
- The way to thinking is so different between male and female, so is the changing rate of emotion. Men are likely to be more stable in mood but will keep one mood longer; women are more emotional but their bad feelings get relief faster.

### 2.4 Competitive research

#### • Feel Me

At a first sight, Feel Me appears to be a text messaging application. Yet, when two people are both looking at the conversation they are having, touches on the screen of one side are shown on the other side as small dots. Touching the same spot triggers a small reaction, such as a vibration or a sound, acknowledging that both parts are there at the same time. Feel Me is a sweet connection and a playful link with the person on the other side, opening a channel for a non-verbal and interactive connection.



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- With

The device is designed for family members who live separately and to communicate over the internet. It is designed with the objective to convey emotions with the assumption that current technology interfaces are made too complex. The device resembles everyday objects (eggs, egg carton) to be familiar thus easy to use. The shape of the pillow is made "huggable" to offer a comfortable interaction.



- The mug

The mug is designed for couples in long-distance relationships. While one is using his/her mug, the partner's mug will perform sound and lighting effects.



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## 2.5 Montage of ring design



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## Chapter 3: Ideation & Design Concept

### 3.1 Design vision

Aims at connecting couples who are in long-distance intimate relationships, providing them an intelligent and proactive tools to exchange their feelings, express their affections and interact with each other.

It allows users to develop their personal user experiences rather than simply delivering the content of a dialogue, helps them to build up atmosphere for emotional communication, provides more realistic interaction, bridges the gap of physical and mental distance between them.

### 3.2 Design criteria

- Intuitive

The design should employ the simplest approach for long-distance couples to communicate their feelings. The interaction should be understandable. A wearable device is desired because users have better access to the information shared by his/her partner comparing to smartphones or other gadgets.

- Interactive

The design addresses tactile interaction, which enables user to physically contact with his/her partner over distance. The physicalness is believed to be the key factor of generating and maintaining intimacy.

- Intelligent

Geared with sensors, this device should have the ability to detect user's mood data and selectively share the information based on the his/her own options.

- Intimate

The interactive activities and user experience provided by the product create intimate feelings. It has to be personal, private and establishing special atmosphere when communicating.

### 3.3 Design concept

/POKEMO is a pair of tactile interactive rings designed for couples who are in long distance relationships. To bridge the gap of separations and make up the missing part of physical interactions, /POKEMO provides them tactile interactions as a brand new experience for emotional communication and mood sharing.

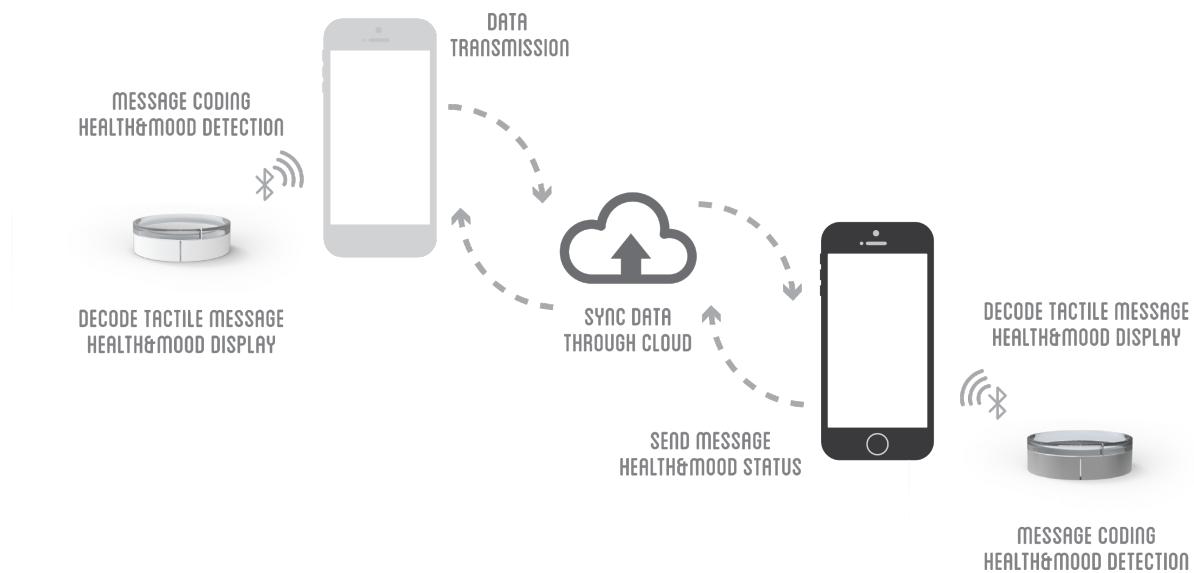
### 3.3.1 The naming - /POKEMO

There is a function on Facebook called pokes. The action “poke”, which means use your finger to touch someone, does not have any special meaning in this virtual world but merely send simple greetings to someone.

The screenshot shows the Facebook Help Center interface. The top navigation bar includes the Facebook logo, a search bar with the placeholder "Hi Michelle, what do you want to find in the Help Center?", and a language selection for "English (US)". Below the navigation, the URL "Desktop Help > Popular Features" is visible. On the left, a sidebar menu lists various features: Groups, Search, Events, Locations, Gifts, Notifications, and Pokes (which is highlighted with a blue background). Other items in the sidebar include Year in Review, Facebook Charity Donations, Q&As, A Look Back, The World Cup on Facebook, Page Post Purchases on Facebook, and a "Back" link. The main content area is titled "Pokes". It contains a section titled "What is a poke? How do I poke someone?" with a note that people poke friends or friends of friends for various reasons like saying hello or getting attention. It shows a notification card for "John Smith and Jane Doe poked you." with a timestamp of "39 secs". Below this, instructions for poking someone are listed: 1. Go to your friend's profile, 2. Click [...] on their cover photo, 3. Select Poke. A note states that if you don't want people poking you, you can block them. It also links to "More info" and "Get help for mobile apps and browsers". The last edit date is Friday. Another section titled "What happens when I poke someone?" notes that when you poke someone, they'll get a notification and can then poke you back. It shows another notification card for "John Smith and Jane Doe poked you." with a timestamp of "39 secs". A note cautions that only the person you poke can see the interaction. It also links to "More info" and "Get help for mobile apps and browsers". The last edit date is Tuesday. At the bottom, there are buttons for "Was this answer helpful? Yes · No" and "Permalink · Share".

Here in this design, /POKEMO equals to "poke+ emo", which denotes poke your emotion. Talking about the punctuation mark “/”(slash), it has a special meaning in some online games — slash plus a verb means take that action(e.g., when you type /wave, your avatar will wave hands). For the reason of stories above, /POKEMO wants to deliver the idea that take the action and poke your emotion to your partner, which is addressing the tactile interaction user experience and wishes the user to physically touch his/her partner over a long distance.

### 3.3.2 Interaction system



Each ring will be equipped with one set of sensors and one set of actuators, which means that it serves as a sending device as well as a receiving device. Signal/data from one side will be transmitted to the user's smart phone using BLE(Bluetooth Low Energy) then get synchronized to the Cloud. The smart phones at both sides will act as a signal hub for data transmission and also processor for mass data analysis.

The user interactions are categorized into two types, one of which is active interaction and the other is passive interaction. Active interaction requires user's inputs to activate the data transmission while passive interactions rely on the data acquired by the sensors. Considering about the main factor of /POKEMO's design spirit — the tactile active interaction is considered as the core part, which allows users to explore their own ways of using /POKEMO through physical actions. Data-dependent passive interactions enhance the intelligence of /POKEMO, helping users conquer communication obstacles and understand each other better.

### 3.3.3 Visual outlook

The form of /POKEMO is unisex design with minimalism style. Making use of material montage design, it creates values in both visual and functional aspects. /POKEMO is more than just an emotion communicator, but also a fashionable couple accessory, a pledge of the romantic relationship. The two line marks, which is switching the material of the two layers, function as the reference mark. This will be elaborated in details in next section.



Different colors and coating material for the lower layer are available, such as ceramic, titanium, precious metals, etc. The package will include a charging station for smart phone and the ring, which is lacquered in the same color and texture with the ring that user has chosen.



### 3.3.4 Functional modules

/POKEMO has 3 core function modules, which are message coder, bad mood alert and health indicator. Message coder is an active interaction module while the rests are passive. This section will illustrate how these three functions serve long-distance couples.

- Message coder

Message coder is a tactile interaction module for couple to send their unique message based on two simple mechanisms — poke and twist. This idea is inspired from an anxiety control therapy — people tend to gently stroke the accessories or clothes they wear and the touch of familiar material has certain soothing effects.

When one pokes the front surface of the ring, where the touch sensor is embedded, his/her partner's ring will vibrate. User can compose varied message codes through making different combinations of long or short vibration patterns.

The line marks of /POKEMO's two layers are the reference baselines for the twist mechanism. The lower layer's(opaque layer) line mark is designed as the origin while the upper layer's line mark is moveable. When one side of the couple twists his/her ring, the other side's upper layer will automatically twists to that specific angle.

Couples can customize their own message codes, making various tactile patterns. Vibrations and the frictional touch generated by the ring layer twisting create new experience for them to exchange simple messages and share their emotions. Moreover, the message coding and decoding process is extremely inconspicuous, which makes it more personal, private and shuns the embarrassing situation exposing the intimate interactions to surroundings.



## MESSAGE CODER

Physically interact with your partner with unique tactile message by poking and twisting /POKEMO.

- Bad mood alert

This module was ideated from the Monkey King's golden hoop, which will tight up when his master Xuanzang incants. The inner layer of the ring, which is made from piezoelectric material, swells when the user's partner has any sudden and extreme emotion changes. The expansion of inner layer will be obvious enough to be noticed but will not hurt the owner's finger. The mood detection is based on the analysis of skin conductance, pulse and motion. The initial threshold value is sampled when the user first wear the ring on his/her finger and the data will be synchronized to Cloud as long term analysis so that the program's mood detection algorithm will adapt to each individual automatically and lessen the error.



## BAD MOOD ALERT

/POKEMO's inner layer tights up to alert you on other side's bad mood.

- Health indicator

Monitoring body temperature, pulse and motion, /POKEMO will be able to determine the health status of the user and reflect that on his/her partner's ring. The upper layer (smart glass layer) of the ring's opacity is changeable. When it is crystal clear, it denotes the user's partner is in a good condition while when it turns foggy, his/her partner may be sick at the moment.



## HEALTH INDICATOR

The opacity of upper ring layer reflects loved one's health status

### 3.3.5 Technical specifications

Each /POKEMO ring will be embedded with a set of sensors and a set of actuators in order to achieve the interactive experiences. In the following section, main sensors and actuators employed in /POKEMO design will be explained.



- Touch sensor (Resistance type)

On the front side of the ring there is a touch sensor. A capacitance touch sensor needs only one electrode to function, which is placed behind a non-conductive panel such as wood, glass, or plastic. The switch works using body capacitance, a property of the human body that gives it great electrical characteristics. Placing fingers across the plates achieves a turn on or closed state. A touch sensor is the simplest kind of tactile sensor. In this case, it is used to trigger the vibration as a tactile message code. (Badger, P. 2013)

- Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. It is used for measuring electric potential (voltage). (Elliot, R. 2012) The twist mechanism of message coder make use of potentiometer, which plot the twisted angles as voltage changes.

- Optical pulse sensor

An optical pulse sensor is installed in the inner layer of the ring. In an optical heart-rate pulse sensor, light is shot into a finger tip. The light either bounces back to a light sensor, or gets absorbed by blood cells. Using continuous light shooting into blood vessels and taking light sensor readings, the system will be able to get heart-beat pulse readings. (Murphy, J. & Gitman, Y. 2012).

- IMU (Inertial Measurement Unit)

IMU is an electronic sensor that had the capability to measure and report the velocity, orientation and gravitational forces. It employs a series of accelerometer and gyroscopes. The so-called inertial measurement unit functions as a detector of current rate of velocity

change or acceleration through one or several accelerometers. It also detects the change of rotational attributes including pitch, roll and yaw by a set of gyroscopes. (Baluta, S. 2009) It monitors user's motion, sleep/awake status, which will be taken into the health status analysis.

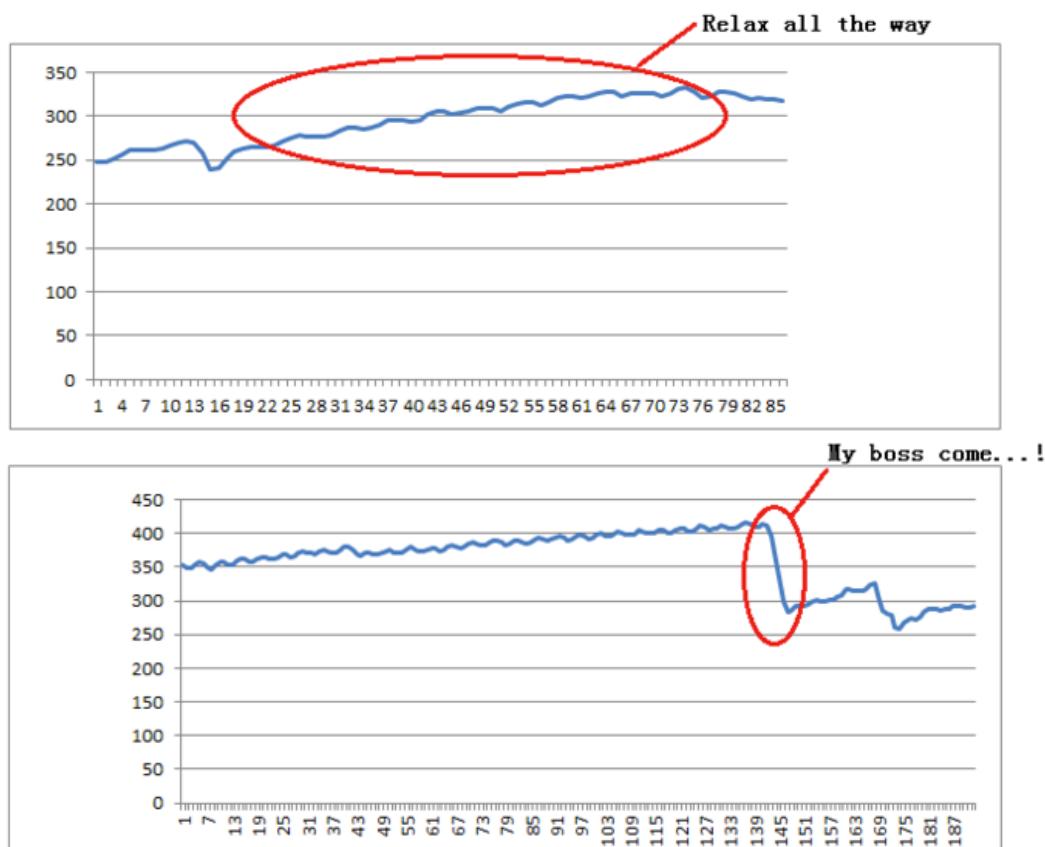
- Thermometer (Temperature sensor)

Electronic thermometer a clinical thermometer that uses a sensor based on thermistors, solid-state electronic devices whose electrical characteristics change with temperature. The thermometer works for health status monitoring in /POKEMO design.

- GSR

GSR, standing for galvanic skin response, is a method of measuring the electrical conductance of the skin. Strong emotion changes can cause stimulus to your sympathetic nervous system, resulting more sweat being secreted by the sweat glands. GSR sensor allows you to spot such strong emotions by simple attaching two electrodes to two fingers on one hand. (Seeed, S. 2014)

GSR is applied in /POKEMO as a mood detection device. When user's mood is stable, the signal output of GSR will be steady with tiny waves, while when there is any sudden change in emotion, the value will dramatically drop. If the decreased value exceeds certain threshold, /POKEMO treats it as a bad mood and will alert the user's partner.



- **Vibrator (Piezoelectric oscillator)**

In a piezoelectric oscillator, there is a crystal material piece that mechanically vibrates as a resonator. In this design case, the vibrator responds to the touch sensor's command and vibrates when the sensor is being touched.

- **Piezoelectric actuator**

Piezoelectric material transforms when there is voltage applied to both sides of the element. /POKEMO's inner layer is made from this kind of material, which enables that specific layer to change size and tight up the ring when the bad mood alert is activated.

- **Smart glass (LCD)**

Smart glass or switchable glass, which is a kind of LCD material, refers to glass or glazing that changes light transmission properties under the application of voltage. Smart glass controls the amount of light transmission. When activated, the glass changes from transparent to translucent, blocking some (or all) wavelengths of light. Smart glass works as a display in the health indicator function of /POKEMO.



- **Inductive charging and rechargeable battery**

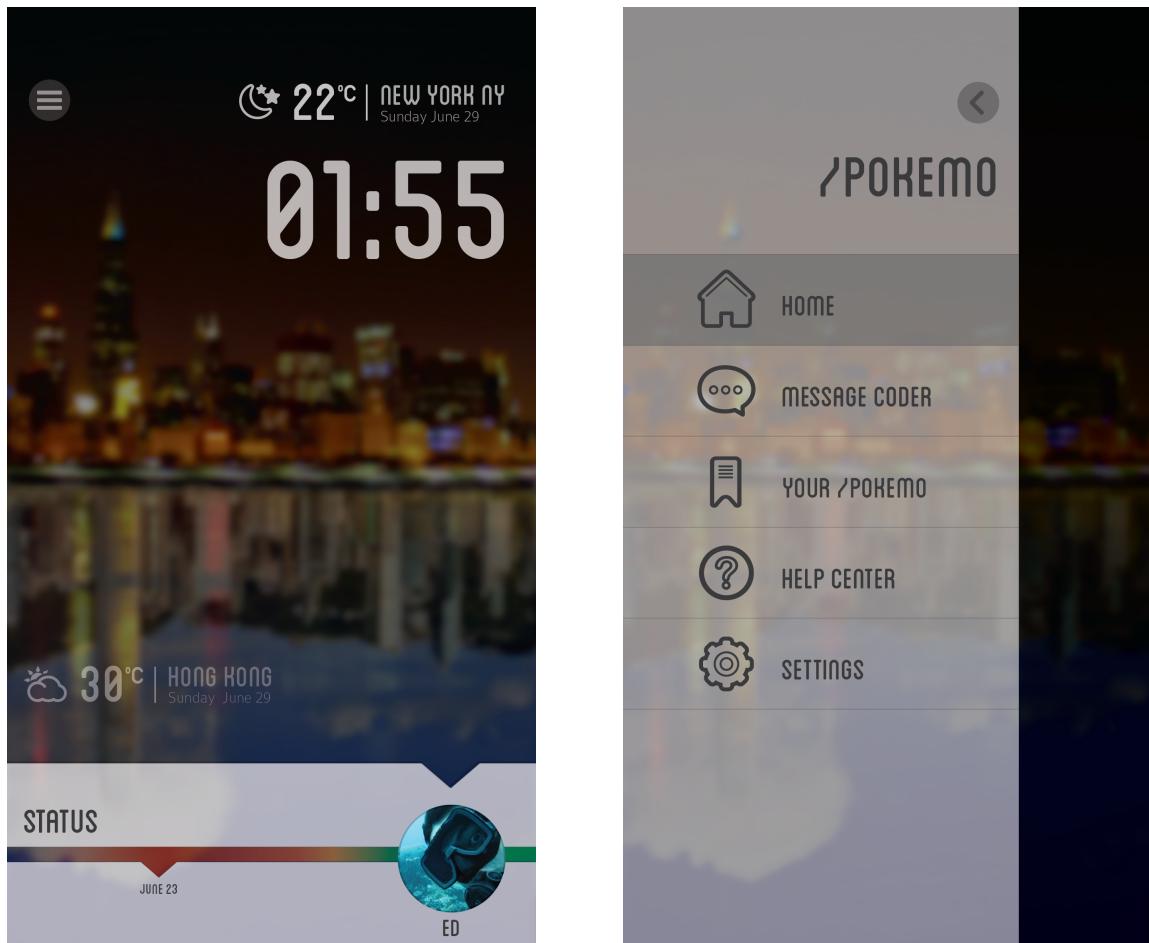
Inductive charging (also known as "wireless charging") uses an electromagnetic field to transfer energy between two objects. /POKEMO is built with rechargeable battery and an inductive charge station is included in the package.

### 3.3.6 APP for smartphones

An app is designed for /POKEMO, which includes the functions of message coder menu, your /POKEMO (the purchase certificates for user), help center and settings.

The home page displays the current landscape views of user's and his/her partner's cities. User can check his/her partner's date, day, time and weather on this page as well. The status bar is color coded — green represents normal while red means abnormal. The status color is an integrated overview of certain day. Press and slide the triangle arrow to select the date.

The menu button is located at the left top. The menu bar will slide out when the menu button is clicked. More features are available in the menu.

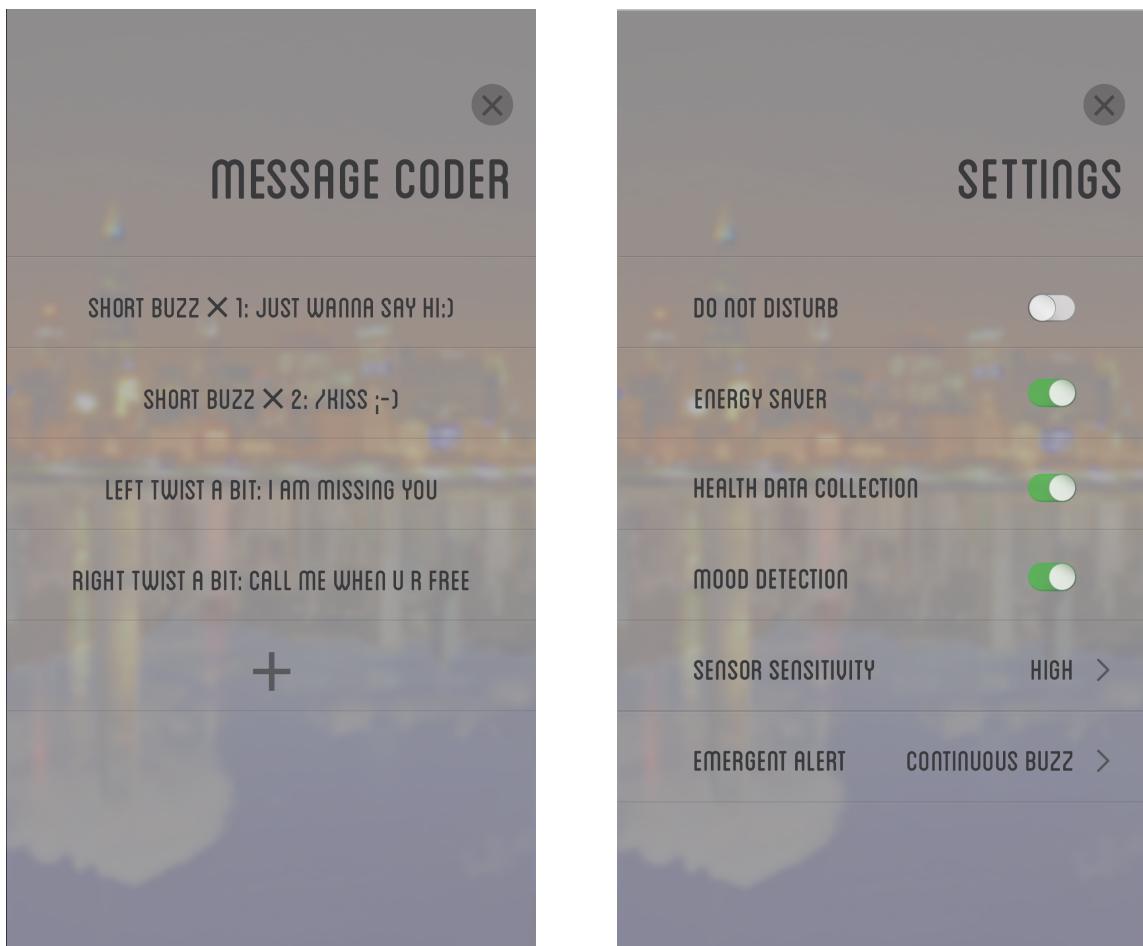


- Message coder

The users who hold one pair of /POKEMO rings will own a connected app. The message coder menu is stored and synchronized through Cloud service. /POKEMO app provides several default message codes when users install it. Users are able to edit the default codes as well as add new codes using customized combination of poke and twist mechanisms. Once one finishing editing the message coder menu, it will be transmitted to the Cloud and updated to his/her partner's smartphone instantly.

- Settings

Another significant function of the app is to set up /POKEMO ring. For the sake that each individual has his/her own choice to decide how much information he/she wants to share with partner, and how much emotion data they want to listen to using /POKEMO, the settings module in the app provides detailed sensor settings as well as "Do Not Disturb" mode for users to customize. Besides, to save battery life, user can choose energy saver mode to reduce data sampling rate and the mass data transmission will only proceed while the smart phone and /POKEMO are on the charging station.



## Chapter 4: Prototyping & User Testing

### 4.1 Visual prototype

A pair of /POKEMO rings were fabricated for demonstration purpose and video shooting. I also handcrafted a form prototype of the charging station.

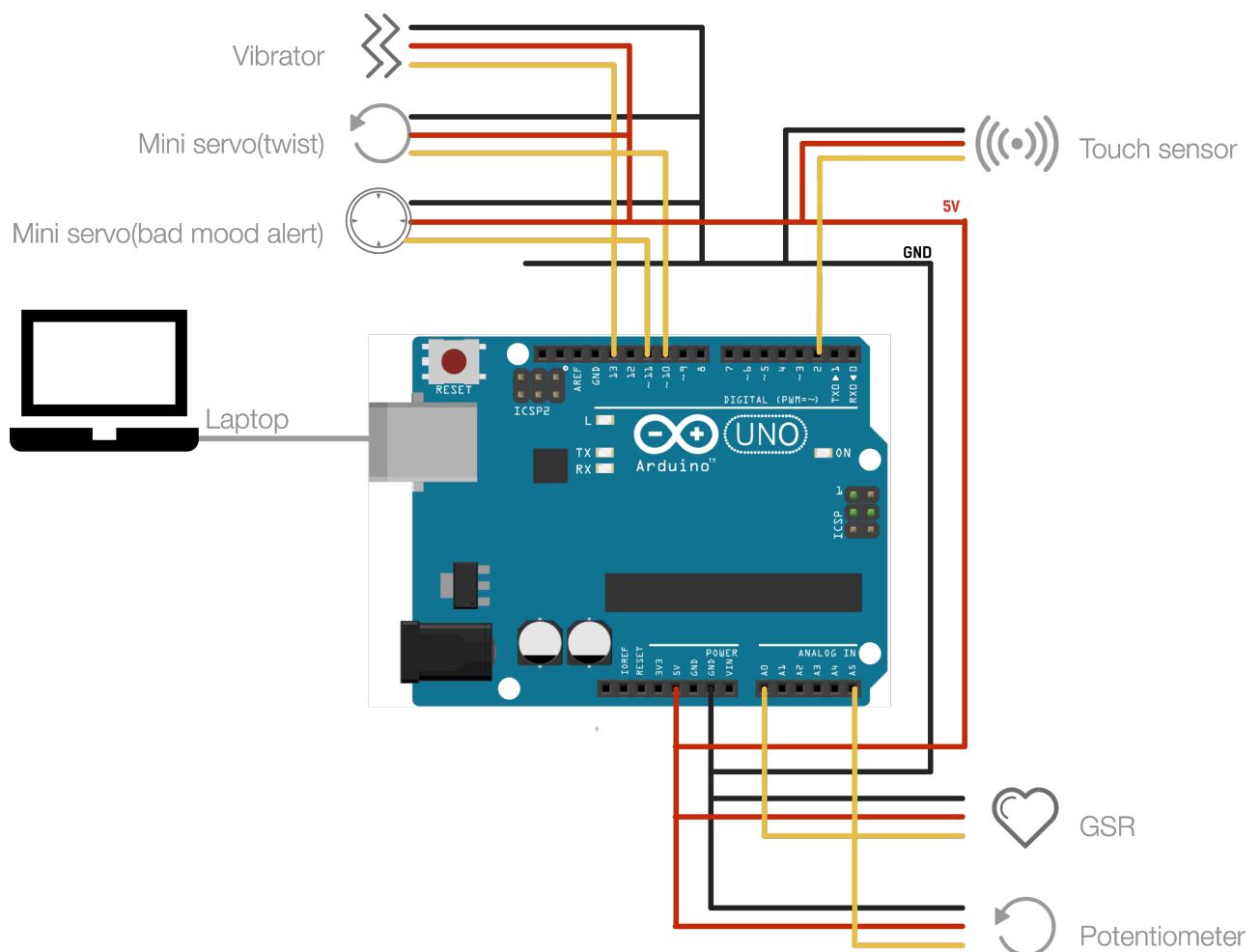
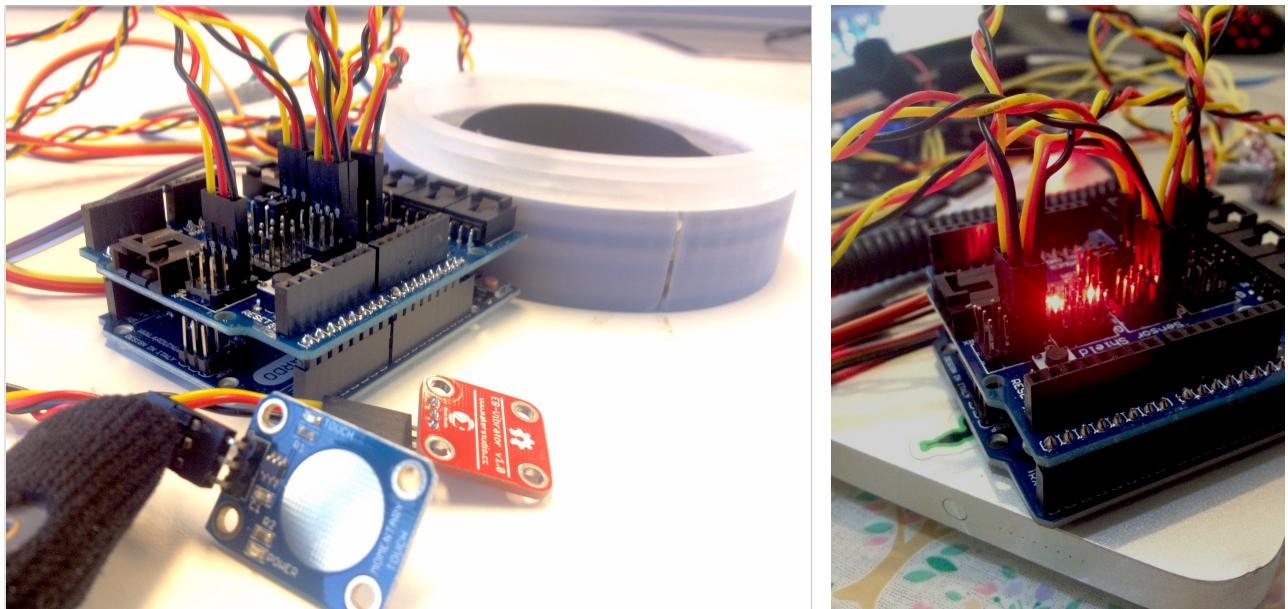
The lower metal layer of the ring is made of aluminum using CNC(Computerized Numerical Control) machining. Anodizing and dyeing were used for surface treatment. The transparent upper layer is laser-cut part with handworks.



## 4.2 Functional prototype

The functional prototype is made with a scale of 1:5, which is an enlarged version. It is mainly used for the user testing. It is able to operate the message coder and bad mood alert modules while the health indicator was not included in this version.

The electronic elements connection were based on the Arduino platform and the program was written using Processing 2.0.



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### 4.3 User testing

To better understand how users understand /POKEMO and how the interaction system will function in the end users' hand, a user testing has been conducted. 3 pairs of participants (6 people) were tested, which includes 2 pairs of couples plus one male and one female.

One set of functional prototype was provided to the couple(participants). They were required to visually and acoustically separated, which is simulating the long-distance relationship user scenario. The prototype includes a sender and a receiver, which were held by participant A and B respectively. Each pair of participants went through each test section with either the sender or the receiver once and change their position to do the second round.

The user testing includes three sections:

1. Self-exploration: First section was an 8-minute self-exploring section, which allowed participants to explore the function and interaction activities freely through touching, using the prototype plus chatting through a fake monitor. The monitor is imitating the video chatting, which is a daily activity for long-distance couple according to the research. The couple can feel free to chat and test the prototype but any physical contact is prohibited.
2. Instructed tasks: This is an instructed section. I did a brief introduction to the main features of this design and the meaning of each feature. Each participant received a task list. This section tested the message coder (poke&twist) and bad mood alert function. The health indicator module was not included because of the limited prototyping skills. The scenario setting was that the couples are visually and acoustically separated, which means that they can only communicate through the prototype.
3. Post-test research: This is a post-evaluation section. Participants were required to finish a simple questionnaire and share their experience as well as feelings about the design in the interview.

- Test results and analysis

### User Testing Analysis of Section 1&2

|                                    | Task                       | Average Duration | Correct Rate | Results   | Comments  | Design Modification                |
|------------------------------------|----------------------------|------------------|--------------|---|---|------------------------------------|
| <b>Section 1: Self-exploration</b> | Try the prototype hardware | 1m               | N/A          | Most of the participants have shown interests to the hardware but have problems of use it correctly.                                  | The prototype's form may not be intuitive judging from an end user's angle. This situation got solved after they listened to the brief of the design concept and product functionality.   | None                               |
|                                    | Go through the APP         | 2m 30s           | N/A          | All participants were able to get access to the information that they wanted from the APP effectively.                                | The overall information structure and the interface presented the information properly.   | None                               |
|                                    |                            |                  |              | 2 of the participants have shown confusion about the wording of "your certificate" in the APP.  | The meaning of "your certificate" may not be clear enough and was not able to deliver the information.  | Change the wording to "My /POKEMO" |
| <b>Section 2: Instructed Tasks</b> | Designer's brief           | 3m               | N/A          | Participants' interests and concentration increased during the design concept presentation, especially the tested 2 pairs of couples. | When illustrated the whole concept, the participants had a chance to understand the idea. It became easier for them to associate the functional prototype's operation to the specific features. Most of them expressed that the interaction seems different from normal communication methods and wanted to have a try. | None                               |

## User Testing Analysis of Section 1&2 con't

|  |  |        |     |  |   |  |
|--|--|--------|-----|--|---|--|
|  | Try the poke function  | 15s    | 6/6 | This is a very simple task. Over half of the participants showed attracted facial expressions when the vibrator buzzed then they were in the receiving position.   | Tactile interaction and new way of message delivering method attracts user's attention fast and effectively.  | None   |
|  | Try the twist function   | 20s    | 4/6 | There were some misunderstanding about the direction of twisting because the prototype's sending side was using a potentiometer as the twist sensor. The potentiometer has no clear marks about the angle and twist direction. | The problem described here is caused by the imperfection of the prototype not the design of the product's outlook.  | Modify the prototype. Add marks or direction indication to the potentiometer for more clear and comprehensive demonstration.   |
|  | Send 2 messages according to the message coder menu in the APP | 1m 30s | 5/6 | Two messages were sent with a short time interval, which led to an incorrect decoding.   | If the break between two message is not clear enough, the users are possible to decode the meaning wrongly. Besides, one mentioned that if he was not pay much attention to the ring at some moment, he may not notice the message, or have difficulty to recall the meaning of the tactile message when he was absent in mind. | Suggest the user to use poke&vibrate function to say hi first, which also serves as an notification. For the default message coder menu, change short buzz*1 for "just wanna say hi" to a long buzz, which is more noticeable. |
|  | Customize messages and send them                               | 2m     | 6/6 | Half of them tried to combine twist and poke for more complicated meaning. The messages they composed were extremely different from each other, personal and funny.  | Couples always have their own jokes, secrete words that only can be understood by themselves. They felt the customization feature would suit couples well and increase the overall entertainment factor.  | None   |

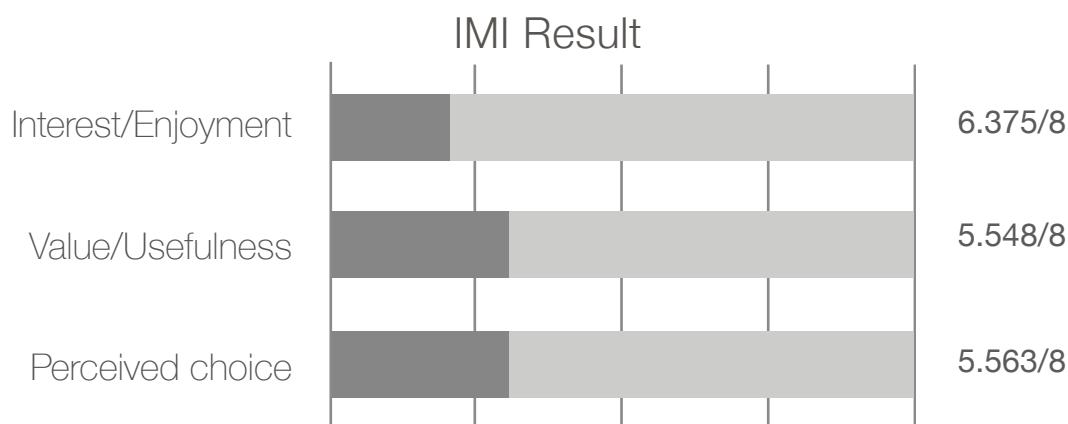
## User Testing Analysis of Section 1&2 con't

|  |                                 |    |     |  |  |  |
|--|---------------------------------|----|-----|--|--|--|
|  | Try the bad mood alert function | 1m | 3/6 | Some participants have concerns that the frequent change of emotion may cause disturbance.   | This concerned me from the very early stage of the design. The temporary solution, which got proofed by the participants, is the sensor sensitivity level setting. User will have his/her own choice about how much mood info he/she wants to listen to.   | None.  |
|  |                                 |    |     | If the emotional party is expecting the ring to tell and rational party his/her mood but the rational one does not response much, this may cause fight. Especially, some mentioned it will be better if you can notice the other side that you are not wearing the ring at the moment.   | The notification about whether the other side is wear the ring is quite debatable. It may also cause some problem if wearing the ring is a one-sided will. However, considering the target audience characteristics, couples who want to purchase this product are likely to be the type that they want more effective, interaction and fun communications, as well as hope to keep in touch frequently. | Add APP push notification if one side disarms the ring. Also add this notification setting to the APP. If you do not want your partner know whether you are wearing the ring or not, you can simply shut down this function in the settings. |
|  |                                 |    |     | The opinions from every participants were different, which varied according to their own personality. But mostly, they admit that if there is communication problem between a couple and this problem cause fight, it is not the tool of communication that should be blamed. The attitudes towards this feature were mostly positive. | The design itself can only act as a more interaction and tactile way, which increase the delightfulness when a couple communicate with each other. It can hardly solve more serious communication problem, which was also not the issue I was addressing when I initiated this concept.  | None   |

- IMI analysis

IMI study is a quantitative analysis focused on user experience. A simple questionnaire is provided to participants, which contains around 25 scale questions. Participants were required to complete the questionnaire after test and the results report the participants evaluation about the user experience of this test. Please refer to Appendix 5 for questionnaire details.

Three main facets(sub-scales) are evaluated, which are interest/enjoyment, value/usefulness and perceived choice. Full score of each sub-scale is 8 and the value is calculated as the mean value of all the related questions' scores.



Referring to the bar chart above, participants' attitude towards the overall user experience and interactions with /POKEMO are positive. This is considered to be a validation of the design concept at this stage.

Most of them believe communicating their feelings with their partner through /POKEMO is quite engaging, fun and enjoyable. Noticeably, female participants' average score of interest/enjoyment sub-scale was 6.625/8, which is 8.1% higher than that of male participants (6.125/8). This indicates that female users may be more attracted by /POKEMO than male users. The design has certain value and usefulness in emotional communication, which enhances their emotion sharing experience indeed. The interactions and user settings allow participants to explore their own way of use rather than obeying certain operation methods.

- Interview results and design refinements

Following section is a sum-up of the post-test interview.

#### 1. Overall evaluation about the interaction using /POKEMO

Most participants expressed that they felt the interactive activities using /POKEMO were quite enjoyable, interesting, interactive, intuitive, direct, easy to understand.

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## 2. The highest-rated features that appeals users

The learning experience at the beginning is engaging and enjoyable to the users. The process of exploring the usage, operation and customization makes it special.

Twist mechanism was the most popular feature among all, which provides user a delayed message that has less time constraint and is easier to be noticed as compared to text messages. The ring provides more convenient, simpler and faster way to code several words, which make the emotional communication more effective. Moreover, some participants felt the action of twisting ring itself is quite fun so that they would like to use it to “disturb” their partner for entertainment.

Customized message coding gives users more opportunity to explore instead of keep using it in a same manner. This also makes the user experience more intimate and personal.

## 3. Compare /POKEMO to normal texting, phone calls, IM, video calls

/POKEMO provides tactile feelings which create a lot of fun and the communication is more intimate. Because /POKEMO is a wearable device, it is more convenient and faster for simple-meaning messages. Besides, the form of ring establishes a branding position that it is designed for couple, which stimulates couple to adore it.

## 4. Problem and confusions during testing

The poke mechanism has chance to be triggered and send unexpected vibration message to the other side. There should be certain way to control the on and off of the poke mechanism. A possible solution is to require user to activate the message coder function by holding the finger tip on the sensor location for a while, say 2 to 3 seconds.

## 5. Suggestions of new interaction/features/functions from participants

One suggested that smart phone app should push notification if one side takes off the ring. This function is debatable from my point of view for the sake that it may have privacy infringe concerns. As a refinement of the design, push notification will be added to the app and meanwhile it provides privacy setting accordingly.

Another participant mentioned SOS GPS function during the interview, which I felt useful as well. /POKEMO will turn on the GPS tracking system when SOS mode is on and inform the other side automatically.

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## Chapter 5: Future Works

Though the major objectives of the project have been achieved, /POKEMO still needs improvements and requires additional work in future:

- Fine and fully functional prototype

The 1:5 scale functional prototype can merely provide users the basic idea about how /POKEMO works. A finer high fidelity prototype with fully functional hardwares and more complete program will be able to communicate the design better.

- Further testing

The current user testing sample, which is 6, is not enough to validate the design concept, especially the design details. Larger user testing volume is needed.

- Target audience expansion

Mentioned by some user testing participants and my project advisor Prof. Huixin Wei, /POKEMO's interaction mechanism can be useful in other conditions. A promising user group might be the elderly who live apart from their sons/daughters. The wearable form provides the best convenience for an elderly to send emergency signal.

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## Chapter 6: Project Evaluation

As defined in the introduction chapter of this report, the aim of this design is to connect couples in long distance relationships, and to fill the gap of physical and mental distance between them. According to responses from the targeted customer groups and user testing outcomes, /POKEMO has achieved this main design objective from my point of view.

Through the process of conducting this project, I have thoroughly researched on the emotional communication habits, methods, applications and user expectations of couples who are in long distance relationships. Wealth of research data, which includes both primary research and secondary research, has provided me in-depth understandings of the design problem and thus I could generate workable design solutions for them. The execution of research was a valuable experience and will be beneficial for future career.

The topic selection and the initial idea were self-motivated. It was quite engaging and enjoyable for me to design something that I personally need and want to use.

As to the prototype fabrication, especially the functional prototype, I have learnt different kinds of new knowledge and skills according to the project needs, such as programming, Arduino, circuit connection and soldering, etc.

In a nutshell, the capstone project provided me an opportunity of conduct a comprehensive design project, in which many factors should be considered including concept design, user analysis, market research, visual form design and technical specifications. It also provides me a chance to learn and train abilities of project management. It is an extremely precious experience that is more than helpful for my future career in the field of interaction design.

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## Appendices

### Appendix 1: Questionnaire I

Research: Communication of Emotion

關於情感溝通的調研

Questionnaire link:

[https://docs.google.com/forms/d/1HVg9E1bVPWmPwfAKe3cxXlpsqwXRUnkd2CFZwvzNoM/viewform?usp=send\\_form](https://docs.google.com/forms/d/1HVg9E1bVPWmPwfAKe3cxXlpsqwXRUnkd2CFZwvzNoM/viewform?usp=send_form)

Response link:

<https://docs.google.com/spreadsheet/ccc?key=0Aig3W49a3lazdGUzZFE1UEpiLUJTSUM4WmJELVFFT0E&usp=sharing>

### Appendix 2: Questionnaire II

Research: Long-Distance Emotional Communication

關於長距離關係的情感溝通之調研

Questionnaire link:

[https://docs.google.com/forms/d/1tLvscI1MaB4oA4J2BIX0yVA6hqjutiluJBBHJwMxA/viewform?usp=send\\_form](https://docs.google.com/forms/d/1tLvscI1MaB4oA4J2BIX0yVA6hqjutiluJBBHJwMxA/viewform?usp=send_form)

Response link:

<https://docs.google.com/spreadsheet/ccc?key=0Aig3W49a3lazdDZNTnpScUxoaxQU1E4WE1GbFV1UFE&usp=sharing>

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## Appendix 3: Interview Summary

ZX | M | 25 | Studied in US for 2 yr

Communicate with family and girlfriend every day

For family member:

- update regularly, say hi everyday when both sides are awake, Skype for around 30min every weekend.
- normally wouldn't mention negative emotions and feelings, will keep them himself. but will report it after everything is settled down.
- sometimes feels pressure about parents expectation
- his profession is different from his parents' fields, bad feelings about study/work pressure can be hard to communicate

For girlfriend:

- non-regular update, more frequent
- make more complaints about the life in US to girlfriend rather than to parents
- feel less stressful and burdened
- health relationship tips: solve all the conflicts before sleep; when one compromise and apologized, the other should accept the apology
- feel happy about every contact
- enjoy the feeling of keeping accompany with each other when ZX is back home; they will keep the video call on when he is in US

MM | F | 23 | Studied in HK for 5 yrs

Communicate with family every week, with boyfriend everyday

For family member:

- non-regular update with her family through WeChat group, not frequent chat and call her family
- normally won't tell her parents when she's in some troubles of study/work
- sometimes will share negative thing with her mom when she feels extremely bad

For boyfriend (in US):

- very frequent SMS
- video call every night before sleep and probably every morning before her bf sleep
- sometimes leave the Skype on when she's sleeping, feels accompanied
- will seek for help and advise from her bf when she meets problems
- like to hand craft accessories as gifts for her bf
- "touch the ring" mental therapy

IL | M | 23 | Studied in EU for 1 yr

- usually don't want to complain to either family or girlfriend about his study/work pressure

- 
- temper might become unstable when he feels stressful, tries to control but still sometimes will lose his temper; then he chooses to contact less with his family/girlfriend

About girlfriend:

- sometimes his girlfriend is very emotional (then he told me that is because of her period, lol...)
- He is thoughtless sometimes. when he has quarreled, it may develop to a cold war; even under some situations, he thought they are fine but his girlfriend is still in an upset mood.

---

## Appendix 4: Task List

### INTRODUCTION

This is an instructed section. The designer will briefly introduce the main features of this design and the meaning of each feature. This section will test the message coder (poke&twist) and bad mood alert function. The health indicator module is not included because of the limited prototyping skills. The scenario setting is that the couples are visually and acoustically separated, which means that they can only communicate through the prototype.

### TASKS

1. Listen to designer's brief about the main features of the design

2. Sender: Try the poke function.

Receiver: Experience the actuators reaction and take down/tell the designer his/her feeling

3. Sender: Try the twist function.

Receiver: Experience the actuators reaction and take down/tell the designer his/her feeling

4. Sender: Read the message coder menu and send the pre-designed messages one by one.

Receiver: Decode the messages and take down the meaning of the messages according to their own understanding. Drop notes if there is any question and confusion about decoding the messages.

PS: The messages may contain further interaction requirements like ring the other side, send SMS or video call. The receiver need to follow the decoded message's instructions and complete the task according to his/her own understanding.

5. Sender: Customize his/her 3 own messages using the combination of poke and twist mechanism. Send the customized messages.

Receiver: The designer will update the customized message coder menu to the receiver and give him/her 1-2min to digest and remember it. After that, he/she will decode the messages sent by the sender.

PS: The messages may contain further interaction requirements like ring the other side, send SMS or video call. The receiver need to follow the decoded message's instructions and complete the task according to his/her own understanding.

6. Sender: Take a deep breathe / think about something sad or annoying

Receiver: Experience the bad mood alert tighten-up mechanism.

After finishing all the task above, switch role and do the second round.

---

## Appendix 5: Post-Test Questionnaire

For each of the following statements, please indicate how true it is for you, using the following scale:

|                    |   |                  |   |   |              |   |
|--------------------|---|------------------|---|---|--------------|---|
| 1                  | 2 | 3                | 4 | 5 | 6            | 7 |
| not at all<br>true |   | somewhat<br>true |   |   | very<br>true |   |

1. I believe that doing this activity could be of some value for me.
2. I believe I had some choice about doing this activity.
3. While I was doing this activity, I was thinking about how much I enjoyed it.
4. I believe that doing this activity is useful for improved communication quality.
5. This activity was fun to do.
6. I think this activity is important for my improvement.
7. I enjoyed doing this activity very much.
8. I really did not have a choice about doing this activity.
9. I did this activity because I wanted to.
10. I think this is an important activity.
11. I felt like I was enjoying the activity while I was doing it.
12. I thought this was a very boring activity.
13. It is possible that this activity could enhance emotional communication with my partner.
14. I felt like I had no choice but to do this activity.
15. I thought this was a very interesting activity.
16. I am willing to do this activity again because I think it is somewhat useful.

- 
- 17. I would describe this activity as very enjoyable.
  - 18. I felt like I had to do this activity.
  - 19. I believe doing this activity could be somewhat beneficial for me.
  - 20. I did this activity because I had to.
  - 21. I believe doing this activity could help me understand my partner.
  - 22. While doing this activity I felt like I had a choice.
  - 23. I would describe this activity as very fun.
  - 24. I felt like it was not my own choice to do this activity.
  - 25. I would be willing to do this activity again because it has some value for me.

---

## Appendix 5: Program Codes

```
import processing.serial.*;
import cc.arduino.*;
Arduino arduino; // main device

// poke variables
int touchSensorReading = 0;
static final int pokeTouchDigitalPin = 2;
static final int pokeVibratorDigitalPin = 13;
int touchingCounter = 0;

// badMoodAlert variables
static final int badMoodAnalogPin = 0;
static final int badMoodServoMotorPin = 10;
int miniServoOutput = 0;
float gsrThreshold = 0;
int gsrSensorInput = 0;
int servoMotorResumingTime = -1;
ServoMotorStatus servoMotorStatus = ServoMotorStatus.IDLE;

// twist variables
static final int twistAnalogPin = 5 ;
static final int twistServoMotorPin = 11;
int servo995Output = 0;
int twistInput = 0;
int previousTwistInput = 0;
int twistThreshold = 8;

void setup(){
    println("starting up the system...\n=====");
    // poke module initialization
    println("initializing poke function... ");
    arduino = new Arduino(this, Arduino.list()[5], 57600);
    arduino.pinMode(pokeTouchDigitalPin, Arduino.INPUT);
    arduino.pinMode(pokeVibratorDigitalPin, Arduino.OUTPUT);
    println("poke function initialization done\n=====");

    // badMoodAlert
    println("initializing bad mood detection... ");
    long sum = 0;
    arduino.pinMode(badMoodAnalogPin, Arduino.INPUT); //declare gsr into pin
    arduino.pinMode(badMoodServoMotorPin, Arduino.SERVO); //D11 control mini servo
    miniServoOutput = 0;
    arduino.servoWrite(badMoodServoMotorPin, miniServoOutput);//setup ring in relax mode
    delay(1000); // wait for the miniServo to reset
    for(int i=0;i<1000;i++){
        gsrSensorInput=arduino.analogRead(badMoodAnalogPin);
        sum += gsrSensorInput;
        delay(5);
    }
    gsrThreshold = sum/1000;
    print("gsrThreshold = ");
    println(gsrThreshold);
}
```

---

```

println("bad moon detection initialization done\n=====");
// twist
println("initializing twist detection... ");
arduino.pinMode(twistAnalogPin, Arduino.INPUT); //declare potentiometer input pin
arduino.pinMode(twistServoMotorPin, Arduino.SERVO); //D10 control servo 995
servo995Output = 95; // adjusted value for servo 995
arduino.servoWrite(twistServoMotorPin, servo995Output);//setup ring upper mark pointing middle
println("bad moon detection initialization done\n=====");

void draw(){
// poke logic
touchSensorReading = arduino.digitalRead(pokeTouchDigitalPin);
if (touchSensorReading > 0){
    if(touchingCounter > 5){
        println("touched, touchSensor reading : " + touchSensorReading);
        arduino.digitalWrite(pokeVibratorDigitalPin, Arduino.HIGH);
    }
    touchingCounter++;
}
else{
    touchingCounter = 0;
    arduino.digitalWrite(pokeVibratorDigitalPin, Arduino.LOW);
}

// badMoodAlert logic
switch (servoMotorStatus){
    case IDLE:
        gsrSensorInput = arduino.analogRead(badMoodAnalogPin);
        println("GSR threshold : " + gsrThreshold + "GSR Sensor Value = " + gsrSensorInput );
        miniServoOutput = (int)abs(gsrThreshold - gsrSensorInput);
        if(miniServoOutput > 120){ // if current value differes from threshold by 50 check again to reduce noise
            gsrSensorInput = arduino.analogRead(badMoodAnalogPin);
            miniServoOutput = (int)abs(gsrThreshold - gsrSensorInput);
            if(miniServoOutput > 120){ // if it's still larger than 50
                servoMotorStatus = ServoMotorStatus.OPERATING;
                servoMotorResumingTime = (second() + 3) % 60; // 3 seconds for motor to rotate
                arduino.servoWrite(badMoodServoMotorPin, 0);
                println("bad mood detected");
            }
        }
        break;
    case OPERATING: // OPERATING
//      println("operating");
        if(second() == servoMotorResumingTime){
            arduino.servoWrite(badMoodServoMotorPin, 10); // reset the motor position
            servoMotorResumingTime = (second() + 1) % 60; // 1 second to reset
            servoMotorStatus = ServoMotorStatus.RESETTING;
        }
        break;
    case RESETTING: // RESETTING
//      println("resetting");
        if(second() == servoMotorResumingTime){
            servoMotorStatus = ServoMotorStatus.IDLE;
        }
        break;
}

```

```
}

// twist logic
twistInput = arduino.analogRead(twistAnalogPin);
if(abs(twistInput - previousTwistInput) > twistThreshold){
    if(twistInput <= 505){
        if(twistInput > 145){
            servo995Output = 172 - (int)((twistInput - 145)/4.235);
        }
        else{
            servo995Output = 172;
        }
    }
    else{
        if(twistInput < 853){
            servo995Output = 172 - (int)((twistInput - 505)/4.5 + 95);
        }
        else {
            servo995Output = 10;
        }
    }
    println(servo995Output);
    arduino.servoWrite(twistServoMotorPin, servo995Output);
}
previousTwistInput = twistInput;

}
```