Social Robots - Group 01

02266 User Experience Engineering

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1 INTRODUCTION(ALL)

Stress in children is an increasingly growing problem. Regardless of what adults may think, a child's life can be quite stressful due to various factors, including test anxiety [9], problems with friends, bullying, body changes and family issues [6]. According to the American Psychological Association, about 20% of children report worrying a great deal, a figure that is highly underestimated by the parents. These worrying findings highlight the need for action to tackle stress and anxiety in children, since chronic stress can lead to a number of psychological and physical issues[3]. A review of 22 relevant studies found strong indications that pet ownership may be beneficial to child and adolescent emotional, cognitive, behavioural, educational and social development. Dogs seem to be the most beneficial and studied of all, perhaps due to a higher level of interaction and reciprocation in comparison to other pets [10]. However, there are many nuisances involved in having a pet, like the responsibility of caring for it and the possible existence of allergies, something that may prevent parents from getting their child one. Dophy, the talking dog robot, was developed with these in mind.

2 EXISTING WORKS(ALL)

Existing robot pets range from attempts to closely mimic the movements and reactions of real pets to pets that have the potential to become personal assistants.

Aibo is a robot dog developed by SONY that simulates the behaviour of a real dog and can be programmed through a web-based API to assist with various tasks around the house, this way contributing to the transformation of a person's house to a smart house. Aibo incorporates much of the responsibility involved in raising a dog, since it needs training and patience to learn new tricks [7]. This can add to its realistic feeling but it can also prove to be a disadvantage for parents wanting to buy it for their children.

Probably the closest to a product developed for promoting mental well-being of a specific target group are **Joy For All** and **Paro**.

Aimed at elderly people, **Joy For All** is a robotic cat that bares a close resemblance to a real one. Its soft fur can give the feeling of petting a real long-haired cat. Sensors built into it respond to motion and touch. Its purring technology imitates the sound and feel of real purring [4].

Similar in its concept and target group, **Paro**, a robotic seal, is a more scientifically supported and studied product. Although it was also originally aimed at elderly people, particularly to people with dementia, it has also been used successfully in various care facilities and for different disorders, such as Autism Spectrum Disorder.[1] Possessing similar features to Joy For All, its design includes a soft fur and sensors that allow it to feel being stroked, this way providing a proven calming effect to residents of nursing homes and healthcare facilities.[2]

Both those last two solutions' drawback is their lack of a meaningful interaction that will imitate a human one, by addressing complex human societal issues.

3 SCOPE(ALL)

Even before the advancements in modern technology, we had a robotic dogs without an artificial intelligence as a children toys. They were simply used to entertain kids, but nowadays with the help of advancements in the modern technology, these simple robotic dogs could even be used to replace our dog friends. By providing artificial intelligence with the help of proper expert consultancy, robotic dogs could also be used as therapy dogs. Research has shown therapy dogs can reduce stress and provide a sense of connection in difficult situations [8].

There is already a lot of research going on in the field of artificial intelligence for pets. Various applications and robots have been developed to replicate pet animals. According to these studies, more and more people are using robots for companionship and therapy [5]. Most of these therapy technologies focus on elderly people and just developed to touch and pet them. In our solution, we will be targeting to develop a speaking, friendly and calming dog for children.

Our **solution** comprises of two main parts which are physical part of robotic dog and artificial intelligence of the dog. The robotic dog will help child to reduce anxiety and stress by scanning the face of the child and listening to child's problems.Then, it will execute some actions according to emotional state of the child. Physical side of the dog should be cuddly and fluffy so that whenever child pets or touches the dog, it should calm the child down. Artificial intelligence side of the dog should be used to evaluate child's emotional state and also should be able to execute some certain actions such as singing a song, telling a story. In order to receive and understand the command of child, technologies such as, voice recognition, voice intonation recognition could be used. Also, for face scanning, image analysis can be utilised.

Our final **customer segment** is the parents of the children with anxiety and stress problems. Customer segment has continuously been refined throughout the iterations by the help of validations. Our **unique value proposition** has also been subjected to change throughout the iterations.

From the project beginning of the project, using quantitative data has been equally rewarding as using quantitative data. Interviews, cognitive walk-through, thinking aloud tests and live reviewing during pitching acted as a catalyst for discussions on how exactly the user perceived the solution and how it would solve their needs. It was thus in a very early stage decided to not focus on a full therapy on children with social disorder as a solution, where the child is being monitored in the home, because parents opt out on this option. Instead, focus has been changed to reduce anxiety and stress on these troubled kids.

4 ITERATIONS

4.1 First iteration(Altug)

What: During the the first iteration, we defined our problem as: psychologists having hard time when trying to therapize the children with social disorders. It was a problem because children with social disorders might not want to talk about their problems to another grown-up(psychologist). We aimed to monitor children with the help of robotic dog during their treatment process, and children would be monitored through this dog from psychologist. Landing page designed to have a monitoring therapy dog.
How: In order to validate our idea, we have used feed-backs we got from workshop session. We have applied qualitative a-b testing to our applicants with various questions. In addition to that, we gave applicants a list of interface elements(icons) and asked them to build an interface using icons(sketching). Then, since applicants familiarized with our system, we asked them to verbalize their opinions(thinking-out loud method).
Outcome: Regarding our monitoring therapy dog idea, the users(all-grown ups) think it is creepy to be monitored by a psychologist through a robotic dog. Even though dog was aimed to be interacting with children, our customer segment would be parents of the children(grown-ups). Therefore, we had to scrape the idea of monitoring dog. Instead, we decided to have a toy-like dog just as a friend to children and landing page changed accordingly.

Figure 1: Change in Landing Page

4.2 Second iteration (Clair)

What: A changed problem and solution should be validated. Since we have changed our robot-dog as a toy and dog will interact with children as a friend, we have to find out what kind of interactions we would like to have between such dog and child.
How: In order to validate our robot-dog friend idea, we conduct a survey on kids and their parents. In this survey, we directed both quantitative and qualitative a-b questions to them(Which kind of dog preferable for kids? Fluffy, real looking or robotic looking? etc.).In addition to this survey, we also reached out to dog-owners from our acquaintances, and directed them some questions(interview-like) about what kind of interactions they have with their real dogs.
Outcome: Regarding kids' preferences about dog appearance, most of them stated that they would like to have fluffy, real looking dog. Also, children described the idea of speaking dogs as funny and cute. As a result of interviews with dog-owners, we have found out 4 most common interactions. Cuddling, snuggling, talking with dog and petting the dog are the main interactions that is between dog and owner.

4.3 Third iteration(Olga)

What: In this iteration, we have to validate our customer segment and need to validate market to make sure that our product is perceived as usable by users. Our customer segment is suspicious because we decided to aim all children and it seems way too large segment.
How: In order to validate our customer segment, we have made discussions with Per and TA and tried to maximize their feedback as much as possible by directing some questions(Likes, Questions, Criticisms, Ideas). For validating our market, we have made online research and find out similar type of projects. In addition to similar type of projects, we also made some research on psychological aspects of the robotic-dogs.
Outcome: After this iteration, we returned back to kind of therapy dog idea as a result of professor's and TA's feedback with research results. Professor and TA said that our customer segment too broad. We narrowed it down to kids with social disorders but not as a whole treatment just to help them out a little bit(reducing anxiety and relieving stress). Hence, target group has changed from all children to children with anxiety. For market validation, we have found plenty of papers and articles that is similar to our project [2], [7].Also, we have found some studies that is showing robotic-pet's can be used to reduce stress and anxiety for children [5], [8], [4]. Therefore, market has been validated by the help of these aforementioned papers.

4.4 Fourth iteration(Sukru)

What: In this iteration, we need to validate that our prototype is a Minimum Viable Product(MVP). We have to decide about what functionalities are most essential ones, and check if they are matching perfectly with our solution defined in Lean Canvas. Also, we have to check if our functionalities in MVP matches with our User Story Map(USM).
How: In order to validate if our prototype is indeed MVP, we have made discussion with Per(professor) and we tried simulate user behavior(cognitive walk-through). We explained to Per how our robo-dog works and how it interacts with people(children), and made him verbalize his opinion on last version of our robo-dog prototype(thinking-out loud). We also used wizard of oz technique in this iteration, because we have tried to mimic our prototype with

a bear doll and make it speak by using our voice.
Outcome: According to feedback we got from professor and our user simulations, MVP should not need to be a walking dog. We have eliminated walking functionality of our prototype. MVP has been minimized to must functionalities which are scanning face, understanding the mood, and executing certain tasks such as telling a story, singing a song cuddling etc.

4.5 Possible future iteration - Future work(Tala)

What: As a future study(or iteration), it can be investigated to check if this robo-dog can be used for anxious children's complete therapy with expert psychologist consultancy. From first iteration, we have already concluded that people do not want to be monitored in their house by someone, even for treatment purposes. Yet, by customizing our robo-dog to every patient(child) with some pre-defined actions for child's behaviour, dog can be used as a treatment solution. Hence, this can be investigated further.
How: In order to validate this possible iteration, comprehensive study should be carried out with a real psychologist. Child with anxiety problems should be observed and results should be evaluated by multiple experts.
Possible Outcome: If results show it is possible use Dophy dog in child's treatment, market validation should be conducted to see if this product can provide turnover for investors. If results show treatment is not possible, leave Dophy as a anxiety reducing friend for children.

5 DISCUSSION/CONCLUSION(ALL)

The building of our idea started by identifying the central problem. We wanted to help children with anxiety, nervousness, stress, etc. This dog will be able to help the child to calm down and make the child want to do more, cause the dog will always be around. By evaluating the product on dog owners and children, we came to the conclusion that having a full on conversation between Dophy and the child would be weird. Therefore, we decided that the dog should be able to respond in different ways e.g. sing a song, ask how the child's day has been, tell a joke or story. This would have a more convenient effect on the child rather than Dophy being monitored by a psychologist. Through validation, we also came to the conclusion that the dog should have full-body sensors to respond to sound and touch and some kind of computing eyes. The computing eyes on Dophy will give a more real and intimate relationship with the child. So, the dog can look the owner in the eyes and also respond by blinking, squeezing, closing the eyes etc. look at figure 2.

Figure 2: Example of dog's facial expression

We omitted evaluating on children with social anxiety. If we had more time we would do that and get a better understanding on how children with social disorder would act, when having a robot dog. We would put the child in different scenarios with the dog, and see how the child acts. Interviewing a psychologist would also be an option, to get a understanding on what methods they use on children with social anxiety and see if we might be able to make Dophy use the methods on the child.

After testing and validating Dophy on children with needs, we came to the conclusion that the purpose of the idea is relevant, because social anxiety is a growing problem. Dophy is reducing the problem by comforting children with needs and is able to be there for the child in social environments.

6 CONTRIBUTION

The authors of this document have equally contributed to the making of the project with wide-variety of discussions, presentations,creation and validation of artifacts.

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A LANDING PAGE

Figure 3: Landing Page of Dophy

B LEAN BUSINESS MODEL CANVAS

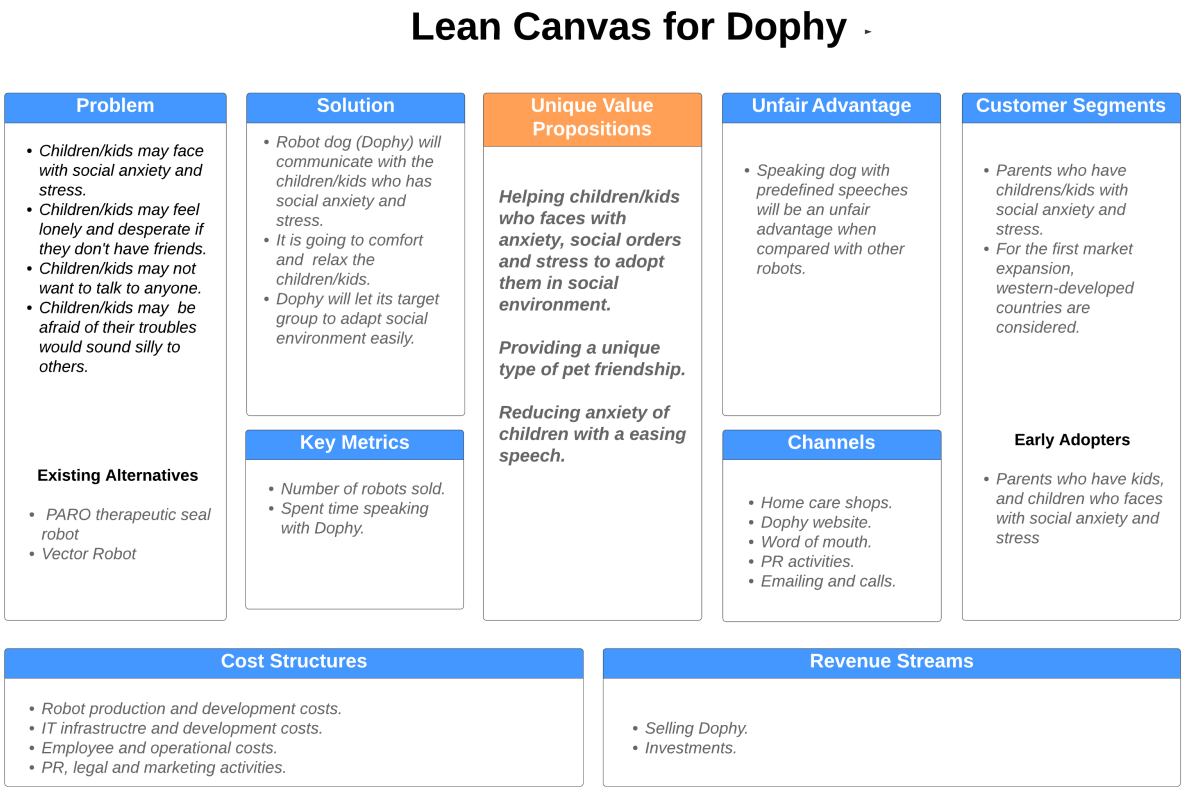

Figure 4: Lean Canvas of Dophy

C WIREFRAMES

Figure 5: Wireframes

D PROTOTYPE

(1) Confidence Support
https://www.youtube.com/watch?v=BPHYMfnr228

(2) Cheering Up Mode
https://www.youtube.com/watch?v=BlbQ6V0klmg

(3) Affirmation Mode
https://www.youtube.com/watch?v=0YTymFsTERw

E USER STORY MAP

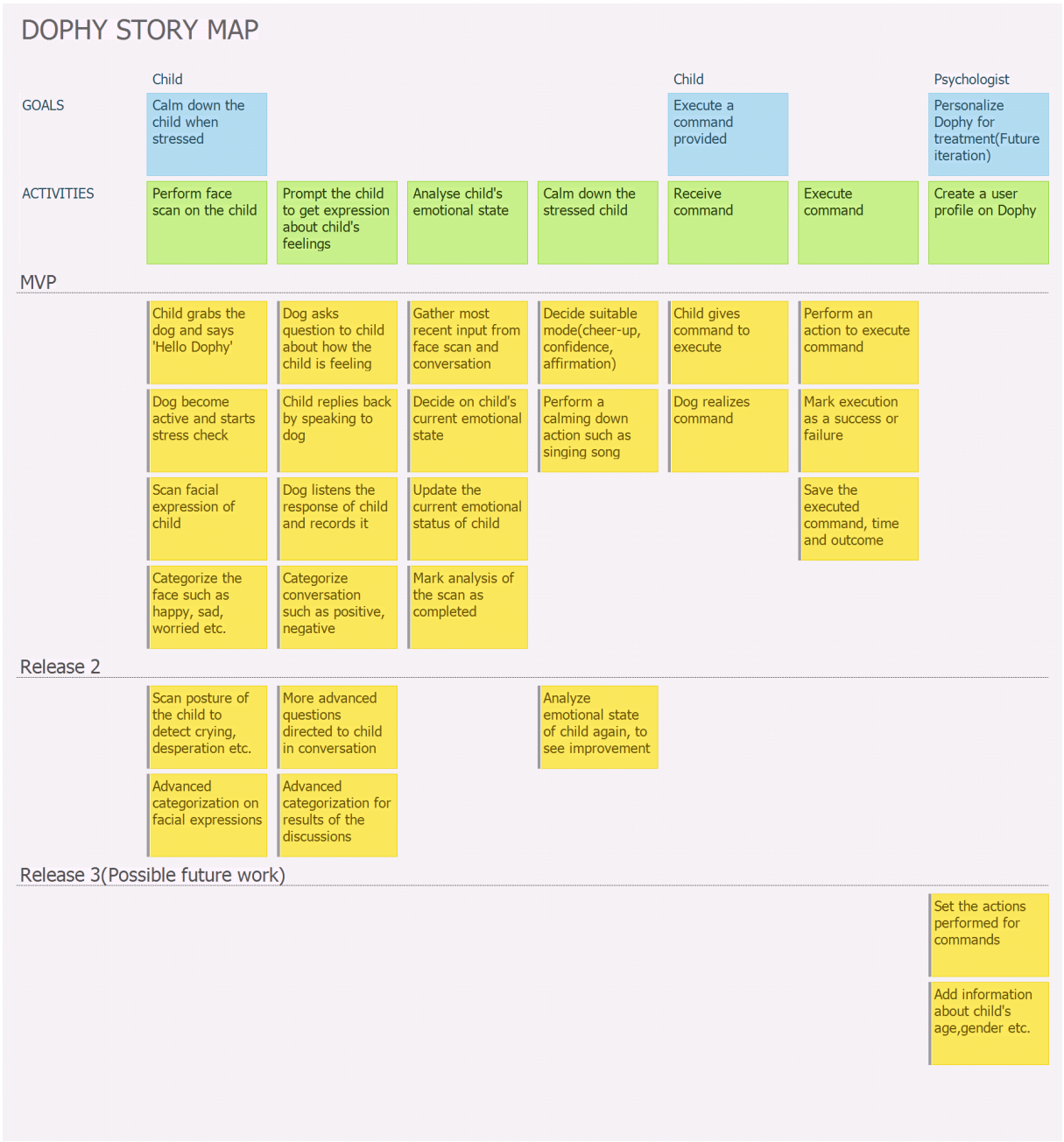

Figure 6: User Story Map of Dophy

F VALIDATION

In order to validate our system, we will be using cognitive walk-through method, that is, we are going to simulate user behaviour as experts of the system. In addition to cognitive walk-through, we will make use of the thinking out loud technique. We have used Qualitative A-B testing in order to compare our prototypes to obtain qualitative feedback. Wizard of Oz method is used to mimic the robot dog's voice. Our main goal for the testing is to evaluate some performance measures with the satisfaction measures. As it is specified previously in lean canvas, our preliminary market segment is Western-developed countries. In these countries, our customer segment is the parents who have kids with social anxiety and stress. Since we couldn't test our prototype to the parents who have kids with social anxiety and stress, we

have tested just normal kids. Throughout all the validation parts, it is important to note that our testing and validation system is **Proxy Validation**.

There are different validation techniques that are conducted. Online survey is conducted via the google forms with 20 participants. Workshop with course participants is conducted. Interviews with dog-owner, lecturer and TA are conducted as well. Participants in the google form are relatives of group members mainly. For the children who are between the ages of six and ten, parents had the roles of observing and explaining the questions. Link for the google form is as follows; For the online survey technique, 84% of the participants are between the ages of 6 and 14. Therefore most of the results are representing our market segment when we consider our proxy validation situation as well. Link for the survey is as follows;

https://forms.gle/6mQNGqn4fYmizfxe9

A workshop was carried out with 3 participants in order to get some feedback and ideas regarding our solution and prototype design. The participants were given a number of questions on several aspects of the product. The questions and answers are given later in the Appendix. Throughout the workshop study, **"Qualitative A-B Testing"** and **"Thinking Out Loud"** methods are used.

F.1 VALIDATION FOR PROBLEM AND MARKET SEGMENT:

For the problem and market segment validation part, first we have searched for the idea speaking with a dog. Problem and market segment validation is done mainly via research papers.

Used Technique: Interview and Feedback from the Lecturer and TA

- **Hypothesis:** Dophy should address to all children who wants to purchase Dophy as a toy.
- **Result:** According to feedbacks from lecturer and TA, Dophy should address for the special kids who has social anxiety and stress.
- **Next step:** Market segment is narrowed down to help children/kids between the ages of 5 and 15 who has social anxiety and stress.

Used Technique: Workshop

Third question in the workshop questionnaire;

- **Hypothesis:** People would get Dophy to calm them down.
- **Result:** All of the people gave reasons for getting a robot dog that suggest they would get it as a substitute for a real dog if for some reason they couldn't get a real one.
- **Next step:** A robot dog should resemble a real dog as much as possible without the negative aspects of it that would drive people to not get a real one in the first place.

Fourth question in the workshop questionnaire;

- **Hypothesis:** Adults will find it weird and disturbing to speak to a robot dog, while children's vivid imagination will allow them to enjoy this instead.
- **Result:** Only one person referred to children only as a potential target group. The rest of them generalized to adults too.
- **Next step:** The sample is small to be able to get a conclusive result but it seems that there will be no problem for Dophy to be used by adults too.

Sixth question in the workshop questionnaire;

- **Hypothesis:** Instead of helping children overcome their social anxiety, it could make them more introverted.
- **Result:** Fears exist regarding this but one person answered that it would be a great conversation starter.
- **Next step:** Apart from comforting children, it should encourage them to have social interactions too.

F.2 VALIDATION FOR PROTOTYPE AND INTERACTION:

Used Technique: Online Survey (Attitude and Quantitative)

Questions and results are as follows;

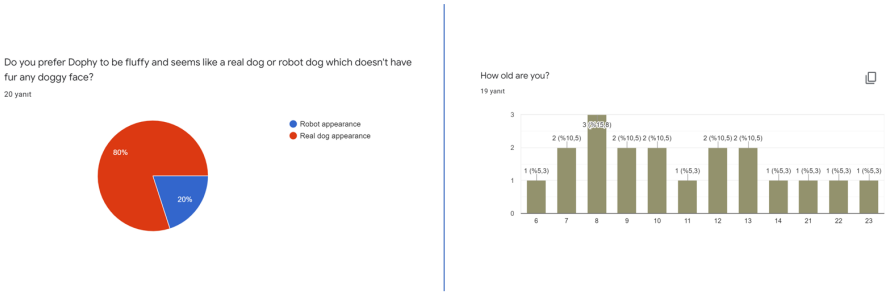

Figure 7: Questions for age distribution and appearance

First and Second Question in the survey;

- **Hypothesis:** Rather than robot appearance, real dog appearance would be a better choice for our market segment.
- **Result:** 80% of the participants agreed with the idea of real dog appearance.
- **Next step:** Robot dog appearance will be like a real doggy appearance.

84% of the participants are between the ages of 6 and 14. Therefore most of the results are representing our market segments.

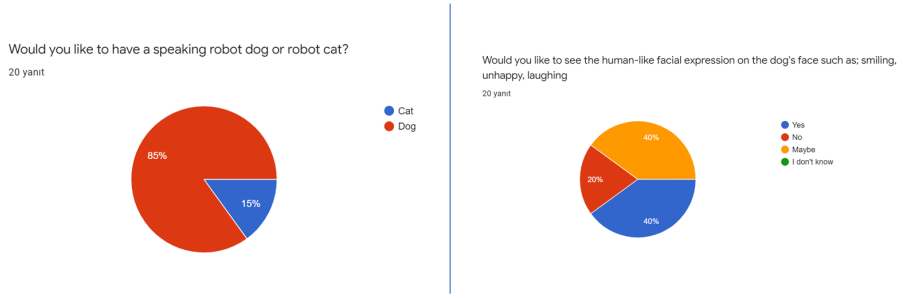

Figure 8: Questions for robot figure and facial expression

Third Question in the survey;

- **Hypothesis:** Children would prefer dog over cat.
- **Result:** 85% of the participants prefer robot dog over robot cat.
- **Next step:** Robot dog will be our prototype.

Fourth Question in the survey;

- **Hypothesis:** Children would prefer robot dog to have human-like facial expression.
- **Result:** Even if the 40% of the participants are in doubt saying "Maybe" but 20% of the participants says "No" to this idea. That means children prefer human-like facial expression.
- **Next step:** Prototype will have human-like expressions such as smiling. When we consider he fact that, robot dog is going to speak, it is not much a surprising act.

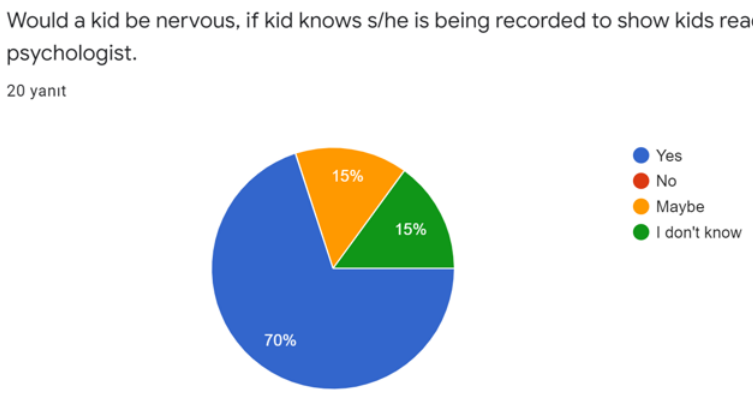

Figure 9: Nervousness of kids

Ninth Question in the survey;

- **Hypothesis:** Kids would be bothered if they would know that they would be watched from the dogs.
- **Result:** Kids and especially parents and any other people living in the same house found this idea a way to increase kids' nervous level instead of decreasing it.
- **Next step:** There won't be any recording system

Used Technique: Workshop

In addition to the workshop questionnaire, we asked the participants to write down a few dialogues that they would imagine being held between Dophy and a child. The results from this can be found later in the Appendix.

First and Second Questions in the workshop questionnaire;

- **Hypothesis:** People's expectations of Dophy would be to give them extra comforting in addition to what real dogs can give them.
- **Result:** People expressed a few different ideas but there was a consensus on that they should be able to cuddle it. Two of the answers focused on the human-language communication aspect too.
- **Next step:** Features will include a dog behaviour along with more functionality.

Seventh Question in the survey;

- **Hypothesis:** Children would prefer dog over cat.
- **Result:** Respondents weren't sure and one of them answered they would prefer the dog.
- **Next step:** Combined with the answers we got from the online survey, robot dog will be our prototype.

Eigth and Tenth Questions in the survey;

- **Hypothesis:** Rather than robot appearance, a real dog appearance with a soft, cuddly fur would be a better choice for our market segment.
- **Result:** The participants agreed on that it shouldn't look like a robot but we got mixed answers on whether it should look like a real or a toy dog, so our result was inconclusive.
- **Next step:** Combined with the answers we got from the online survey, it will have the appearance of a real dog.

Ninth Question in the survey;

- **Hypothesis:** It could be confusing for children to hear a real-looking dog speak, since real dogs don't.
- **Result:** We got an answer that it would depend on the child's age and another one that it would be at first.
- **Next step:** Target this at a certain age group in which children are able to understand the difference between a real dog and a toy/robot one.

Ninth Question in the survey;

- **Hypothesis:** Adding human expressions to a real dog face would be disturbing.
- **Result:** Two out of three people strongly believed the dog should have human-like expressions.
- **Next step:** We will add human-like expressions to the robot dog.

Used Technique: Interview

- **Hypothesis:** Interactions like cuddling and talking are wanted by the users.
- **Result:** These kind of interactions are some of the wanted close relations which would relax the users.

- **Next step:** Interactions are going to be supported by the fluffy fur and real dog appearance.
  Interview Speech (Summary);
  Interviewer (SHS): As you have mentioned before, you have pet right?
  Adrian Atienza: Yes, I have a dog named as "eda".
  Interviewer (SHS): What do you love most while playing or spending time with eda?
  Adrian Atienza: I talk to my dog and spend time with playing games. I love cuddling and snuggling with him. Sometimes we do wresting. And it is so relaxing to pet eda.
  Interviewer (SHS): If you would have a robot dog, would you like to do these kind of interactions as well?
  Adrian Atienza: Yes, of course.
  Interviewer (SHS): Thanks for you time.

Used Technique: Feedback from lecturer and Thinking out loud techniques is used with lecturer.

- **Hypothesis:** Our minimum viable product can't be simplified more to match with our goals.
- **Result:** There exists some redundant functionalities.
- **Next step:** Detect these redundant functionalities.

Used Technique: Cognitive walk-through and Wizard of Oz techniques are used to detect redundant functionalities.

- **Hypothesis:** Dophy doesn't need to have functionality of walking in order to achieve the main goals.
- **Result:** Walking function doesn't provide anything towards our goal
- **Next step:** Dophy doesn't need to be a walking dog. This function is eliminated. MVP is simplified.

F.3 VALIDATION FOR CONCEPT:

Used Technique: Online Survey (Attitude Quantitative)

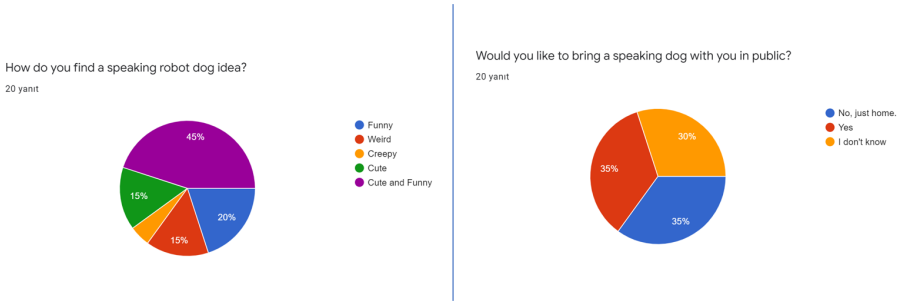

Figure 10: Questions for speaking dog idea and usage in public or home.

Fifth Question in the survey;

- **Hypothesis:** Speaking robot dog idea might be met as a weird product for the users.
- **Result:** Nearly, 80% of the participants finds speaking idea "Funny", "Cute" or both.
- **Next step:** There isn't any disadvantage in the idea speaking robot dog.

Sixth Question in the survey;

- **Hypothesis:** Usage area of the Dophy should be home.
- **Result:** 30% of the participants are hesitant to bring into public. 35% of the participants considers to use them only in home. Rest of the participants agrees to bring Dophy in public. There isn't an consensus.
- **Next step:** Since there isn't a consensus, this validation is inconclusive. For that reason, for the other steps, to narrow down our idea, we have just focused to idea of "kid is speaking with Dophy at home." But kid of course transport Dophy wherever kid wants.

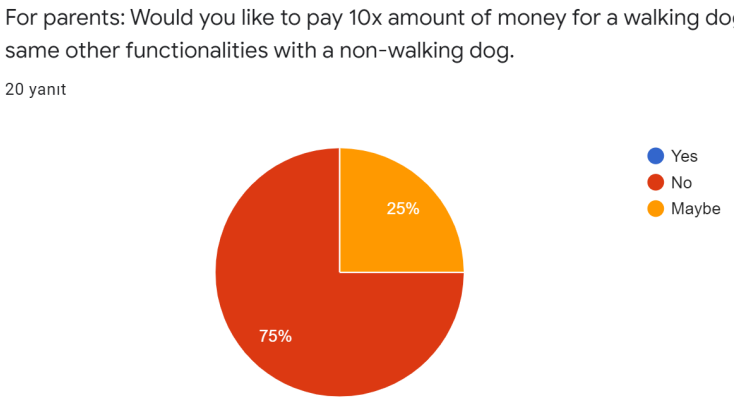

Figure 11: Parents preference

- **Hypothesis:** Parents who are our actual market segment would want to pay greater amount of money for robot to move.
- **Result:** 75% of the participants disagrees that they wouldn't pay greater amount of money for a walking dog.
- **Next step:** Since the robot's main functionality doesn't change, minimum viable product will be a non-m walking dog.

Used Technique: Workshop

Fifth Question in the workshop questionnaire;

- **Hypothesis:** Users would want to keep it at home.
- **Result:** Two out of three people responded that they would want to be able to take it everywhere.
- **Next step:** Functionality that would allow it to be discreet when among strangers should be added (e.g. mute).

F.4 Workshop Questionnaire

Questions :

1) What are your expectations from this therapy dog?
2) What kind of comfort you expect?
3) What would be your motivation to purchase therapy dog?
4) What could be t he market segment? Do you think adults would like to speak to this therapy dog?
5) Where should you bring Dophy? Do you think Dophy should just be located at psychological centers?
6) Is Dophy going to lead people to be more introvert and non-social person?
7) Do you think there should be a cat version of Dophy?
8) What should be the shape of dog? – A puffy, cute one or more or like a robot dog
9) Would it be confusing for children or kids to play with talking dogs since the real ones don't talk
10) Which one do you prefer? Dog face with robot body or robot face phone screen with dog body?
11) Do you want to see expressions on the dog's face?

Answers :

Participant 1 :

1) Someone to speak to.
2) Fluffy, listens, cuddle.
3) Loneliness, allergy.
4) Lonely children.
5) At home.
6) If it speaks too much? Real dogs don't.
7) Perhaps.
8) Should be fluffy, not too much robot.
9) At first yes.
10) Dog face.
11) Yes. Very much.

Participant 2 :

1) It should not be controlled by a therapist or any other human. Super creepy.
2) That of a dog. Increased levels of oxytocin (eye contact and cuddles).
3) Allergies.
4) Dog lovers with allergies.
5) Everywhere.
6) No - vice versa? Conversation starter. 7) Depends on their "personality".
8) Should look like a "toy dog", should be cuddly!
9) Not if they look like a toy.
10) It should look like a toy - a fluffy one -, not like a robot. So yes, it should have a face.
11) Yes. Otherwise you lose the therapeutic aspect.

Participant 3 :

1) Ask therapeutic questions, showing interest. That it is soft and cuddly, to make me want to hug it.
2) "Hugs", listening, therapeutic questions.
3) If my child was in need of a pet but for some reason couldn't get a real dog.
4) Customers: Parents, elderly homes, kindergartens. I think adults would speak to it.
5) Ideally everywhere.
6) Hopefully not. But it's a danger worth considering.
7) Sure, but I would prefer the dog.
8) A puffy, cute one.
9) Depends on the age of the kid I think.
10) Either or. Not a mix.
11) Not human expressions, I think that would be weird. If they look like "dog expressions" it's fine.

Workshop Interactions

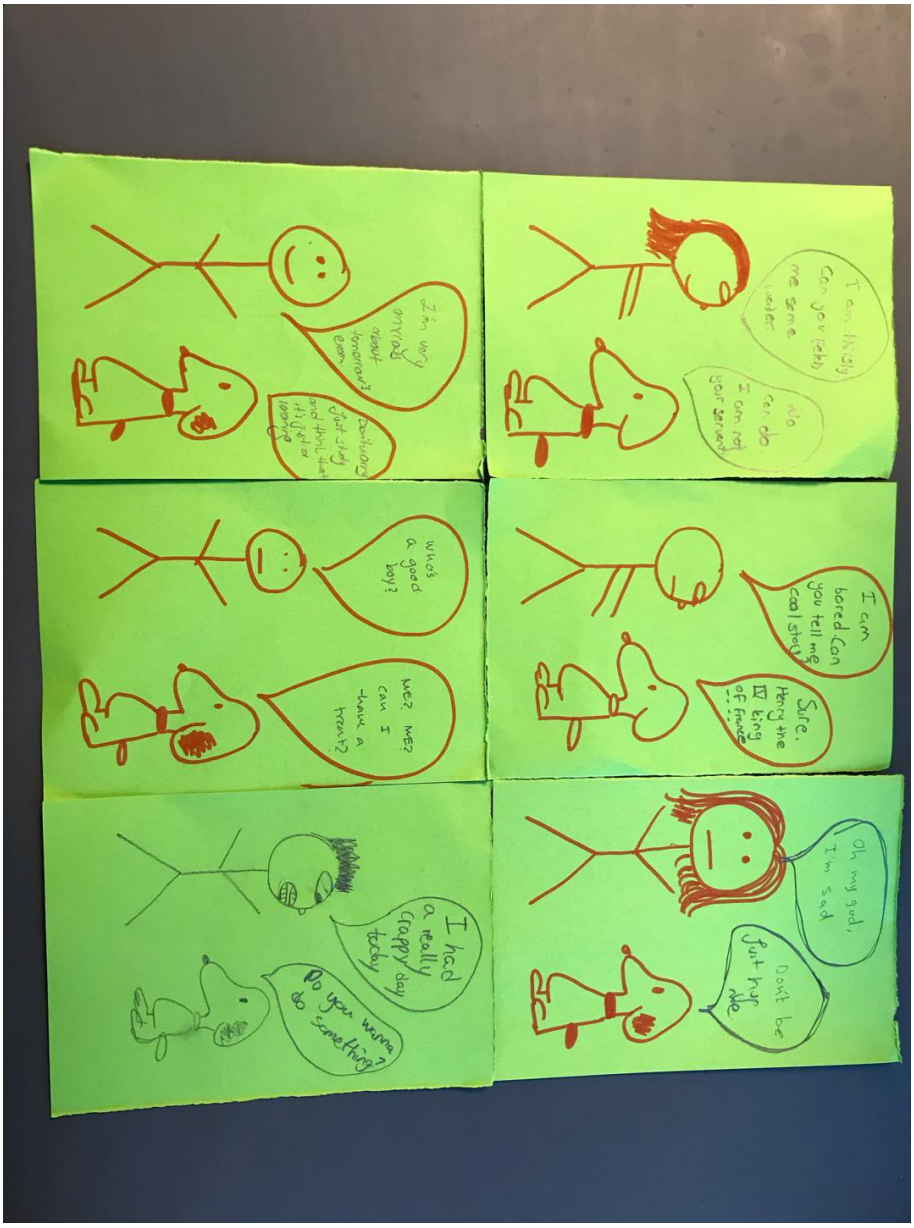

Figure 12: Possible dialogues written by the workshop participants