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Author	Chokpitiboon, Pirasa(Sugiura, Kazunori) 杉浦, 一徳
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Master's Thesis

Academic Year 2018

HappiHatch: Virtual Pet for Real World Interaction Encouragement

Graduate School of Media Design,
Keio University

Pirasa Chokpitiboon

A Master's Thesis
submitted to Graduate School of Media Design, Keio University
in partial fulfillment of the requirements for the degree of
MASTER of Media Design

Pirasa Chokpitiboon

Thesis Committee:
      Associate Professor Kazunori Sugiura   (Supervisor)
      Professor Matthew Waldman   (Co-supervisor)
      Professor Akira Kato   (Co-supervisor)

Abstract of Master's Thesis of Academic Year 2018

HappiHatch: Virtual Pet for Real World Interaction Encouragement

Category: Design

Summary

Human is a social creature, we are meant to connect with each other. Still, sometimes socialization failure occurs and it could lead to social isolation which results in the infinite loneliness cycle. Many approaches are designed to solve this issue by either connecting people together or proposing an alternative way as virtual friendship. Each approach has its own benefits and limitations, this study was conducted to combine both mentioned solutions' good aspects together for a better outcome. HappiHatch is introduced as a virtual pet that can utilize the advantage of being user's safe space as a catalyst to encourage them for more interpersonal activities. It is designed as a physical toy that can talk to the user as their virtual friend, it could learn about their interests and seek suggestions in order to motivate more activities and connections with friends. To evaluate the idea, two experiments were conducted. The first test is the quantitative test that assessed the effect of concept idea toward user's perception of interpersonal connection and the second test is the qualitative test that evaluated user's feeling toward the physical prototype. The positive outcomes showed that HappiHatch could gain user's affection and be able to motivate them for more real world interaction.

Keywords:

Virtual Pet, Persuasive Technology, Real World Interaction

Graduate School of Media Design, Keio University

Pirasa Chokpitiboon

Acknowledgements

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Chapter 1
Introduction

1.1 Background

Humans are social creatures, our body is created to respond to each other and our lifestyle is affected by those actions [29]. That's why human do socialization to stay connected, even though not everyone is good at it. Sometimes, when people are unable to connect with others, they would separate themselves as they did not feel safe in the social situation which could lead to more possibilities of social isolation and result them in the cycle of loneliness [24].

For the author's personal experience, being an introvert person who mostly enjoy spending time alone and feel tired every time after a long socialization could cause some distance between herself and other people. Even though being alone is a good treat for introvert, there is also a time that they feel lonely and need someone to talk to. Still, her own personality that is not a talkative person with occasionally social awkward make the "going out" a difficult task to do. This is another motivation for the author to invent a tool that could help decrease loneliness and open the opportunity for her to enjoy the socialization again.

In order to break through the loneliness problem, many methods are suggested such as improving social skills, providing social support and the most effective way is to increase opportunity for social interaction [15]. There are many tools invented such as Tinder[1] that offers chances of meeting new people or Facebook[2] that aims to connect people together. Still, for people who start developing fear of social interaction, it's easier for them to turn away from human and open to an artificial friend who is always available and accept them with no condition instead. The virtual relationship is easy and always come with positive response but, at the same time, could lead user to even more isolation [4].

Among those mentioned solutions, the author is in doubt would it be better if each items' benefit could be combined together to serve user a better way to get out of the loneliness cycle. In order to proceed that, this research is conducted to

find the possibility to utilize user's safe space with non-human as an inspiration for them to start a human-to-human interaction again.

1.2   Research Question

From the background described earlier, the author is looking for a solution that could encourage person who doesn't have much confidence to connect with other people. The virtual pet might be a good alternative way to recreate empathy and affiliation within a person as a practice for them to share it with other human being. Thus, the research question is stated as

- How could virtual pet be used as a catalyst to motivate more real-world interaction in a person

This research aims to solve user's loneliness problem by persuading them to do more activities and interpersonal interactions. By using the virtual pet, it can respond back to the user as an immediate reward for them to continue their actions.

1.3   Concept

For the purposed solution, the author would like to introduce the virtual pet named "HappiHatch" as a medium to establish desired behaviors of the user in an indirect way.

HappiHatch is designed with belief that it would gain user's trust and companionship as other virtual friend did by being their safe space where they could express themselves and start developing the owner-pet relationship. Then, an extra feature would be added to encourage user to do more activities and engage more with people around them.

HappiHatch started with an idea of virtual pet, the unisex pet form that is friendly and capable for wider range of ages and genders. User can feel free to talk and share their day with the pet as their social support. At the same time, the pet can learn about user's interest throughout the talk. The key feature is an activity ornament which could grow according to user's active activity. These ornaments aim to encourage user to do more things as they could get a positive response as reward [6]. The more reward they could get, the more active they become and also more opportunities for them to interact with other people.

Furthermore, HappiHatch's personality is designed to love humans, it enjoys when user talked about their friends and always seek for opportunity to connect user's interest with people. It can ask user a favor to help balancing their activities and keep in touch with friends. By offering a task, user is more motivated by perceived belongingness toward the pet [11] so there's more willingness for them to take action.

1.4   Objective

The objective of this research is to design a virtual pet that can not just only solve user's loneliness but also can prevent them from falling back into that state again by motivating more connection between people as a sustainable solution. The author aim to use common interest as a medium for the virtual pet to encourage user to interact with others.

Notes

1   https://tinder.com/
2   https://www.facebook.com

Chapter 2
Literature Review

In order to user virtual pet as a motivation for user to do more activity, many aspects are studied to understand what technology that could perform the action and why it could persuade human to perform as expected. This section will mention about three aspects that could derive the goal of the author. First, the persuasive technology will be discussed to identify the reason why the system could affect user's decision and behavior. Second, virtual friendship will be clarified with various examples to understand how it could gain affection from user and what is still missing. Finally, Human-to-Human Interaction will be examined to find the way to implement it within the virtual pet product.

2.1 Persuasive Technology

The technology recently plays an important role in human's behavior, not just only to support user but also being able to lead their action. As when user perceived computers as a human being, they start developing social response back to the system. This is an important key idea that many products trying to stimulate social factors so they can influence on user's thoughts and behaviors [12].

2.1.1 UbiFit Garden

UbiFit Garden is a study conducted for research purpose in Seattle Metropolitan. Its goal is to encourage user to do more physical activities by offering a reward of each action as flower image in user's mobile screen. The recording data could be done by the tracking device attached to the user and mobile application that they can log the activity manually in case that the device couldn't identify their action. There is no direct interaction between the user and the garden, they can only observe the result from their mobile screen's wallpaper.

The important feature is that there's no punishment as the researcher prefer to use a positive reinforcement in the system and glanceable display that is easy for the user to notices the changes. Still, participants reported that the image reward is a good encouragement for them to do more exercise. The more flowers they could have, the more achievement they could accomplish [6].

Figure 2.1: Ubifit Garden's display

2.1.2   Pokémon Go

Unlike UbiFit discussed earlier, Pokémon Go[1] was created as a commercial game for user's entertainment by Niantic, Inc.[2] Users are the one who decided to download and play the game by themselves, not just gathered for the study purpose. Thus, it could gain over 45 million daily active users after a few days from the first launch, and after a year passed, it still has around five million daily active users and 65 million monthly active users [2]. It could be said that the famous Pokémon character plays a big role on user's intention to play the game. But it couldn't come this far if the game system itself isn't attractive enough.

Pokémon Go's gameplay is that user can explore around the map to find Pokémon they could catch, visit PokéStop for acquiring items, or visit Pokémon

Gym and battle for their team. This is an indirect persuasive technology as the map in the game is exactly the same as in the real world, user's geographical location will reflect as their character's position inside the game so they need to physically go outside for their in-game interaction. This part is an indirect way that persuade user to do more physical activities. There is also a research studied the consequences of the Pokémon Go which found out it can help increasing users walk steps and possibilities for them to engage with other players during their play [23].

Figure 2.2: Pokémon Go's map screen

2.1.3   Social Interaction Encouragement

There are also some works trying to use robot as a medium to connect between people. For example, There is a research studied Paro[3], seal robot as a medium to trigger interaction among elders. They observed people in nursing home's reaction toward the subject placed in the center of the group and found its existence could enhance the social environment [20].

Another work is Social Mascot, a portable toy that can perform action to encourage the communication between strangers. The mascot would connect to

each other without owners awareness to check for matching possibility, then will start dancing to gain user's attention and open a chance for them to start conversation [21].

Thus, these examples only studied in the environment that people were already together and provoked interaction from their action toward the subjected item. This research is aiming for another approach that the medium still works for user who separated themselves from others.

In conclusion, human's action could be motivated by the technology. There are some cases that users got attracted by the digital outcome or an entertainment result and other cases that the existence of technology could be used as a trigger for their action. This means the technology has enough influence on human being, users are willing to do something as long as a rewarding action can satisfy them.

2.2   Virtual Friendship

In the age of digital era, people are looking for better solutions in their life by using lots of technology to help them. Digital companionship is also another solution that has been developed over time as it could answer user's needs for entertainment and belongingness without worrying about being judged or looking after issue like the interaction toward the living being.

2.2.1   Tamagotchi

Tamagotchi[4] is a digital pet in a palm-sized device that user needs to take care of it by clicking to feed, clean, or play with the pet so it could grow up. Each Tamagotchi also came with multiple possibilities of evolution according to user's action. The average age of each Tamagotchi is around 30 days and the game would be reset after the pet died. This product has gone famous all over the world since its release in late 1990s [5]. It is the original idea of the virtual pet which came with basic needs like the real pet could have, with a benefit of the portable size that user can bring it along to anywhere they go.

2.2.2   Furby

Furby[5] is an enhanced version of the virtual pet as it came with the physical existence. It is a fluffy robotic toy that speaks its own language added with

Figure 2.3: Tamagotchi's original product

animated ear, LCD eye display and body movement. The user can pet and hold the Furby and feed it either by tapping on its tongue or via the interaction inside the mobile application. It requires less caring from the user because it doesn't have any basic needs. Basically, Furby is just a talking toy that aims for user's entertainment. Unlike Tamagotchi that targets children, this product is more famous among adult and young people [22].

2.2.3 Aibo

Another interesting product is a smart companion like Aibo[6], dog-like robotic pets that can recognize what it saw and also respond to user's voice or touch. It can walk on its own, notice and remember its surrounding, or even learn a trick from the user. Aibo can understand human language, express its emotion via eyes and ears, and even act as a webcam for the owner using the camera on its nose [28]. Each Aibo also has its own personality and behavior, depends in the way user raise them. Its imitation of a real pet could enhance user's enjoyment without worrying about taking care of it.

Figure 2.4: Furby moving its ears with love

Figure 2.5: Aibo giving its hand to owner

2.2.4   Replika

Further than an entertainment, developers also seek for more benefits driven by the
technology. With the power of Artificial Intelligence, now we can have computer
as a friend who understands and accepts us in all aspects. For example, Replika[7] is

a chat-bot with the interface like normal mobile chat application. By exchanging message with the user, the system can gain more information about them and know how to respond properly. Moreover, a photo sharing feature that it could identify a face, if user willing to share their identity, and other contexts such as food or place can help enhancing an AI to be more humanized. Replika can gain over two million downloads after four months from the first launch [4] with report said it could be user's best friend who always gives them support [13].

Figure 2.6: Replika's screenshot

2.2.5   Gatebox

Another interesting example is Gatebox[8], a virtual home robot in a form of a projected 3D character living inside a glass tube. The system consists of voice interaction, user's facial and movement detection, and smart home control. With the housewife image character, it could wake user up in the morning, send him off to work, turn on the light prepared for him when he's on his way back home, and even chat with him during a day via the mobile application. This product aims

for more realistic feeling by stimulating the human's action so the user could feel like the character does exist in the real world.

Figure 2.7: Gatebox talking with user

As described above, many products are invented with ability to fulfill user's need of companionship. Virtual friendship could benefit on being user's safe space where user can open up more easily and decrease their loneliness. Still, the robot is not a human, it could not replace the real relationship with human and can also affect user in a bad way. Too much AI engagement could develop false perception toward the real social interaction and could lead user to more isolation [13].

2.3 Human-to-Human Interaction

Even though many digital companionship products are invented as discussed in the previous section, there is still a gap comparing to the friendship among human. There is a paper argued that being friends without or seldom engagement in real life could not be entitled as genuine friendship. It is a case that studied people's relationship via social network system as it couldn't cover up all intimacy factors without physical connection [14]. In which, the author believes that it could also be applied to the AI friend's situation.

2.3.1   Facebook's Events

Nowadays, technology trend has been shifted to focus more on human-to-human interaction. Facebook[9], a well-known social network system launched in 2004 with over two billion monthly active users and still growing [9], also understand the significance of physical interaction as they introduced "Events" feature; or what has been called "My Parties" at that time; as a tool for user to invite friends for meet-up since the first year after the site was established [26]. Later in 2011, Facebook added more feature called "Suggested Events" as it could analyze user's behavior from their interests or check-ins and give suggestions to encourage them to do more offline activities [8].

Events feature can gain at least 100 million users daily [7] so the company realize of the opportunity and launched it as standalone application called "Facebook Local[10]" aiming for an easier way for users to hang out with others. The key features are quite the same as the Facebook site, it offers nearby attractions that user's friends going to, added with enhanced interface such as map or calendar for displaying events. The app even offers food ordering feature in case users prefer to spend time together at their own places instead of going out [10].
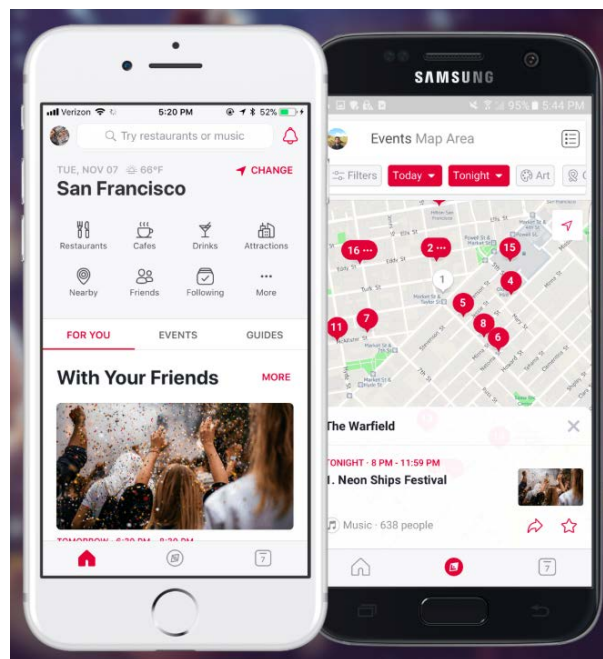
Figure 2.8: Facebook Local Application

2.3.2   Niantic's Games

This trend also expands to the gaming field, Ingress[11], the augmented reality game that overlaps in-game location with the real world so user must go to each place to do mission such as collecting item or acquiring the power for their team. There are many aspects of the game that can support human-to-human interaction. For example, team system that could encourage users to interact with their teammate to accomplish the goal together, players even set up their local communities to exchange information for the team. Ingress also frequently arranges live events in various places for many hundreds of players to join and make friends. Many users reported that they have a better social life since they started playing the game [16].

Moreover, the game creator, Niantic, Inc. extended the core idea of Ingress by collaborating with other famous fictional universes. Resulting "Pokémon Go" that has gone famous already and "Harry Potter: Wizards Unite" that is still in development. As written in their official blog[12], the company understand how their "Digital reality" could bring people together and they're aiming to pursue their vision by expanding targets to various fields of interest.

Figure 2.9: Ingress game by Niantic, Inc.

As explained above, Facebook Events and Niantic's games are now well-known to people and both have a massive amount of active users which can be implied that physical interaction is still important even in this digital era. The author also realizes this concern and would like to expand the intercommunication possibilities by proposing a new way to encourage user using virtual friendship. Hoping it could help user who doesn't have enough confidence to regain their courage and able to enjoy the socialization again.

Notes

1   https://www.pokemongo.com/

2   https://www.nianticlabs.com/

3   http://www.parorobots.com/

4   http://us.tamagotchifriends.com/

5   https://furby.hasbro.com/en-us

6   https://aibo.sony.jp/

7   https://replika.ai/

8   https://gatebox.ai/

9   https://www.facebook.com/

10   https://www.facebook.com/local

11   https://www.ingress.com/

12   https://www.nianticlabs.com/blog/wizardsunite/

Chapter 3
Design

3.1 Conceptual Design

Since the idea started from a desire to help people with social interaction problem, the author seeks for a product that user can open themselves freely. The existing solutions that offer chances for users to meet new friends cannot fit their lifestyle because it forced them too much, it'd be better if there is something to connect them with others. Pet is another interesting option, it's another form of relationship that can provide a feeling of calm and relaxation. Some people might join the communities to gain more information about how to take care of their pet or some can interact with other people during their dog walking. Still, a normal pet cannot give enough influence for its owner to become active, it needs something more extraordinary than that.

The author ends up with the idea of virtual pet as its characteristic of user's safe space where they can talk and release their emotions without fear of being judged. The design of virtual pet should be capable for wide range of ages and genders so it got inspired from the design of Japanese famous monster franchise called "Pokémon[1]". With the fictional character, it is easier to humanize the part that could benefit user such as facial expression or verbal response while it is still available to customize other parts to gain their affection toward the virtual pet. It is also capable to apply the evolution feature to the character in order to maintain user's active usage and continuity.

3.1.1 Activity Ornament

After the idea of a virtual pet is set, the next step is to enhance the product to achieve the goal of real-world interaction encouragement. By applying the idea of persuasive technology discussed in the previous chapter, HappiHatch needs to provide some positive responses back to user in order to motivate more actions.

Further than the positive emotion of the virtual pet as a response, the author's looking for more options to enhance user's participation. Many solutions were discussed such as point feature that user can do activities to obtain points that could be exchanged for shop's discount but this idea has no relation with the virtual pet at all, it's better implemented as another standalone product. Another idea is the evolution of the virtual pet according to the activity they've done but it's difficult for the real implementation because there are many possibilities to combine each activity with the pet's evolution. Thus, the gamification is an interesting idea as it could provide an immediate response back to user's action and the reward itself isn't too heavy for them to get pressured if they couldn't accomplish the mission.

As a result, activity ornament was invented as an active response from virtual pet toward user's action. These icons can be designed as a part of the virtual pet so it could maintain the unity of the system and also can be created separately so the implementation is easier than the pet's evolution idea discussed above. The author aims to use the activity ornament to encourage user to do more activities and open more chances for socialization. These ornaments started as a simple circle which will be leveled up into various images according to user's activity category such as food, media, or sports. Once the activity hasn't been reported for a while, the ornament can be leveled down to the circle again so the virtual pet can notice the change and remind user to keep balancing their actions.

3.1.2   Artificial Intelligence

In order to enhance the virtual pet's status from a normal toy to someone who could motivate user to become better. The Artificial Intelligence, an ability that computer could mimic human's cognitive function and develop the knowledge itself by learning from data input, is selected as a main feature in the system. With this ability, the virtual pet can learn more about user, know their interest, remember stories they told, and match them with events or friends as a suggestion for the growth of ornaments.

Not only the ability to match user's story with activity request, the author also aims to use the Artificial Intelligence to enhance the virtual pet so it could gain user trust and affection. The more user talked to the pet, the more it learns and develops itself from a machine to a living being. To the best of the author's knowledge, this is the most effective way to humanize the system in order to derive the best virtual friendship to user.
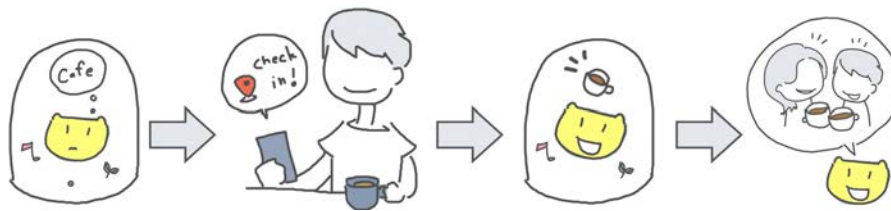
Figure 3.1: HappiHatch's Concept Design

In conclusion, HappiHatch is a virtual pet that could act as user's friend. It can give them a social support and suggest them to do more real-world activities. The design is a snowglobe with diameter around 10 centimeters with a height of 15 centimeters. It could be placed as a home decoration and noticed user when they got back home and chat with it. Inside the snowglobe, there is a virtual pet as user's companion and activity ornaments as positive responses toward user's action. With this design, the author hopes it could be a catalyst for the person who doesn't have much confidence to rebuild courage and enjoy the socialization again.

3.2   Target Persona

For a better picture of the research idea and goal, Target Persona, a made-up character used for segmentation targeting [3] is set. With the understanding of their "pain and gain", the author would be able to point out the problem needed to be solved, and the expected result that target persona can satisfy.

In this study, the target persona is people who have characteristics as follows:

1. With age around 22-27 years old, they just started working for a few years so they haven't gotten used to the adult life yet. In their school life, keeping in touch with friends is an easy task as they could meet together almost every day and also have almost the same experiences with the same age in the same environment. But for the professional environment that they're working for a company, their colleagues have different backgrounds, age, and expertise so it's hard for them to make friends. They also started developing distance with their schoolmates because of the difference in work and free time.

2. They usually feel lonely and isolated. As their problem discussed above, they feel down and left alone. They don't have much confidence to go out and meet new people whether the cause is their bad feeling or low self-esteem. They really need someone to be with them and listen to them but they don't know where to find or how to reach to that person. This is the key pain-point of the research's target

3. They have ever used or interested in the AI friend. As for the information era, AI is a common thing that could be applied in various fields. The easiest example is an AI inside smart phone's operating system such as Google Assistant[2] or Siri by Apple[3], user can ask an AI to perform easy tasks for them and also could chat for an entertainment. So, if the target persona is already used to or open to the AI system, it's easier for HappiHatch to acquire data from user and persuade them to do something. The author hopes to use this opportunity to regain user's confidence and bring them back to the offline relationship.

3.3   Use-Case Scenario

From the Target Persona, a fictional character named "William" is created as an owner of the HappiHatch to demonstrate the use-case scenario in this section. William, a 24-years-old quiet guy, has started his first job for a year and has encountered lots of loneliness problems. He isn't a talkative person so he doesn't know how to start a conversation either with his colleagues or his old friends in the university. That's when HappiHatch plays an important role in his life.

Every day, when he gets back home after work, William talks with HappiHatch about his day and express his lonely feeling. The virtual pet always comforts him with warm word and suggests him many interesting things to lift up his mood, today it talked about brand new cafe opened nearby his office because it knows he enjoys drinking coffee and hasn't reported that activity for a while, *"I noticed that the coffee icon is leveled down, how about visiting new cafe near your office?"*. William agreed to take a look at that cafe after his work in tomorrow's evening. His phone prompt the "Task confirmation" dialog after the pet heard his acceptance, he clicked "OK" to add the event to the application.

The next day, William went to the cafe as he promised with HappiHatch. At that place, William took out his phone and check-in his location inside the

application. The display showed the reward of his action as location pin icon, he put his phone back and enjoy the taste of his favourite coffee. When he got home, he walked to the virtual pet, open the mobile application, and swipe the reward icon from his phone toward it. HappiHatch received the reward via Bluetooth feature, one ornament icon grew up into a coffee icon and the pet showed gratitude back to William, *"Wow! You went to that cafe and I got my coffee icon back, thank you! How was it?"*. William appreciated the change and shared his good moment with the pet.

Figure 3.2: HappiHatch's scenario of submitting mission

Later, HappiHatch remembered his friend named "Kate" who used to be in the coffee club with him when they were in the university so it reminded him about her, *"Your story reminds me of Kate, what do you think whether she would enjoy this new cafe too?"*. William was still happy with his cafe experience so he replied positively back to the virtual pet, which could be implied that there's an opportunity to connect between these two people. *"Then, how about inviting her next time? It has been a while anyway"*, the virtual pet persuaded him to do offline interaction by using their common interest of a coffee as a medium for the connection. William, who always feels lonely and don't know how to start approaching to someone, just got a topic to start conversation with his friend so he accepted the request and added it to the mobile application. Next time he went to the cafe with Kate, he could open the application to check-in for the reward. He might also share a selfie image of him and his friend together for extra points. After a few clicks, the reporting process was done so William could enjoy his time with Kate. The HappiHatch won't interrupt this precious moment, it just faithfully waited for him in his house, until the time he got home and ready for sharing.

3.4   Preliminary Test

The preliminary test was conducted to gain more information about user's insights and the system design. Mobile chat application was selected as a medium due to its capability of communication tool that allows the author to act as a virtual pet instead of implementing the real system. This test was conducted with three users, two male and one female, with age between 25-30 years old. Each user would talk with the virtual pet for seven consecutive days while it's trying to lighten up their mood and encourage them to do more activities. The key feature is a daily updated image of the pet according to user's story in each day.

3.4.1   Methodology

Before the experiment, pre-questionnaire was conducted to design suitable ornaments for user with the open question *"What has interested you lately?"*. For example, a music note icon was designed for user who answered about their favorite band or a utensils icon that was designed for user who replied with a food-related topic. The initial image is the virtual pet smiling beside two to three ornament icons. User was also asked to schedule a time that they expected to be available for a talk in which they all selected night time after dinner.

During the experiment, the author would create new Facebook account as a virtual pet and use that account to chat with user. Every day, at the preset time, user would be asked what they have done and what story they would like to share. Their activity would affect the ornament icon, for example, when user talked about watching movie could help them enlighten their thought, the sparkling icon would be added to the movie ornament. The virtual pet also tried to detect keyword from user and suggest the activity for them, for example, when user mentioned about their trip to London in an upcoming week, the pet would seek for event nearby and suggested them a light installation event at King's Cross. Before the chat ends each day, updated image of the virtual pet would be drawn to reflect user's activities and moods, the pet might point out what's highlight of the change or cheer up the user through its facial expression. This pattern continues for seven days until the end of the experiment.

After the experiment is done, user would complete the post-questionnaire to check for their feeling and feedback. They were also asked about the platform and interaction method they'd prefer for further development.
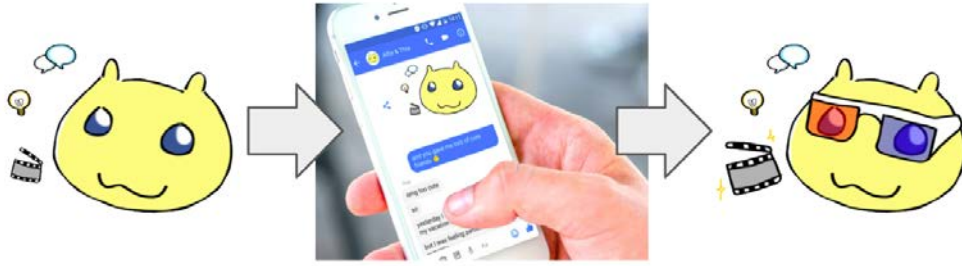
Figure 3.3: Preliminary test's concept

3.4.2   Result

From the preliminary test, the result shows that it's possible for the system to detect user's keyword and seek for suggested activity via keyword search in a search engine or location and time search in Facebook Events. Even though the suggested event in this experiment was done manually, the author believes this procedure could be done automatically. As Facebook Local app could suggest events to users based on their interests and locations [10], it would be possible for the virtual pet to extract information by chatting with user and fetch for suggested activity by the keyword search from other sites.

For the user experience aspect, there are two limitations found in the mobile chat application. First, the typing interaction required more focus from user as they need to open the app in order to talk with the pet, resulting their replies weren't done continually during the experiment. The author believes it would be better if user can chat via voice interaction as it requires less effort compared to the typing. Furthermore, it could help user to release their emotion more easily and their voice tone could also be used for emotional analysis.

Table 3.1: Delayed time record for each user

Scheduled time	Delay time (minutes)							Average Delay
22.00	2	-[1]	3	1	1	20	4	5.16
19.00	17	26	18	4	11	3	9	12.57
19.00	55	15	77	21	9	84	19	40

[1] No reply from user on that day

Second, it's difficult for the system to detect whether user's free to talk or not. Even though they were asked to set the scheduled time for a chat before

the experiment, it turned out that their routine was more flexible so there were often delay time from the user's first response. As displayed in the Table 3.1, the delayed time can start from a few minutes up to over an hour. It would be better if the virtual pet could be implemented as a physical object placed inside user's room so it could guarantee that once the virtual pet detects the user, it means they're at home and there's more possibility for them to available for a talk.

For the overall result, user satisfied having the virtual pet and agreed it could help them decrease their loneliness. They'd like to continue talking with the virtual pet for at least a month, one user also mentioned indefinitely. This could be implied that the virtual pet can give a positive feeling to user and could conduct a perceived relationship toward them. There's also a quote from user during post interview stated that *"Never knew I needed this service, I realized that I'm lonely and I need someone to talk to."* which is the key idea of this research. The author hopes this study could create a better listener for user and open the new opportunity for them to connect with other people.
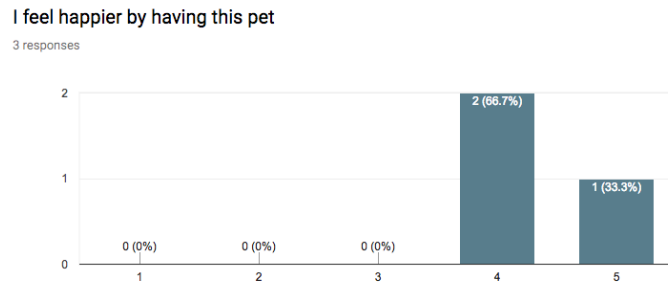

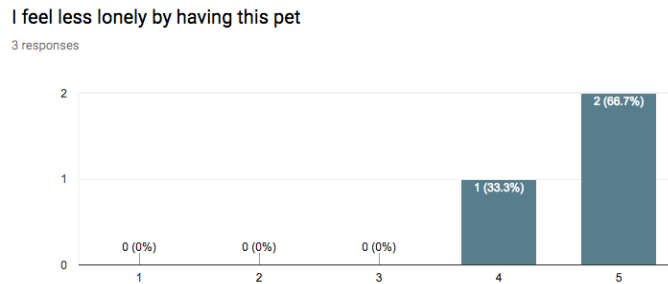Figure 3.4: Preliminary test result on user's happiness

Figure 3.5: Preliminary test result on user's loneliness

3.5   Hypothesis

From the preliminary test, it could be implied that the virtual pet has potential to be user's friend to help them relieve their emotion and reduce their loneliness. Next step is to verify whether this virtual friendship could be used as a catalyst for user to interact more with other people or not. Thus, the author has proposed the hypothesis as:

- Virtual pet can encourage user to interact with friends by using mutual interest as a medium

This statement would be verified by the evaluation in the next section after the design of the virtual pet was revised based on the result in the preliminary test mentioned above.

3.6   Revised Design

From the preliminary test result, the design was changed to a physical form of the virtual pet that could serve the tangible feeling to user. At first, the design was a snowglobe as it could fill with many items such as the virtual pet and the ornament inside. This could benefit as the virtual pets form is flexible for further evolution to keep users continuity. But it would exchange with the disadvantage as its not a real physical form with inability of touch and sense. Like Gatebox[4], the use case scenario is that the user taps on a button to speak with the character and see her from the distance while a furby[5] provide better interaction to user as they can hold and pat the pet directly. Since the design of this research is a virtual pet, the author believes that touch is also a good characteristic for enhancing owner-pet relationship [19] so the design was changed to more tangible form like a plushie.

When the plushie format was designed, next step is to figure out the way to add activity ornaments inside the pets body. The stomach is the first choice in the consideration as it is the biggest part of the body with good reference as Teletubbies[6], creatures that have a television on their abdomen to show some data. By adding screen in the pets belly, HappiHatch could display activity ornaments to user and also use it to emphasize the level changing in each ornament. Also, the same display would be used as the pets eyes so it could show various facial expression as a response to user.

Figure 3.6: Teletubbies with screen on their belly

The plushie should have similar size to the previous design, diameter around 10 centimeters with a height of 15 centimeters, so it could be placed as home decoration and also capable for the user to hold it with both hands. The fluffy surface could comfort user when they touch the pet, they can also stroke on its head or back as they could do with other domestics pets. HappiHatch's animated eyes would increase liveliness of the system and stimulate human-like response as if the user is talking with someone. These features aim to encourage user to talk openly to the pet, establish connection with it, and get motivated to do as its request. The virtual pet would listen to all user's stories and relate them with suggested activity in order to persuade them for more interpersonal interactions.

Notes

1   `https://www.pokemon.com/us/`

2   `https://assistant.google.com/`

3   `https://www.apple.com/ios/siri/`

4   `https://gatebox.ai/`

5   `https://furby.hasbro.com/en-us`

6   `http://www.teletubbies.com/`

Figure 3.7: HappiHatch's concept image of the revised design

Figure 3.8: Example of various display in HappiHatch's eyes and belly

Chapter 4
Evaluation

In order to verify the hypothesis stated in the previous section. Two tests were conducted in order to cover all aspects of the result. The first one was the quantitative test that used the simplified version of the product in a form of an online test and evaluated with the assessment questionnaire. The second test was the qualitative test that used the physical prototype and evaluated with user interviews.

4.1 Quantitative Test

The quantitative approach is the analysis of numerical data using statistical relationship for generalized findings [18]. This test was done aiming to prove whether the virtual pet's existence could enhance user's interpersonal connection or not. Since this test focuses on numbers of users, it should be generalized enough to support many users at a time. The online questionnaire site was selected as a medium because it could be completed without a conductor and also easy to spread over the Internet for participants acquirement.

4.1.1 Methodology

In order to build the relationship between user and the virtual pet, the experiment cannot be done within a single test. So, the experiment is divided into three test sets as follows:

1. A-Test for the user to get used to the system, the virtual pet would introduce the activity ornament to user and ask them to do some activity to make it grows.

2. B-Test for the virtual pet to show user the upgrade of an activity ornament

based on their action. It would ask whether user did activity alone or with other people then persuade them to do it again with someone.

3. C-Test for collecting data about user's activity with other people.

In each test, the virtual pet would ask about user's day to mimic the conversation behavior before introducing them to the purpose in each corresponding step. Since the main task aimed for user to do some activity, there will be three days gap time between each test in order to spare time for them to complete the pet's request.

The four types of basic activities were designed for the experiment's implementation by categorizing leisure time activity statistic from various websites [1] [17] [30] with extra conditions. First, it should be an activity that could be either done alone or with someone so the task doesn't force user to interact with people in the early step. Second, it should be an activity that could be done with less time required and could be fulfilled within three days gap between each test set as the task isn't too difficult and trouble the user. Finally, four types of activity could be described as follows:

1. Food e.g. eating out, cooking, baking, drinking, and cafe visiting

2. Media e.g. movie, music, singing, games, and Social Network

3. Relax e.g. meditation, reading, shopping, gardening, and pets

4. Sports e.g. yoga, jogging, gym, badminton, and soccer
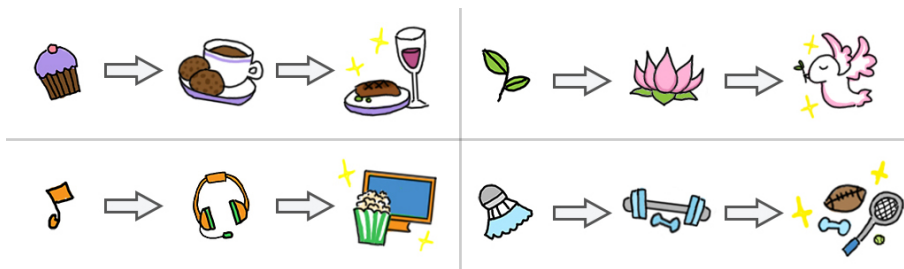
Figure 4.1: The design of Activity ornament and its evolution

For the implementation, Responster[1] questionnaire site was used in order to represent the interaction with the virtual pet. Its page-by-page question design

could benefit on imitation of the conversation behavior together with the logic skip as each choice could lead to different results. User is free to choose a type of activity they would like to do, re-select activity if their action differed from their task in the previous test, refuse to follow the pet's request and exit the experiment, or retry the test again if they could not accomplish them at that time.

In each question, the image of the virtual pet is displayed on the screen together with the question and answers. The virtual pet's eyes could change according to its mood in each statement. For example, they can be shown as heart-shaped eyes when the pet is happy or teary eyes when the pet is sad. Activity ornaments in the belly also can be upgraded to an upper level if user did some activity in the following test set.
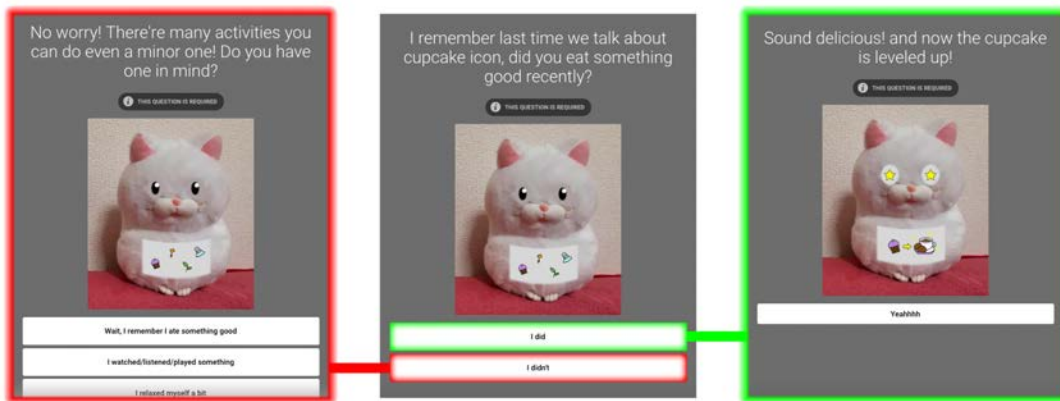
Figure 4.2: Responster's screenshot with different path for each choice

For the assessment test, the Social Connectedness Scale was used as it is a measurement of respondent's perception of interpersonal connection. It was also proved in the reliability and consistency within two weeks interval [24]. This questionnaire would be filled five times during the experiment as follows:

1. Day 1: Pre-Test for collecting user's basic information

2. Day 2: after A-Test prototype

3. Day 5: after B-Test prototype

4. Day 8: after C-Test prototype, with additional survey for user's feedback

5. Day 11: Post-Test for the follow up assessment
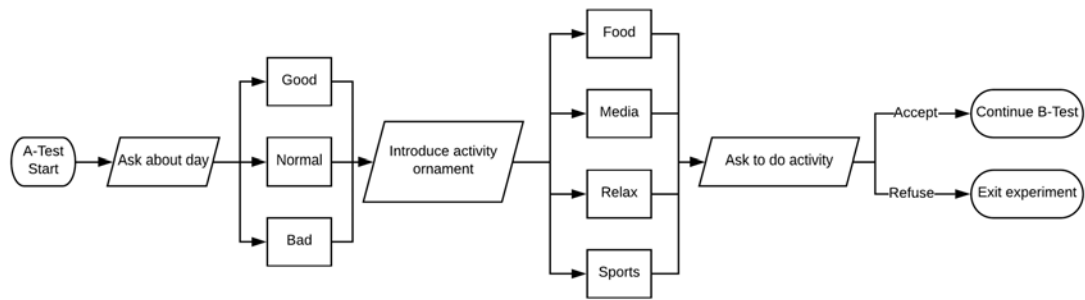
Figure 4.3: Flow chart for A-Test
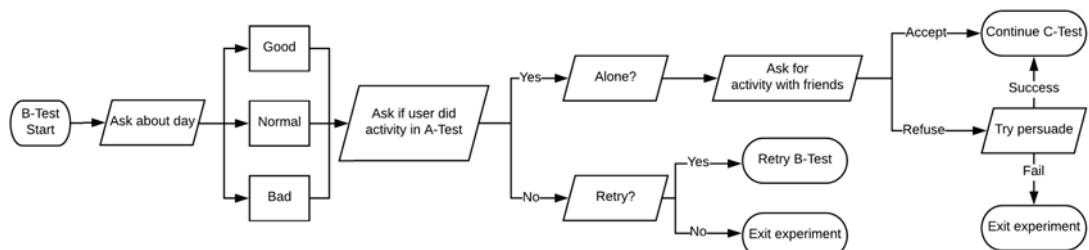
Figure 4.4: Flow chart for B-Test
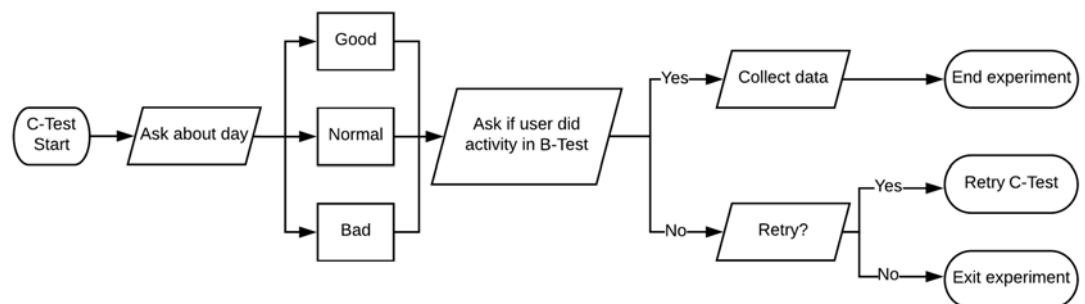
Figure 4.5: Flow chart for C-Test

The experiment was done within two weeks interval so if there's a positive difference in the questionnaire, it could be implied that the virtual pet could affect user's perception of connection with other people. Also, username and contact information were asked in the pre-survey for the conductor to send next test's URL and confirm the same identity of the respondent in each test. These data were excluded from the analysis and destroyed after the collection process.

4.1.2   Result

There are total 30 participants, age between 23-32 years old with the gender ratio almost 1:1. From the whole process, two participants were lost during the experiment and another one withdrawn by refusing to follow the virtual pet's task after the B-Test so only 27 results could be analyzed in the final step.

Table 4.1: The average value of the Social Connectedness Scale in each test set

Test set	Pre	A	B	C	Post
Average value	3.27	3.31	3.53	3.39	3.38

By comparing the average value of the Social Connectedness Scale in each test set as displayed in Table 4.1, the overall values are not significantly different. Even though the author expected the average value in the C-Test to be the highest as it is the test that collects result after user did activities with other people, in actual the B-Test value scored the highest. This might occurred because it is the test that the virtual pet persuaded users to interact with other people so they started developing their thought about their friends after the prototype test. Also, C-Test implementation was too short as the pet asked for a result and ended the experiment immediately. If the conversation length could be extended to establish the same feeling as in the B-Test, the author believes the result would be the highest score as assumed. For the Post-Test result, the value is close to the result in C-Test and still higher than the score in the Pre-Test. This is a good sign showing that the prototype has a positive effect on a user's perception of social connection.

The author also analyzed data from the Social Connectedness Scale by grouping value range and comparing result between each test set as displayed in Figure 4.6. From a quick glance, there is no specific pattern in these data but there is a sign that three test sets with the prototype implementation could score higher as the trend of A-Test, B-Test, and C-Test values are all shifted to the right side. Also, the count of replies in the highest value range (score 4 to 5) shows an apparent difference that three test sets could gain higher amount than the result in Pre-Test and Post-Test. This could be implied that user's interaction with the prototype could affect on their perception toward connection with other people in a positive aspect. Thus, even the result in Post-Test is higher than what's in the Pre-Test, the overall trend of two graphs are quite the same.
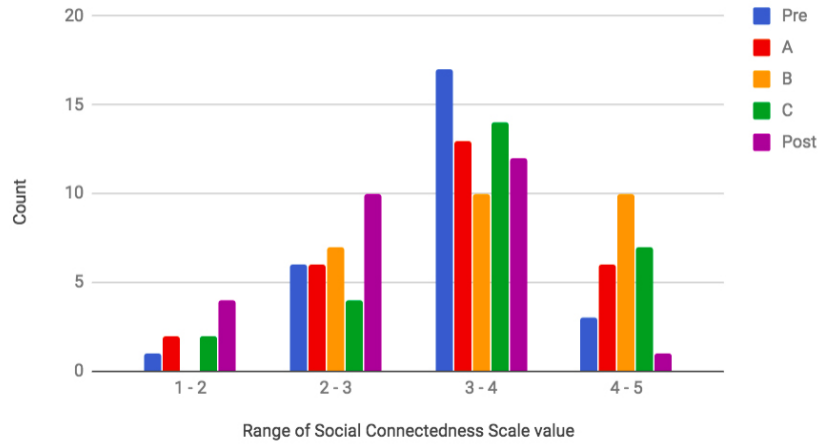
Figure 4.6: Overall trend of the Social Connectedness Scale in each test
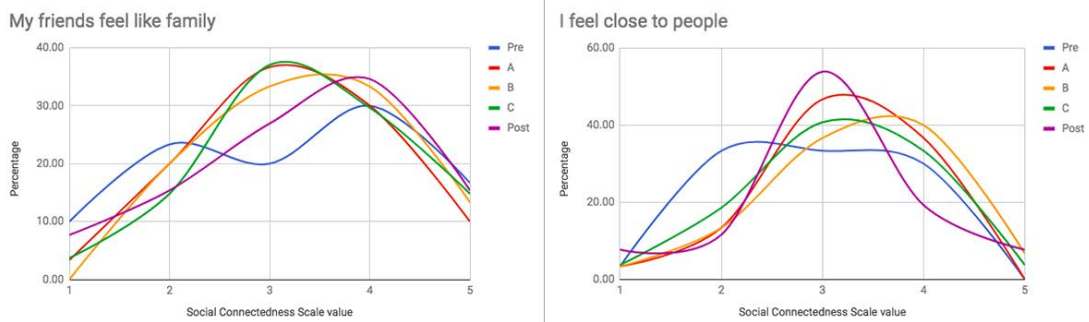
Figure 4.7: Percentage of value in each specific question

To focus more in detail, each question of the Social Connectedness Scale was analyzed separately. The interesting results are two graphs as displayed in Figure 4.7. For the question *"My friends feel like family"* and *"I feel close to people"*, the data trends for all three test sets are more dominant to the upper right side which means participants answer more in the higher score. This is also another good sign of the virtual pet prototype's positive affect toward users.

In the B-Test, users were asked whether their first task to do an activity was done alone or with others. With this data, the author aimed to analyze the difference between two sample groups. The result shows that 60% of participants (16 people) did the activity alone. Also, the comparing the assessment result between two cases, as displayed in Figure 4.8, showed that value trends of those who did an activity with someone are all shifted to the right as a good outcome.

31
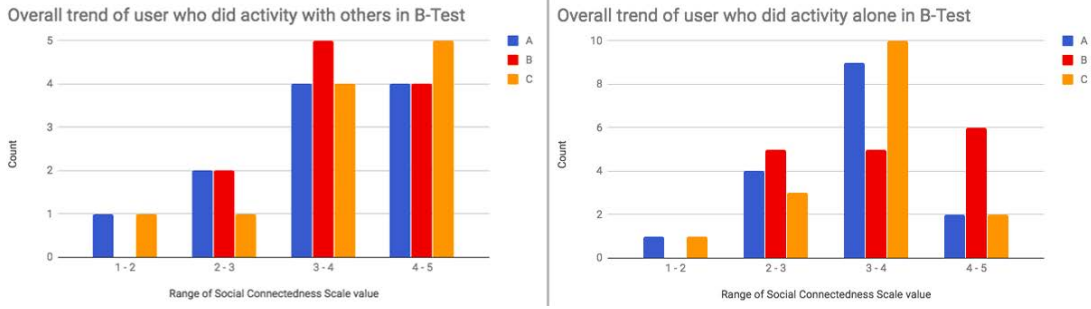
Figure 4.8: Comparing data between participants who did activity alone and with others

Table 4.2: The number of persuasion between users who did activity alone and with others

Number of persuasion (times)	Number of $user_{others}$[1]	Number of $user_{alone}$[2]
0	11	9
1	0	3
2	0	3
3	0	1

[1] User who did the previous task with others
[2] User who did the previous task alone

Furthermore, when the virtual pet asked user to do an activity again with someone. All participants that already connected with others during the previous test accepted the pet's request immediately while only 56% of participants who did activity alone did the same response. As displayed in the Table 4.2, the virtual pet need more times to persuade users in the second group. It would remind users about their friends or family, show them the positive energy of going out with someone, and if it still didn't work, it would cry and apologize to the user as a final step. In the end, the virtual pet succeeded to encourage the interpersonal activities as all participants accepted the task. There's only one participant withdrew from this experiment with the reason that they're too busy and difficult to spare time. This participant had already done activity with other people in the previous test so it didn't affect much to the result. Some users reported that they're not good at social interaction but they still accept the pet's request. One user also mentioned that the virtual pet helped them build their confidence and feel easier to socialize as their mood is positive. These results showed that the virtual pet can persuade user to interact with others by using the activity as a medium.

Table 4.3: Additional questions and results in the Post-Test

Question	Average value
1. This game can stimulate feeling like I'm talking to a virtual pet	3.59
2. I'm willing to do something for this virtual pet	3.59
3. The virtual pet can help me to connect with my friends	3.00
4. If I can hold the pet and talk to it, I'm more willing to express myself	3.70
5. If I can hold the pet and talk to it, I'm more willing to do something for it	3.74

Thus, this is only a primary result since the prototype was done online without any physical interaction. With additional questionnaire done in the Post-Test, participants were asked about their feeling toward the test using Likert-Type scale [27] with 1 equals "Strongly Disagree" and 5 equals "Strongly Agree". From the Table 4.3, their impression toward this version of prototype and intention to accept the pet's request is somewhat positive as the average value of the first two questions equals to 3.59. Still, this prototype version cannot prove much ability to connect with people as the average value of the third question is neutral. The author agrees at this point since three test sets were not much enough for the virtual pet to build a connection with the user and influence their action. For further development, the last two questions were asked for participants' opinion toward the physical prototype resulting in the high average value nearby 4 means it would be more effective than the current prototype.

In conclusion, this virtual pet prototype could encourage users to do something and interact with other people by using the activity category as a medium. This action also affected a user's perception of interpersonal connection as evaluated by the Social Connectedness Scale. Even the result cannot show a major significance, it is still a good sign that can prove the HappiHatch's idea in basis. The author believes that if the tangible product could be implemented, the evaluation result would be better.

4.2   Qualitative Test

The qualitative approach is the analysis of nonnumerical data such as words or actions for particularistic findings [18]. This test aims to study user's insight toward the virtual pet in the real use case scenario by using the physical prototype. Since this test focuses on in-depth interviews, it could be conducted to only few numbers of users according to the limitation of time and resources.

4.2.1 Methodology

In order to create the real use case scenario, the physical prototype is required to stimulate a "life" of the virtual pet. From the revised design mentioned in Chapter 3, cat plushie, a soft toy in form of a stuffed animal, was selected for representing the HappiHatch's character. The author also enhanced the liveliness of the virtual pet by adding screen inside the plushie for the animation in the eyes as facial expression and the belly as activity ornaments display.

Figure 4.9: HappiHatch prototype with animated eye and icons in the belly

In order to put the animation inside the plushie, the surface area of the eyes and belly need to be removed before inserting a smartphone as a screen inside. Chrome Remote Desktop[2] application that allows remote access to the computer was used for transformation of a smartphone to the computer's external screen. This method would allow the author to control information displayed on the virtual pet without direct contact with the plushie. Also, the Chrome Remote Desk-

top could connect between two devices as wireless connection so user could hold or place the product freely. Still, the application itself allows touch on the smartphone to control the connected computer so the Touch Blocker[3] application is needed to prevent user from accidental intervention with the computer in the experiment's conductor side.
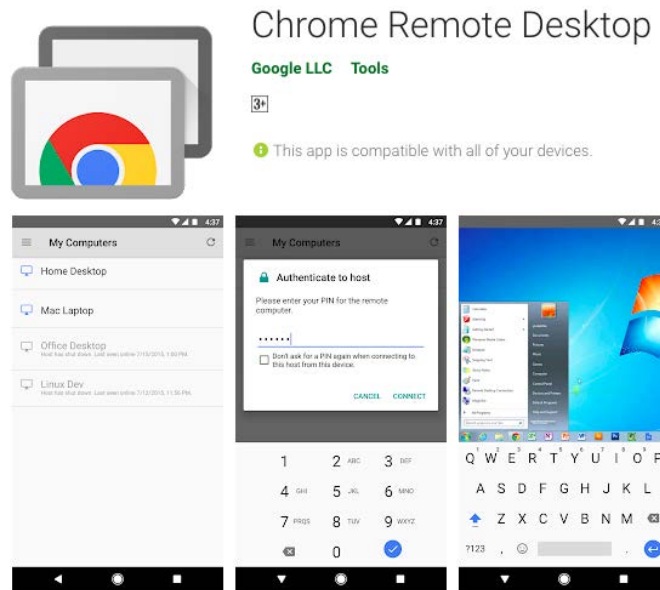
Figure 4.10: Chrome Remote Desktop application

The next step is the content inside the screen. As in the quantitative test, the image resources were already prepared for various cases but the author believes that there would be a better way to display information rather than the static image. So, the animation would be implemented to create smooth transition between each facial expression and floating activity icons in the belly for more realistic feeling of the virtual pet.

Figure 4.11: Animation example of HappiHatch's eyes: awake from sleep

Moreover, instead of a interaction via static text used in the previous test, voice interaction would be applied as discussed in the preliminary test that it is easier

for user to talk with the pet and express their emotion. The voice resources were prepared in advance by recording with basic sentences, questions, and emotional expressions. Still, the Chrome Remote Desktop application doesn't support audio sharing so the sound will come out from the conductor's computer instead of the smartphone inside the virtual pet. Therefore, Bluetooth speaker was added inside the plushie to emit a voice from itself as it can support a wireless connection within a short distance.
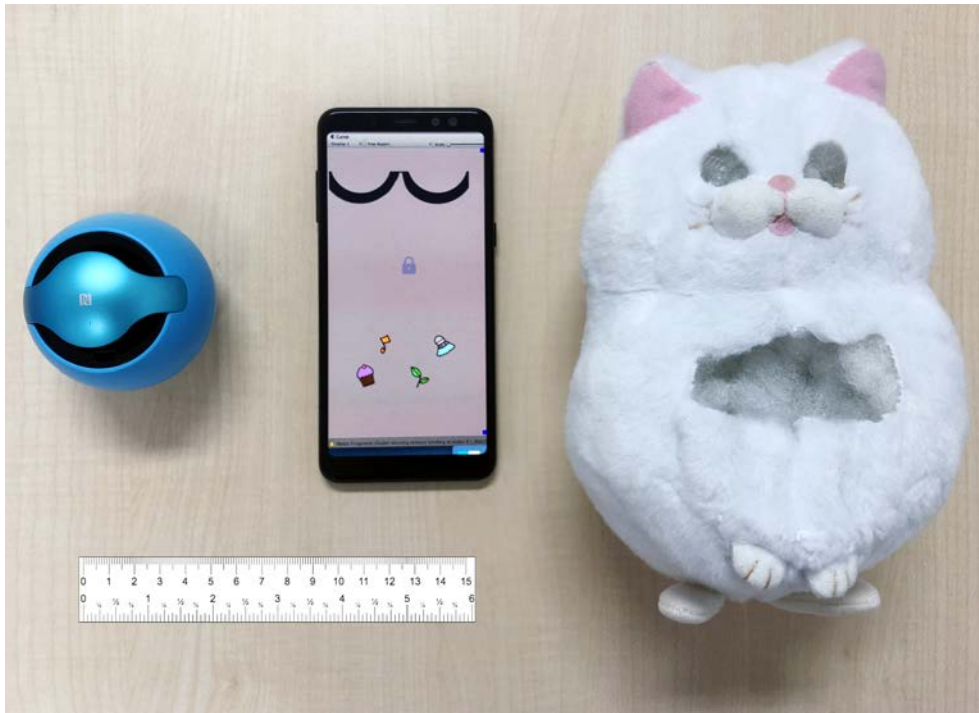
Figure 4.12: Prototype components, From left to right: Bluetooth speaker, smartphone with Chrome Remote Desktop application, and the plushie

After all resources were prepared, the Unity[4], a game engine that supports various platforms with both 2D and 3D graphics using the script in C# language, was used as a tool to combine all assets together. In each command, the button would be used as a trigger to start playing video and audio. For example, *"Awake"* button will trigger video transition from sleeping eyes to normal eyes as shown in Figure 4.11 together with audio *"Hi, I'm HappiHatch. How are you today?"* as an opening scene for user to interact with the virtual pet. Buttons can be grouped into three main sections as follows:

- Main task e.g. opening and closing scene, pet talking about the activity ornaments, or pet asking user about their activity

- Expression e.g. happy, sad, thank you, or don't understand

- Belly e.g. floating icons, ornament's introduction, or ornament's evolution
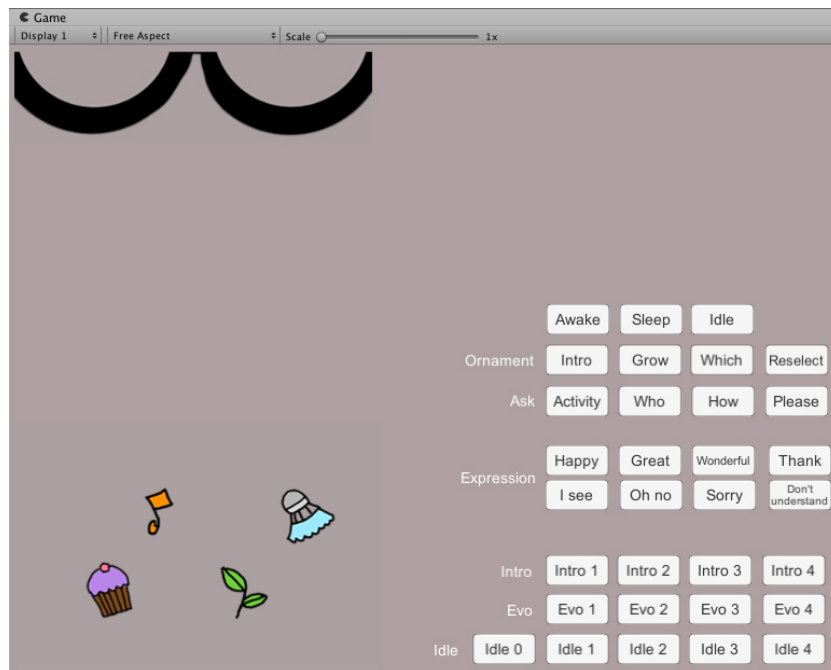
Figure 4.13: Unity program screenshot, the left side is only what projected on the screen inside the plushie while the right side is button controller for animation of the virtual pet.

For the experiment design, the author focused on collecting feedback and study on user's feeling toward the virtual pet's existence more than focusing on the potential of it to encourage interpersonal interaction since that test was already done in the quantitative test. So, the flow of this conversation was designed as follows:

1. The pet is sleeping, see how user design to wake it up

2. The pet is awake, ask about user's day and response with emotion

3. The pet introduce user the activity ornament and ask if they've done anything recently with their friends or not

    (a) If no, retry again by express sadness and beg user for a story

    (b) If yes, express happiness and show the ornament's upgrade

4. The pet says goodbye to user and goes back to sleep to end the experiment

As displayed above, the flow is quite loose as HappiHatch's behavior needed to be adapted to user's actions. The Wizard of Oz experiment, a method that has human control the system behind to stimulate the expected result like full implementation is completed [25], was used so the experiment conductor could observe user's behavior and control the virtual pet's response in real time. After the experiment was done, the in-depth interview would be performed to acquire information on how user feels toward the HappiHatch, how it could affect on their behaviors, and what's different for user who also did the online version in the previous test.

4.2.2   Result

There are 12 participants, 7 female and 5 male with age between 23-28 years old. 58% of participants are people who have done the quantitative test before so they already understand the concept of the HappiHatch, this is a good chance to observe how much the physical product could affect their perception.

Once participants saw the physical prototype, 75% of them smiled and praised for its cuteness as the first impression. All female participants did the mentioned reaction while 3 out of 5 male participants said nothing. During the experiment, 5 out of 7 female participants touch and hold the prototype as a physical connection while all male participants only use the verbal interaction. This result could be implied that the design is more attractive to female users. One male participant also mentioned that it's looked "too girlish" to him, he'd rather prefer a mobile application with the activity ornaments alone for an activity encouragement but the rest still agreed that the physical product gives better feeling comparing to the static mobile application. For the interaction with an ornament, most users tapped the icon on the virtual pet's belly when it asked them to choose one. The display's shape and position make them expected the touchscreen function to be implemented. This action also could help to enhance the conversation flow during the experiment.

The experiment result also depends on the participants' personalities, some users (two male and one female) focused more on the functional advantage like

Figure 4.14: User's playing with HappiHatch's belly during the experiment

other smart devices. These participants are people who are socially confident and have someone for their daily conversation already so there are no points for them to use this product as they prefer to talk to the real person instead. Still, they enjoyed the appearance of the virtual pet and willing to use it for other purposes.

Further than three people as discussed earlier and one male user who found the prototype is too girlish for him, the overall participants (67%) enjoy the existence of the HappiHatch. They'd like to talk with it every day for either entertainment or social support. They agreed to accept the virtual pet's request to go out or interact with their friends. When the participants were asked whether they're motivated by the activity ornament or the talking pet itself, they replied they'd do something just for the virtual pet. Activity ornaments sound interesting to them, some said that they can be a good motivation, but the main reason is still for the HappiHatch to be happy. This could be explained as the perceived belongingness, the feeling of connection and acceptance toward the pet can influence user's action [11]. Participants also reported that talking with the virtual pet could reduce their loneliness and motivate them to do more activities.

For the comparison with the previous test, all participants who did both experiments said that this version of the prototype is better because it looks more

real and they enjoy the tangible product. Even for male participants who rarely touch the virtual pet, they still prefer the physical appearance as it gives better feeling toward the pet and also easier for them to talk to it. For those who have met the HappiHatch for the first time, they gave positive feedbacks toward the product and enjoyed interacting with it.

Moreover, the Social Connectedness Scale questionnaire was also used for verifying user's perception of interpersonal connection. The average value before the prototype test is 3.58 while the average value after a conversation with the prototype around five minutes is 3.81. The score after the experiment is apparently higher in a short period of time. This is a good sign showing that the virtual pet could affect user's mindset in a positive way.

In conclusion, the physical prototype could create better feeling and connection with the user. They enjoyed their time with the HappiHatch and willing to do what it requested. This prototype is more effective toward female users in which the author need to do more research to find a proper product that can attract user in all genders. Still, the experiment result shows it isn't compatible with people who are socially confident because they'd rather prefer talking with a real person instead. This result is corresponding to the Target Persona as this product aimed to help person who has already faced the loneliness problem and isolated himself from others.

4.3   Summary

To summarize, the first test showed that the virtual pet has a potential to encourage user for more interpersonal activities as it could ask participants to do an activity with someone during the B-Test. Especially for participants who prefer to do an activity alone in the previous A-Test, some of them wouldn't complete the mission if the virtual pet stopped persuading them after the first question. Also, the positive trend of the Social Connectedness Scale resulting in this experiment could demonstrate the effect of the virtual pet toward the user's perception. These positive values showed that they could feel more successful in maintaining companionship which makes it easier for them to keep connecting with others and reduce a chance for the isolation [24].

For the second test, it could be explained that the physical appearance has more impact on user's affection and willing to follow the suggestion. Participants feel more connected to the virtual pet and enjoy having its company for either

entertainment or social support. As the more user perceived the virtual pet as a living being, the more effect it could influence on their action [12], this physical prototype could provide better result compared to the static website. By combining two experiments result together, these outcomes showed the positive trend that the virtual pet could connect with users and persuade them to do more real-world interactions.

Notes

1   https://www.responster.com/

2   https://chrome.google.com/remotedesktop

3   https://play.google.com/store/apps/details?id=com.clstudios.screenlock

4   https://unity3d.com/

Chapter 5
Result and Discussion

5.1 Conclusion

The proposal of the virtual pet that could encourage user's real world interaction has been evaluated with two approaches. The results showed that the virtual pet can form a relationship with the user and affect their perception of the interpersonal connection in a positive way. Even though those experiments have some limitation according to the insufficiency of time and resources, it still can show an upward trend in user's connectedness scale and their active behavior's improvement.

Thus, the hypothesis stated in Chapter 3 as *"Virtual pet can encourage user to interact with friends by using mutual interest as a medium"* could be proved as true because user reported their activity as the pet suggested in the quantitative test and showed more engagement and positive result with the physical prototype in the qualitative test.

For the research question: *"How could virtual pet be used as a catalyst to motivate more real-world interaction in a person"*, the author found the solution is that the virtual pet could generate the perceived belongingness between itself and the user. This kind of relationship could relax user as their social support and lead them to do something for the pet. It could ask user to do more activities and interact with their friends so the pet could stay happy and the activity ornaments could grow. These are positive feedbacks that the HappiHatch could respond back to the user immediately as an encouragement for them to continue their actions.

5.2 Limitation

From the evaluation method, even though both quantitative test and qualitative test were done, the author believes that there could be a proper way to prove the

idea of this project. By using the Social Connectedness Scale as an assessment, it'd be better to control other variables that might affect the result of the questionnaire such as the time that user takes the test and special occasion that user encountered with more people. If the assessment test could be done daily at the exact same time for one week before testing with the prototype, during testing with the prototype daily for another week or more, and the follow up test for another week. The result would be more precise and easier to analyze the influence of the virtual pet toward user's perception on the interpersonal connection.

Also, if the physical prototype could be implemented with a real chat bot rather than a fixed dialog as done in this report, the author believes that it could make the virtual pet become more humanized and could establish more connection and influences toward the user. Hence, more time and resources are required for experiment procedure.

5.3   Future work

Even though a white cat plushie is used for representing the HappiHatch's character, the author believes it would be better if the character could be implemented with various types of animals, voice tones, and characteristics. If user can have a HappiHatch that matches with their personality, it'd be easier for them to be fond of it and open themselves to the virtual pet.

Moreover, to enhance the ability of HappiHatch, it would be better if the virtual pet could connect to user's Social Network System so it could learn more information about the user, their activities, and their friends. Also, if user and their friends could connect their own HappiHatch together via the Internet or Bluetooth connection. The virtual pet itself could exchange their owner's data and seek more connections between them. The more virtual pet could know about the user, the more accurate it can suggest activities and meetup opportunities to them. Thus, concerns about information usage and privacy policy should be discussed before further development.

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Appendix

A Assessment Test

I feel disconnected from the world around me *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Even around people I know, I don't feel that I really belong *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I feel close to people *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

I am able to relate to my peers *

	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

Figure A.1: Social Connectedness Scale Questionnaire (1/2)

Figure A.2: Social Connectedness Scale Questionnaire (2/2)

B   A-Test Question list

1. Please input your username (Textbox)

2. Hi! How are you today?

   (a) Today is a good day :D (Go to 3.)

   (b) so so (Go to 4.)

   (c) Not quite well (Go to 5.)

3. Great Can you tell me more about it? (Textbox)

(a) Good to hear that! Now let's do something fun. Can you see these cute icons on my belly? It can grew up according to your action! (Go to 6.)

4. At least it's not a bad day! Anything in particular for today? (Textbox)

   (a) Then let's do something new, see these icons on my belly? You can help me to level them up! (Go to 6.)

5. Oh my I know you have done a great work today! Can you tell me more? (Textbox)

   (a) It's okay, tomorrow is going to be better! Let me relax you with these cute icons on my belly. It can grow up too, you know? (Go to 6.)

6. These are activity ornaments. If you do some related activities, it will be upgraded! Please select one for more detail.

   (a) Cupcake (Go to 7.)
   (b) Music note (Go to 9.)
   (c) Leaves (Go to 11.)
   (d) Badminton (Go to 13.)
   (e) I don't care (Go to 16.)

7. Cupcake is Food category that will grow when you eat out! Do you have any plan in your mind?

   (a) I might visit some cafe nearby

      i. Cafe! I like visiting cafe for good coffee and dessert (Go to 8.)

   (b) I am thinking of one of my favourite restaurants

      i. Restaurant is always a good choice for good food without troubling on cooking (Go to 8.)

   (c) I want to go out for drink!

      i. My friends also enjoy drinking as their best way to release stress! (Go to 8.)

   (d) Not sure, how about other category? (Go to 6.)

8. So you have selected FOOD activity! Can you do it so next time we talk we can see the icon growing up?

    (a) Sure (Go to 15.)

    (b) Wait, let me decide again (Go to 6.)

    (c) I won't do anything for you (Go to 16.)

9. Music note is Media category that will grow when you watch or play something. Do you have any thing you like?

    (a) Games, of course!

        i. Yeah Gaming is the best way for entertainment! (Go to 10.)

    (b) I enjoy music a lot

        i. Music is fabulous! Either listening, singing, or playing instrument is cool (Go to 10.)

    (c) Maybe watching some movie or series?

        i. I'm thinking about bringing popcorn and enjoy watching now! (Go to 10.)

    (d) Not sure, how about other category? (Go to 6.)

10. So you have selected MEDIA activity! Can you do it so next time we talk we can see the icon growing up?

    (a) Sure (Go to 15.)

    (b) Wait, let me decide again (Go to 6.)

    (c) I won't do anything for you (Go to 16.)

11. Leaves is Relax category that will grow when you give yourself a break. What'd you like to do?

    (a) Spend all the money on shopping!

        i. Shopping is a therapy! Pay it for your happiness! (Go to 12.)

    (b) I regain energy from pets or plants

        i. Awww I love nature, I love pets, I love plants! (Go to 12.)

    (c) Calmful way such as meditation or reading

      i. Peaceful mind sure bring you a better day! (Go to 12.)

   (d) Not sure, how about other category? (Go to 6.)

12. So you have selected RELAX activity! Can you do it so next time we talk we can see the icon growing up?

   (a) Sure (Go to 15.)

   (b) Wait, let me decide again (Go to 6.)

   (c) I won't do anything for you (Go to 16.)

13. Badminton is Sports category that will grow when you work out! Do you exercise?

   (a) I do jogging/running

      i. Grab your running shoes and get ready for a run! (Go to 14.)

   (b) I will visit gym soon

      i. Aww Gym is always a good place to keep you healthy (Go to 14.)

   (c) I play sports e.g. badminton or soccer

      i. An entertaining way to do exercise, cool! (Go to 14.)

   (d) Not sure, how about other category? (Go to 6.)

14. So you have selected SPORTS activity! Can you do it so next time we talk we can see the icon growing up?

   (a) Sure (Go to 15.)

   (b) Wait, let me decide again (Go to 6.)

   (c) I won't do anything for you (Go to 16.)

15. Great! I'll ping you again in a few days. Can't wait for the result! (End Test)

16. I'm sorry if I ask too much from you, I promise I'll be gone

   (a) Well, if I can see those choices again... (Go to 6.)

   (b) BYE (End Test, no B-Test)

C   B-Test Question list

Note: Assume user select FOOD activity from A-Test, other 3 cases have similar question list with few differences in detail and order.

1. Please input your username (Textbox)

2. Nice to see you again! How it's going?

    (a) Brilliant! :D (Go to 3.)

    (b) Just a normal day (Go to 4.)

    (c) A bit gloomy (Go to 5.)

3. Wonderful! What make you happy today? (Textbox)

    (a) Sounds good! I'm happy to see you happy. (Go to 6.)

4. Normal day is a good chance for a better tomorrow! Any particular thing today? (Textbox)

    (a) Well then, let's talk about something new! (Go to 6.)

5. I'm sorry to hear that, wanna share your feeling to me? (Textbox)

    (a) Remember you still have me! Let me cheer you up (Go to 6.)

6. I remember last time we talk about cupcake icon, did you eat something good recently?

    (a) I did (Go to 10.)

    (b) I didn't (Go to 7.)

7. No worry! There're many activities you can do even a minor one! Do you have one in mind?

    (a) Wait, I remember I ate something good (Go to 10.)

    (b) I watched/listened/played something (Go to 11.)

    (c) I relaxed myself a bit (Go to 12.)

    (d) I did exercise (Go to 13.)

    (e) No thing at all (Go to 8.)

8. I see....or should we talk again later to see if you have something to share?

    (a) OK

        i. Thank you! I'm looking forward to talk to you again! (End Test, retry next time)

    (b) I'm done with you already (Go to 9.)

9. I'm sorry if I ask too much from you, I promise I'll be gone

    (a) Well, if I can see those choices again... (Go to 7.)

    (b) BYE (End Test, no C-Test)

10. Great! What dish did you have? (Textbox)

    (a) Sound delicious! and now the cupcake is leveled up! (Go to 14.)

11. Great! What media activity did you do? (Textbox)

    (a) Sound good! and now the music note is leveled up! (Go to 14.)

12. Great! What relaxing activity did you do? (Textbox)

    (a) Interesting! and now leaves is leveled up! (Go to 14.)

13. Great! What exercise did you do? (Textbox)

    (a) Woww! and now badminton is leveled up! (Go to 14.)

14. By the way, did you enjoy it alone or with someone?

    (a) Alone (Go to 15.)

    (b) With someone (Go to 19.)

15. Hmm I can feel some challenge now. How about inviting someone to join you or to discuss with?

    (a) Challenge Accepted! (Go to 21.)

    (b) I don't know who I can talk too (Go to 16.)

16. It can be anyone! Your colleagues, your family, friend who share interest, or friend who joined you last time.

(a) I think I have someone in my mind now (Go to 21.)

(b) I don't think I can do it (Go to 17.)

17. Don't underestimate yourself! Isn't a sharing enjoyment with someone sound good?

(a) Okay, I'll do it (Go to 21.)

(b) Stop annoying me (Go to 18.)

18. I'm sorry if I ask too much from you, I promise I'll be gone

(a) Okay, okay, I'll do it (Go to 21.)

(b) BYE (End Test, no C-Test)

19. I love people! Can you tell me more about him/her? (Textbox)

20. I wanna hear more! How about inviting him/her to join you again?

(a) Sure (Go to 21.)

(b) I don't think I'll do it (Go to 18.)

21. Such a spirit! Please enjoy your activity and I'll wait for your story! (End Test)

D   C-Test Question list

Note: Assume user did FOOD activity from B-Test, other 3 cases have similar question list with few differences in detail and order.

1. Please input your username (Textbox)

2. We meet again! How are you doing?

(a) Happy :D (Go to 3.)

(b) Neither good nor bad (Go to 4.)

(c) Not so well (Go to 5.)

3. I'm happy to hear that! Wanna share it with me? (Textbox)

    (a) Brilliant! Thank you for a good story (Go to 6.)

4. I see more opportunities for better day! Anything in particular today? (Textbox)

    (a) I see, wish you have a better day tomorrow! (Go to 6.)

5. Oh my, wanna share your feeling to me? I'm all ears. (Textbox)

    (a) I know you'll have better day soon! May I talk about other thing to freshen you up? (Go to 6.)

6. Last time we talk about food activity, did you go out eating with someone?

    (a) I did (Go to 10.)

    (b) I didn't (Go to 7.)

7. No worry! There're many activities you can do even a minor one! Do you have one in mind?

    (a) Wait, I remember I went out eating with someone (Go to 10.)

    (b) I watched/listened/played something with someone (Go to 11.)

    (c) I relaxed with someone (Go to 12.)

    (d) I did exercise with someone (Go to 13.)

    (e) No thing at all (Go to 8.)

8. I see....or should we talk again later to see if you have something to share?

    (a) OK

        i. Thank you! I'm looking forward to talk to you again! (End Test, retry next time)

    (b) I'm done with you already (Go to 9.)

9. I'm sorry if I ask too much from you, I promise I'll be gone

    (a) Well, if I can see those choices again... (Go to 7.)

    (b) BYE (End Test)

10. You are so cool! Who you went out eating with? and how was it? (Textbox)

(a) Fabulous! You make the icon grow again! (Go to 14.)

11. You are so cool! Who you did media activity with? and how was it? (Textbox)

    (a) Fabulous! You make the media icon grow! (Go to 14.)

12. You are so cool! Who you went out relaxing with? and how was it? (Textbox)

    (a) Fabulous! You make the relax icon grow! (Go to 14.)

13. You are so cool! Who you worked out with? and how was it? (Textbox)

    (a) Fabulous! You make the exercise icon grow! (Go to 14.)

14. I'm grateful that you do all these things to me. Thank you so much!

    (a) But I'm sorry to say that this is the end of experiment now. I'll miss you and please be happy.

        i. Good bye :) (End Test)
        ii. Nooooo I wanna to talk more! (Go to 15.)

15. Thank you for loving me! Feel free to write down your feeling as the last message among us. (Textbox, End Test)

E   EyeScript.cs that control HappiHatch's eyes

```
public class EyeScript : MonoBehaviour {

    // status value for updating video to idle state
    int videoStatus = 0;
    bool isVideoFinish = false;
    const int STATUS_IDLE = 0;
    const int STATUS_AWAKE = 1;
    const int STATUS_SLEEP = 2;
    const int STATUS_SAD = 3;
    const int STATUS_SAD_IDLE = 4;
```

```
// variable declaration is not display

    // Use this for initialization
    void Start () {
    btnAwake.onClick.AddListener(awake);
    btnSleep.onClick.AddListener(sleep);
    btnIdle.onClick.AddListener(idle);

    btnOrnamentIntro.onClick.AddListener(delegate {
    speakWithNormalFace(audioOrnamentIntro); });
    btnOrnamentCanGrow.onClick.AddListener(delegate {
    speakWithNormalFace(audioOrnamentCanGrow); });
    btnOrnamentWhich.onClick.AddListener(delegate {
    speakWithNormalFace(audioOrnamentWhich); });
    btnOrnamentReselect.onClick.AddListener(delegate {
    speakWithNormalFace(audioOrnamentReselect); });

    btnAskActivity.onClick.AddListener(delegate {
    speakWithNormalFace(audioAskActivity); });
    btnAskWho.onClick.AddListener(delegate {
    speakWithNormalFace(audioAskWho); });
    btnAskHow.onClick.AddListener(delegate {
    speakWithNormalFace(audioAskHow); });
    btnAskPlease.onClick.AddListener(delegate {
    speakWithSadFace(audioAskPlease); });

    btnExpHappy.onClick.AddListener(delegate {
    speakWithLoveFace(audioExpHappy); });
    btnExpGreat.onClick.AddListener(delegate {
    speakWithLoveFace(audioExpGreat); });
    btnExpWonderful.onClick.AddListener(delegate {
    speakWithLoveFace(audioExpWonderful); });
    btnExpThank.onClick.AddListener(delegate {
    speakWithLoveFace(audioExpThank); });
    btnExpISee.onClick.AddListener(delegate {
    speakWithNormalFace(audioExpISee); });
    btnExpOhNo.onClick.AddListener(delegate {
    speakWithSadFace(audioExpOhNo); });
    btnExpSorry.onClick.AddListener(delegate {
```

```
        speakWithSadFace(audioExpSorry); });
        btnExpDontUnderstand.onClick.AddListener(delegate {
        speakWithSadFace(audioExpDontUnderstand); });
        }

        void awake()
        {
        videoStatus = STATUS_AWAKE;
        playVideo(videoAwake, false);
        playAudio(audioHi, 0.2f);
        }

    void sleep(){
        // play sound to say goodbye before animate sleep
        idle();
        playAudio(audioSleep);
        Invoke("sleepIdle", 5);
    }

    void sleepIdle(){
        videoStatus = STATUS_SLEEP;
        playVideo(videoSleep, false);
    }

    void sad(){
        Debug.Log("start sad");
        videoStatus = STATUS_SAD;
        playVideo(videoSad, false);
    }

    void love(){
        videoStatus = STATUS_IDLE;
        playVideo(videoHeart, true);
    }

    public void star(){
        videoStatus = STATUS_IDLE;
        playVideo(videoStar, true);
    }
```

```
void speakWithNormalFace(AudioClip audioClip){
    playAudio(audioClip);
    idle();
}

void speakWithSadFace(AudioClip audioClip)
{
    playAudio(audioClip);
    // don't play sad transition if it's already sad
    if (videoStatus != STATUS_SAD_IDLE) {
        sad();
    }
}

void speakWithLoveFace(AudioClip audioClip)
{
    playAudio(audioClip);
    love();
}

void speakWithStarFace(AudioClip audioClip)
{
    playAudio(audioClip);
    star();
}

public void idle(){
    videoStatus = STATUS_IDLE;
    playVideo(videoIdle, true);
}

void playAudio(AudioClip audioClip){
    playAudio(audioClip, 0f);
}

void playAudio(AudioClip audioClip, float delay)
{
    audioSrc.Stop();
```

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```
        audioSrc.clip = audioClip;
        audioSrc.PlayDelayed(delay);
    }


    void playVideo(VideoClip video, bool isLoop){
        Debug.Log("Play video " + video.name);
        eyePlayer.Stop();

        isVideoFinish = isLoop; // indicator for checkVideoOver method
        eyePlayer.isLooping = isLoop;
        eyePlayer.clip = video;
        eyePlayer.Play();
    }


    // Update is called once per frame
    void Update () {
        // only check for video over if it's not looping
        if (videoStatus != STATUS_IDLE && videoStatus != STATUS_SAD_IDLE
        && !isVideoFinish)
        {
            if (isVideoOver())
            {
                isVideoFinish = true;
                switch (videoStatus)
                {
                    case STATUS_AWAKE:
                        // awake finish, play sound and change eye to idle mode
                        Debug.Log("Finish awake");
                        idle();
                        break;
                    case STATUS_SLEEP:
                        Debug.Log("Finish sleep");
                        videoStatus = STATUS_IDLE;
                        playVideo(videoSleepIdle, true);
                        break;
                    case STATUS_SAD:
                        Debug.Log("Finish sad");
                        videoStatus = STATUS_SAD_IDLE;
```

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```
                        playVideo(videoSadIdle, true);
                        break;
                }
            }
        }
        }


    //checkOver function will use current frame and total frames of
    //video player video to determine if the video is over.
    bool isVideoOver()
    {
        long playerCurrentFrame = eyePlayer.frame;
        long playerFrameCount = System.Convert.ToInt64(
        eyePlayer.GetComponent<VideoPlayer>().frameCount);

        if (playerFrameCount != 0 && playerCurrentFrame >= playerFrameCount){
            Debug.Log("Video "+eyePlayer.clip.name+" is over");
            return true;
        }
        return false;
    }
}
```

F   BellyScript.cs that control HappiHatch's belly

```
public class BellyScript : MonoBehaviour {

    // variable declaration is not display

    void Start () {
        // assign method to each button
        for (int i = 0; i < bellyBtnNormals.Length; i++)
        {
            // cannot user i as value changed before delegate method called
            int i2 = i;
            bellyBtnNormals[i].onClick.AddListener(
            delegate { bellyNormalClick(i2); });
        }
```

```
        for (int i = 0; i < bellyBtnIntros.Length; i++) {
            int i2 = i;
            bellyBtnIntros[i].onClick.AddListener
            (delegate{bellyIntroClick(i2);});
        }

        for (int i = 0; i < bellyClipEvos.Length; i++)
        {
            int i2 = i;
            bellyBtnEvos[i].onClick.AddListener(
            delegate { bellyEvoClick(i2); });
        }
        }


// normal clip, loop animated
void bellyNormalClick(int index)
{
    Debug.Log("normal click " + index);
    playVideo(bellyClipNormals[index], true);
}


// introduction clip, animation focusing on single icon
void bellyIntroClick(int index)
{
    Debug.Log("intro click "+index);
    playVideo(bellyClipIntros[index], false);
    playAudio(bellyAudioIntros[index]);
}


// evolution clip, play animation once
void bellyEvoClick(int index)
{
    Debug.Log("evo click " + index);
    eyePlayer.GetComponent<EyeScript>().star(); // play star on the eye
    playVideo(bellyClipEvos[index], false);
    playAudio(bellyAudioEvo);
}
```

```
void playVideo(VideoClip video, bool isLoop)
{
    bellyPlayer.Stop();

    bellyPlayer.isLooping = isLoop;
    bellyPlayer.clip = video;
    bellyPlayer.Play();
}

void playAudio(AudioClip audioClip){
    audioSrc.Stop();

    audioSrc.clip = audioClip;
    audioSrc.Play();
}

    // Update is called once per frame
    void Update () {

    }
}
```

G   Button controller and result

- Awake button

  - Video: Transition from sleeping eyes to normal eyes
  - Audio: "Hi, I'm HappiHatch. How are you today?"
  - After video finished: Idle video for normal eyes

- Sleep button

  - Video: Transition from normal eyes to sleeping eyes
  - Audio: "That's the end of the experiment, I'm gonna sleep now. Bye"
  - After video finished: Idle video for sleeping eyes

- Idle button

– Video: Normal eyes, blink every second

- Intro button

  – Video: Normal eyes, blink every second

  – Audio: "Hey, look at my belly. There are a lot of icons here"

- Grow button

  – Video: Normal eyes, blink every second

  – Audio: "They can grow according to your activity"

- Which button

  – Video: Normal eyes, blink every second

  – Audio: "Which one that you're interested in?"

- Reselect button

  – Video: Normal eyes, blink every second

  – Audio: "Or maybe you can re-select the icon again"

- Activity button

  – Video: Normal eyes, blink every second

  – Audio: "Have you done any activities with your friends?"

- Who button

  – Video: Normal eyes, blink every second

  – Audio: "Did someone join you? Who are they?"

- How button

  – Video: Normal eyes, blink every second

  – Audio: "Aha...How was it?"

- Please button

  – Video: Sad eyes, blink every second

– Audio: "Anything you can think of. Please, I wanna hear that"

- Happy button

    – Video: Heart-shaped eyes, blink every second
    – Audio: "I'm so happy"

- Great button

    – Video: Heart-shaped eyes, blink every second
    – Audio: "That's great!"

- Wonderful button

    – Video: Heart-shaped eyes, blink every second
    – Audio: "That's so wonderful!"

- Thank button

    – Video: Heart-shaped eyes, blink every second
    – Audio: "Thank you!"

- I see button

    – Video: Normal eyes, blink every second
    – Audio: "Mhmm, I see."

- Oh no button

    – Video: Sad eyes, blink every second
    – Audio: "Oh no"

- Sorry button

    – Video: Sad eyes, blink every second
    – Audio: "I'm sorry"

- Don't understand button

    – Video: Sad eyes, blink every second

- – Audio: "I don't understand"

- Intro 1 button

    - – Video: focus and zoom to the cupcake ornament

    - – Audio: "The cupcake is food icon, it grows when you eat out or cook with someone"

- Intro 2 button

    - – Video: focus and zoom to the music note ornament

    - – Audio: "Music note is media activity, it grows when you watch something or play something with someone"

- Intro 3 button

    - – Video: focus and zoom to the leaf ornament

    - – Audio: "The Leaf is relax activity, it grows when you go shopping or chilling with someone"

- Intro 4 button

    - – Video: focus and zoom to the badminton ornament

    - – Audio: "Badminton is sport activity, it grows when you exercise with someone"

- Evo 1 button

    - – Video: cupcake ornament turn into coffee cup ornament

    - – Video: Star-shaped eye, blink every second

    - – Audio: "And the icon is level up!"

- Evo 2 button

    - – Video: music note ornament turn into headset ornament

    - – Video: Star-shaped eye, blink every second

    - – Audio: "And the icon is level up!"

- Evo 3 button

- Video: leaf ornament turn into lotus ornament

- Video: Star-shaped eye, blink every second

- Audio: "And the icon is level up!"

- Evo 4 button

  - Video: badminton ornament turn into dumbbell ornament

  - Video: Star-shaped eye, blink every second

  - Audio: "And the icon is level up!"

- Idle 0 button

  - Video: floating ornaments: cupcake, music note, leaf, badminton

- Idle 1 button

  - Video: floating ornaments: coffee cup, music note, leaf, badminton

- Idle 2 button

  - Video: floating ornaments: cupcake, headset, leaf, badminton

- Idle 3 button

  - Video: floating ornaments: cupcake, music note, lotus, badminton

- Idle 4 button

  - Video: floating ornaments: cupcake, music note, leaf, dumbbell