

SUNDACHE

POLOGUE

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01. SUMMARY

This report details the work of the final bachelor project of Xiaoying Chen in 2017. I developed “Sundache”, an emotion visualisation tool for the family under quarrel situation, under the squad of Interactive Lighting.

The aim of this project is to research and find a possible way to smooth the communication and reduce quarrelling between family members via lighting visualisation of emotion in the home environment. Based on the results, it provides a research on the relationship of the bonding and communication between family members, as well as some new insights and the possibility of emotion visualisation.

Within this report, you may find an extensive description of “Sundache”, description and analysis of the current problems, the design process and future development (recommendations). The structure of this report is based on the chronological order of the design process. Throughout this report, I will show and justify my process and decisions that had been made throughout the semester.

02. PROLOGUE: Project Motivation

After studying oversea for several years, I experienced the importance of the family more and more. Family is always the harbour for you to rest, and our family members are the only ones in the world will embrace us with unconditional love. However, this love is often suffering from different “disasters”. The warm chit-chat after dinner with our family members are replaced by digital products. The respect we give to our family is sometimes even less than that we give to a stranger. We show thankful to a stranger for getting a cup of water for us but we seldom appreciate all things our family do for us. Technologies made the world smaller, but is the distance between our hearts estranging soundlessly? Technologies have developed so quickly to satisfy different physical needs for human beings, and more people start to pursue spiritual and emotional needs. One of my vision is to bring families and friends back together and closer (family re-bonding). Furthermore, I found people lives too quickly these days, we have little time to stay quiet and think for a while. Life is

full of chaos, we paid too much attentions on the chores but lose our sights of the real important things. However, life is too short, we have to cherish it and live in the moment. So holding with these two visions, I have a broad concept of my final bachelor project. I want to design something to trigger the self-thinking of people and help them to get awareness on appreciating things in life especially in a family context.

My first choice of the squad is Seamless Interaction Design for Everyday Life since I find it suits my vision the most. Although the squad of Interactive Lighting is my second choice, I still found a way to integrate my vision on the project and I even got unexpected insights in this squad. Since this squad is very focused on the user’s perspective, it helped me to continuously remind myself to stand on a user’s perspective. Besides, this squad provides me with a lot of knowledge on the lighting in a home environment which can be useful to my design.

03. INTRODUCTION

3.1. Project Goal

The interactive lighting system has been developed rapidly these years. The basic function of lighting cannot satisfy us anymore, people starts to think more about the various possibility of lighting. One of the main areas of lighting is the home environment, different personalised lighting systems can be used by the normal consumers and various designs are not only about lighting but also connect everything at home to create a smart environment for users.

A home becomes unique by the people who live in it. We all want to have a happily-ever-after life, but the reality is full of challenges and barriers. One of the huge barriers in a family is the quarrels. Sometimes arguments are helpful to solve a problem, but most family conflicts are caused by trivial things. There is always no need to have a serious argument or even a fight to

solve the problems but people react under their impulse. Some bad words being said during the irrational argument may hurt our beloved ones unintentionally, especially when it occurs between a parent in front of their child(ren).

The importance of a good family relationship has been shown from many research. Children's minds and behavioural characteristics are not only determined by the genes but also by the way they are treated by their parents. [1] Frequent quarrelling between family members may cause psychological problems in the growing children. Since the children are easily influenced by the behaviour of their parents, there is a great chance that they will act the same in front of their children, which will cause a bad circle.

I have read a lot of papers and news talking about domestic violence, the effects on children are non-reversible, some of them may suffering depression afterwards. [2,3] Studies show that 3 – 4 million children ages of 3-17 are at risk of exposure to domestic violence each year. Witnessing can mean **SEEING** actual incidents of physical abuse, or **HEARING** threats or fighting noises from another room. Children may also **OBSERVE** the aftermath of physical abuse such as blood, tears, torn clothing, and broken items. Finally, children may be **AWARE** of the tension in the home. [4,5,6] Verbal violence seems to count for little compared to physical abuse, but this happens most commonly among the families and we most easily ignore it. This is as serious as other domestic violence.

Therefore, I carried out this project to gain a deeper insight of the current communication situation among a family. I want to find a way to let the people who are quarrelling aware of the serious

bad situation, and try to calm down and think for a while of the consequences of it. Quarrelling may seem to be insignificant, but it needs the attention from the people who are quarrelling, starting to think whether they are hurting others' feelings, especially their children. Otherwise, it will only make the situation worse rather than solving the problems. [7]

Therefore, I carried out this project to gain a deeper insight of the current communication situation among a family. I want to find a way to let the people who are quarrelling aware of the serious bad situation, and try to calm down and think for a while of the consequences of it. Quarrelling may seem to be insignificant, but it needs the attention from the people who are quarrelling, starting to think whether they are hurting others' feelings, especially their children. Otherwise, it will only make the situation worse rather than solving the problems.




3.2. Concept Description: Sundache

Family is always the harbour for us to rest, but this harbour often experiences different types of thunderstorms which will break the harbour at the end. One of the common storms is quarrelling. Parents often arguing about trivial things, hurting each other's feelings and feel so bad afterwards. Quarrelling is always not their intention, but sometimes people just can hardly control their emotions.

When I was still a child, I felt so scared when my parents start quarrelling, all I could do is to run into my room and hold my teddy bear tightly. However, I want to give the children like my young self an opportunity to express their fear and interfere the quarrelling between their parents.

Sundache is a wall lamp to visualise emotions for a family. It is in a shape of the sun, which represents the family, shine for us and support us. Rays of light shine out with great brilliancy when the bonding in the family is close and strong. However, when quarrelling happens, the rays will lose their brightness little by little and the light will blink unstably. Meanwhile, when the child run into his room and hold his teddy bear tightly, the light will know. A crack will slowly grow onto the wall from the lamp indicating that the quarrelling is hurting this family silently. It's just like a wound which will form inside other's heart when you quarrel with each other. More cracks will grow if the quarrelling doesn't stop, and the more cracks grow, the longer time it takes for the light to turn back to the original bright state. Just like the wound in people's mind, the deeper the wound is, the longer time it takes to recover. Sundache is to remind and warn the parents when they want to quarrel, they are creating cracks in their children's hearts unconsciously.



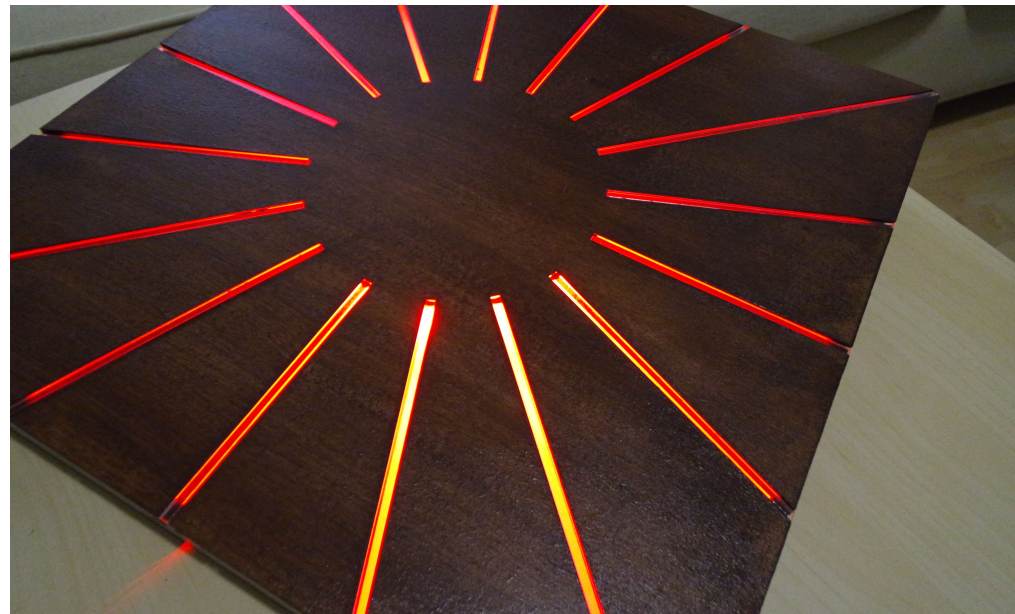
3.2.1. Meaning of the Name

Sundache is a combination of Sunday and ache. In my view, Sunday is the day that family should spend together, so I choose “Sunday” to represent the time the family spent together. However, quarrelling is like a small illness to the family, so I choose “ache” to represents quarrelling. An ache seems to be a little pain at first, but it may develop into a big issue if you don’t receive timely treatment. Just like the serious arguments between parents in front of their children. It seems no big deal at first, but a tiny bad seed will grow in the children’s minds. So these two elements combined to “Sundache”, which represents the quarrelling in a family.

3.2.2. Detail Operation

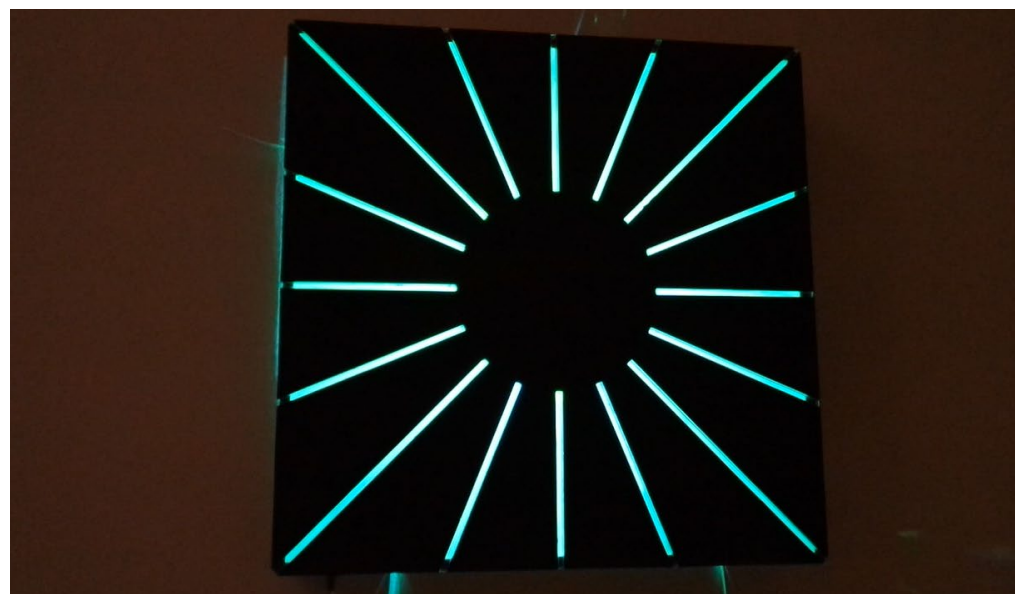
When it's harmony

When the atmosphere is harmony and no arguments happen, Sundache will shine rays of red bright light, just like the sun.



When quarrelling starts

When quarrelling starts, the intensity of the light will dim a little and the light will blink unstably, which means the good bonding of the family is under threat. The sound and face recognition will be detected to recognise whether it is under a quarrelling situation.



When quarrelling happens and the child hugged the toy

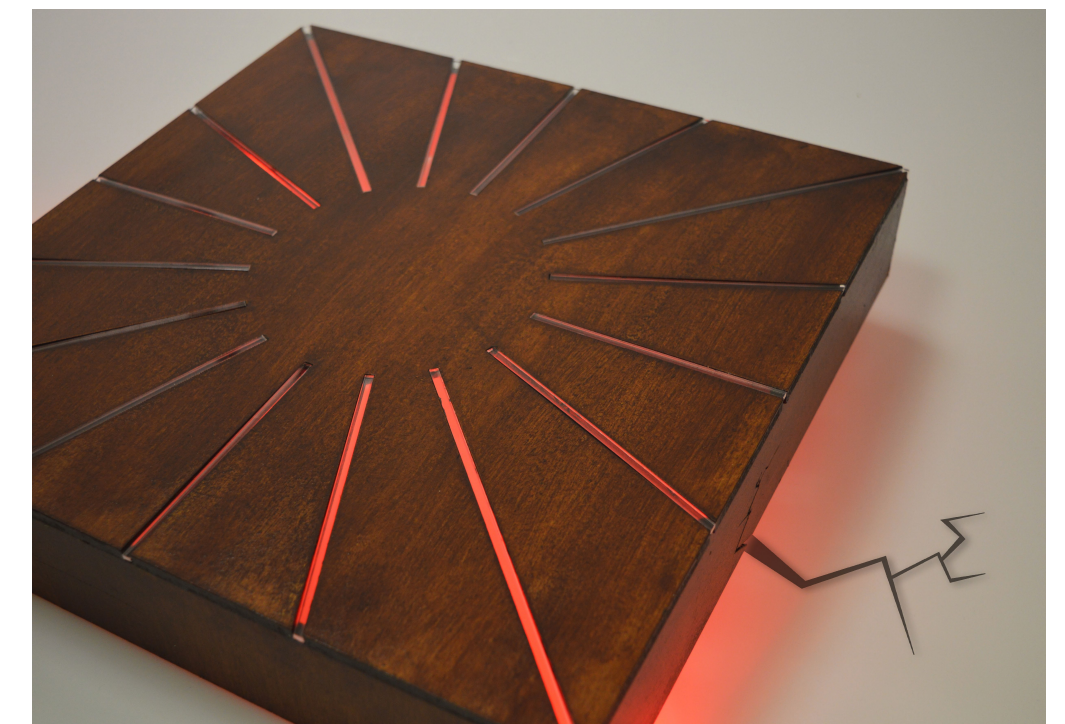
When quarrelling is going on and the child hugged his/her toy, Sundache will lose its brightness. Instead, one of the side light will light up, which will project a crack on the wall. Now, the parents may notice the change of the light and they have two options to do, one is to continue the quarrelling, another is to stop quarrelling and go to check their child.



When the parents choose to continue quarrelling

When the parents choose to continue

quarrelling, more and more side lights will light up, hence more and more cracks will grow onto the wall. The intensity will also increase as time goes on, so the cracks will be bigger and more visible. The cracks represent the wound the parents are causing in the child's mind. The more quarrelling they caused, the more wound in the child's mind.



When the parents stop quarrelling

When the parents stop quarrelling, the cracks will fade slowly, and the brightness of Sundache will gradually regain. The more cracks the parents caused, the longer time it takes to fade away. Which is the same as the wound the caused in their child's heart, the deeper the wound is, the longer time it needs to recover.

04. APPROACH

I used an interactive design approach within the process. To generate concepts and gaining data from the users following methods are used.

4.1. Brainstorming Stage

4.1.1. Mind mapping

In the beginning of the project, I started to work out as many ideas as possible in a hierarchical tree and cluster format. Start off my goal in the centre, in this case, communication between families. I did this with other students to gain a broader insight into the project.

4.1.2. Group Ideation

Besides, I had a group brainstorming session with potential users. More brains are always better than one. This allowed me to go further in one direction and develop the concept towards practical.

4.2. Concept Ideation

4.2.1. Questionnaires

After determining the direction of the project, questionnaires were used to get a quantitative data. This helped me to gain the insights of the current situation of the family communication and found potential problems to explore deeper.

4.2.2. Interviews

After analysing the results from the questionnaires, I carried out interviews with 4 people to talk about some findings from the questionnaires. People are not directly aware of their everyday experiences. With interviews, I could find out what they say and think. Besides, this helped me to gain deeper insights from the stakeholders.

4.2.3. Storyboard/Persona

During the ideation, I created personas to envision the current situation and the situation after generating my concept. This was a way for me to create empathy with the users and helped me to organise the findings from questionnaires and interviews.

4.3. Concept Validation

4.3.1. Context Experiment

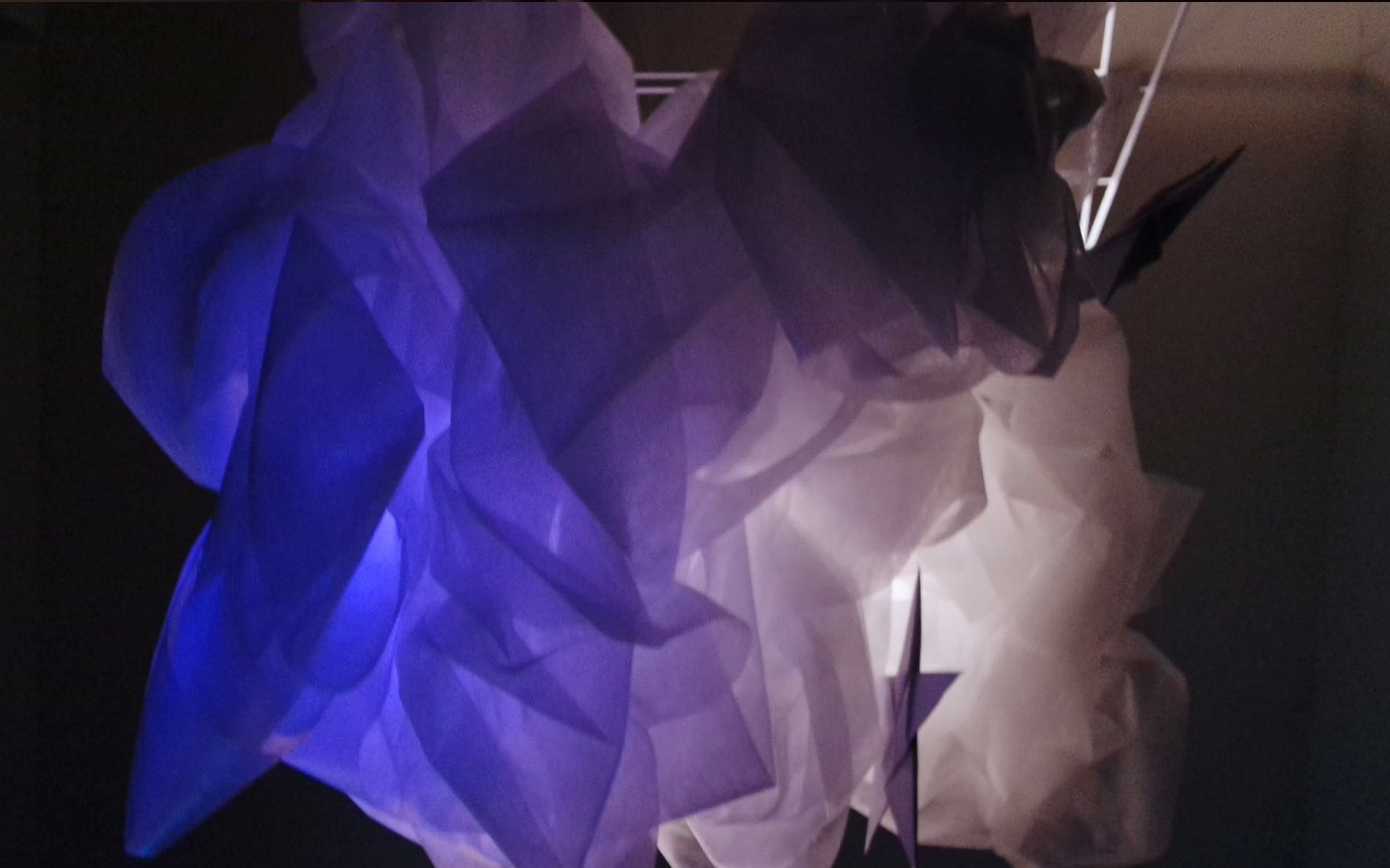
After I had a concept and a prototype, I created a context for the participants and let them experience different situations. They gave their opinions to me and I observed their behaviour and facial emotions. This helped me to see whether the concept can work and gave me valuable insights from the users.

4.3.2. Technology Acceptance Model (TAM, Davis 1993)

This method was used to evaluate the final concept. This explained people's acceptance of the product in professional context. The model includes: Perceived Usefulness, Perceived Ease of Use and Attitude towards use. This was used to know whether the concept can be understood by most of the potential users. Besides, whether this would work and arouse their awareness under quarrelling situation.

05. DESIGN PROCESS

The design process was formed up by two iterations, each iteration had been through the design circle. They were also carried with different research methods, including papers researches, questionnaires (quantitative research), interviews (qualitative research), and contextual experiment.



5.1. Iteration 1

The first iteration describes the main activities I did until Mid-Term Demo day. Since I was only determined my focus on family communication, not specific to quarrelling situation between parents in front of children. The research in the first iteration is more broadly focused on the current situation of family communication and potential communication problems.

5.1.1. Prior Research

The first iteration starts by forming a questionnaire for 165 people focused on the family communication. Following by deepening interviews with 4 people around 22s. Based on the findings, several concepts are formed and one was selected to develop further.

5.1.1.1. Questionnaire

There are five questions I want to research through this questionnaire:

1. Are there problems exist in family communication?
2. What are the problems?
3. What are the cause of the problems?
4. How do people feel and how they react to this kind of problems?
5. How to improve current situation?

This questionnaire has been filled in by 165 people. Age ranges from 16 years old to above 55 years old (16 - 25 yrs = 27; 26 - 35 yrs = 22; 36 – 45 yrs = 42; 46 – 55 yrs = 63; above 55 = 11). 34 of

them are the only child in their family while 131 people have brothers and / or sisters. 121 of them are have formed a new family with their spouses and/or have child(ren), while 44 haven't been married.

The main part of questionnaire is in the form of Likert Scale[8], there is a five point scale (range from 1-5) which is used to allow the individual to express how much they agree or disagree with a particular statement. The numerical value from 1 to 5 represent strongly disagree / disagree / neutral / agree / strongly agree correspondingly.

The full text of this questionnaire can be found in Appendix A.

5.1.1.1.1. Results and Analysis

1. When I'm at home, I always spend my time with my family members rather than alone. (Scale 1-5: Strongly Disagree – Strongly Agree)

Mean not married:	3.02	Median not married:	3
Mean married:	3.71	Median married:	4
Mean Total:	3.52	Median Total:	3

Table 1. Table of the results of means and medians for question 1

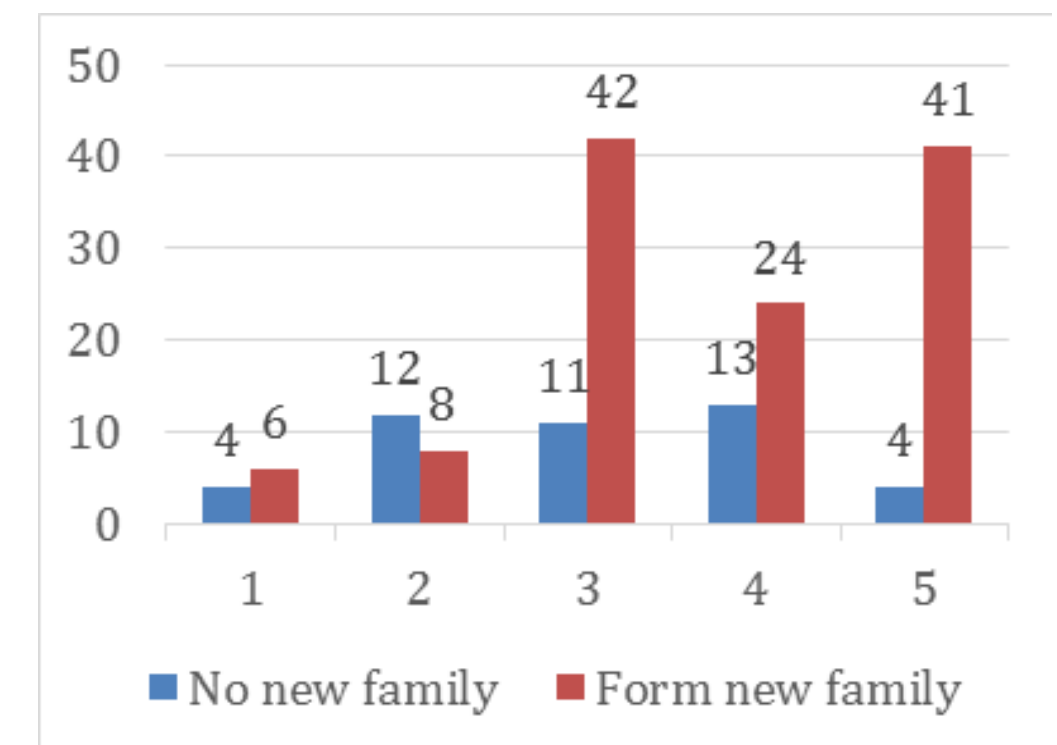


Figure 1. Results of question 1

2. I think I have pretty enough communication with my family members. (Scale 1-5: Strongly Disagree – Strongly Agree)

Mean not married:	2.82	Median not married:	3
Mean married:	3.26	Median married:	3
Mean Total:	3.14	Median Total:	3

Table 2. Table of the results of means and medians for question 1

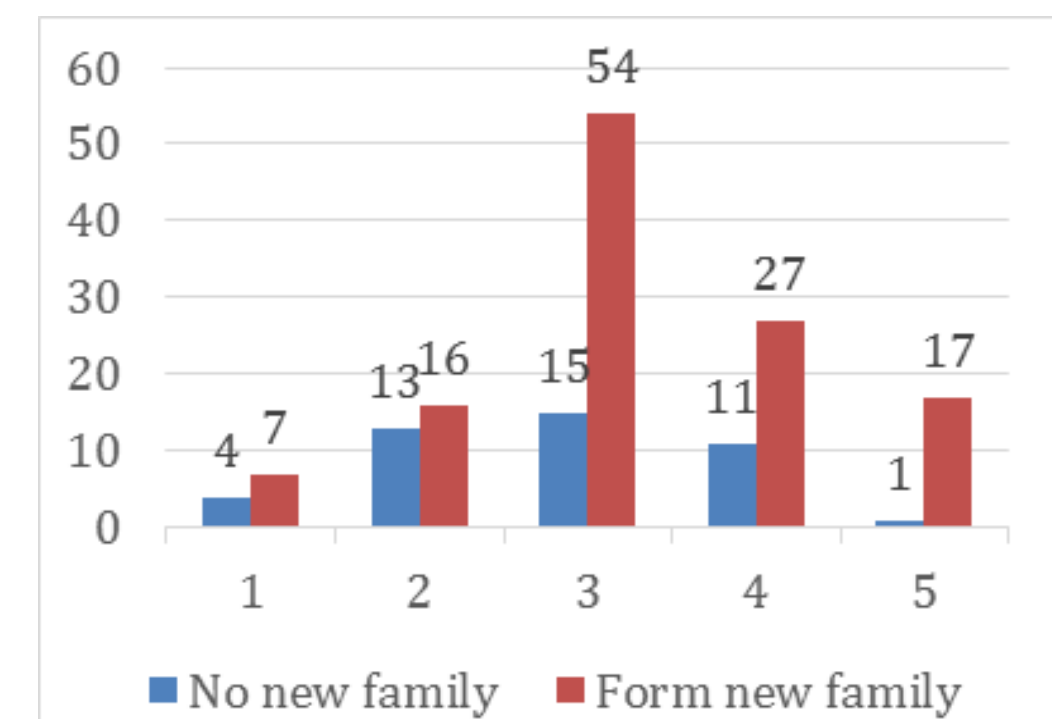


Figure 2. Results of question 2

3. I always get enough response when I try to communicate with my family members. (Scale 1-5: Strongly Disagree – Strongly Agree)

Mean not married:	3.52	Median not married:	4
Mean married:	3.64	Median married:	4
Mean Total:	3.61	Median Total:	4

Table 3. Table of the results of means and medians for question 3

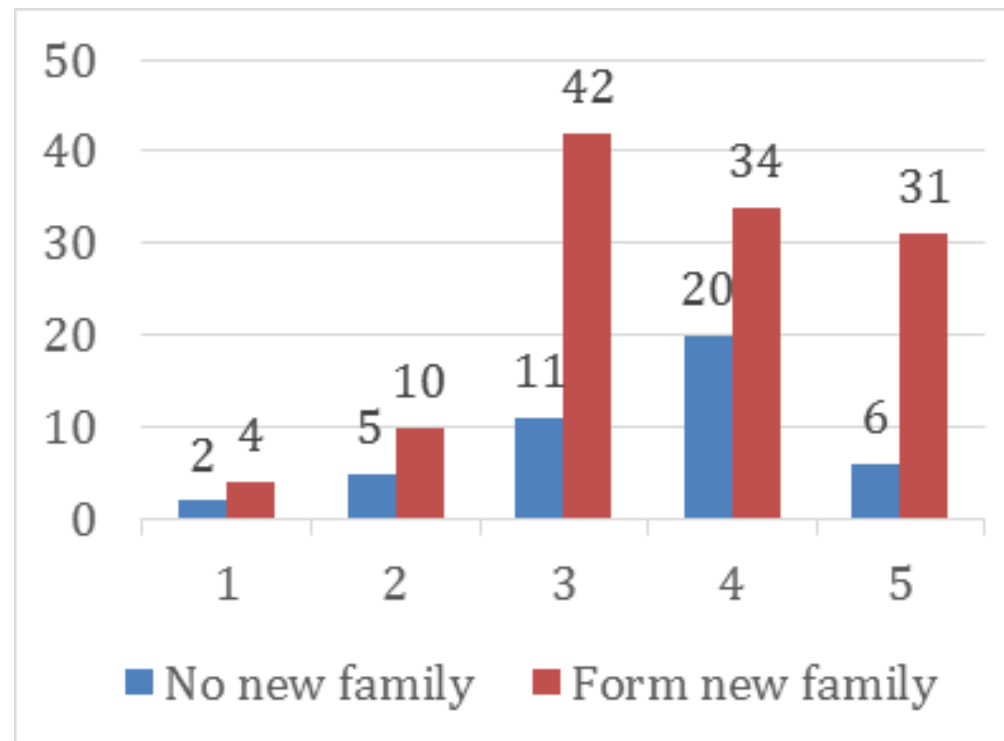


Figure 3. Results of question 3

4. When I contact with my family, I don't really have something important to talk, I just want to know they are doing well. (Scale 1-5: Strongly Disagree – Strongly Agree)

Mean not married:	4.11	Median not married:	4
Mean married:	4.06	Median married:	4
Mean Total:	4.07	Median Total:	4

Table 4. Table of the results of means and medians for question 4

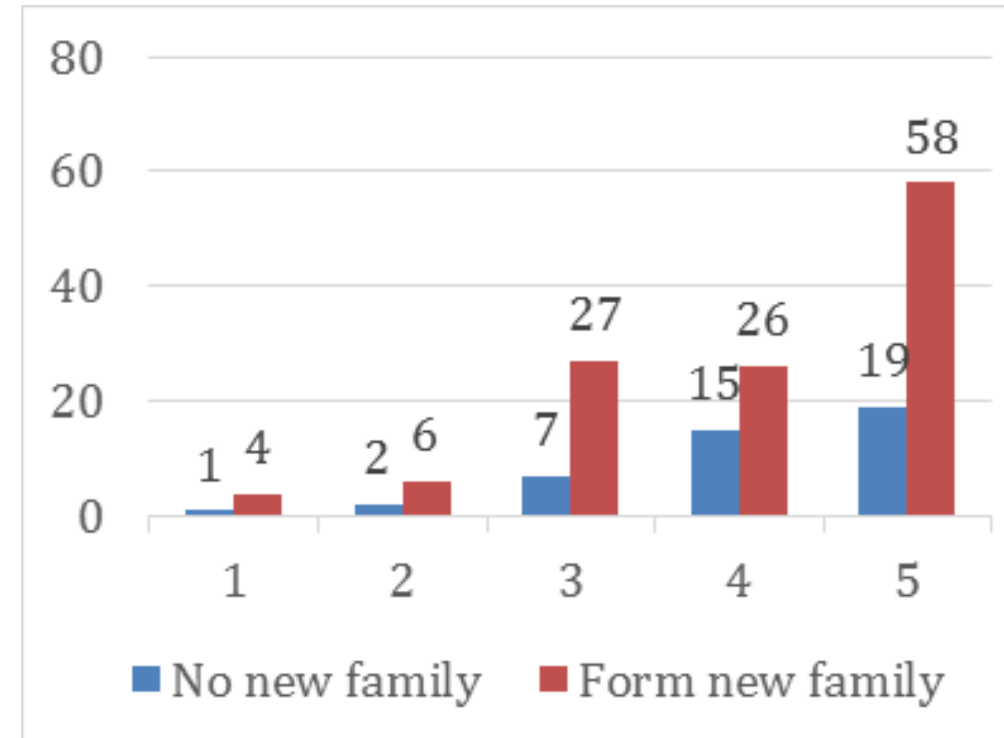


Figure 4. Results of question 4

5. I want to have more communication with my family members (parents, and/or brothers and/or sisters). (Scale 1-5: Strongly Disagree – Strongly Agree)

Mean not married:	4.00	Median not married:	4
Mean married:	4.12	Median married:	4
Mean Total:	4.08	Median Total:	4

Table 5. Table of the results of means and medians for question 5

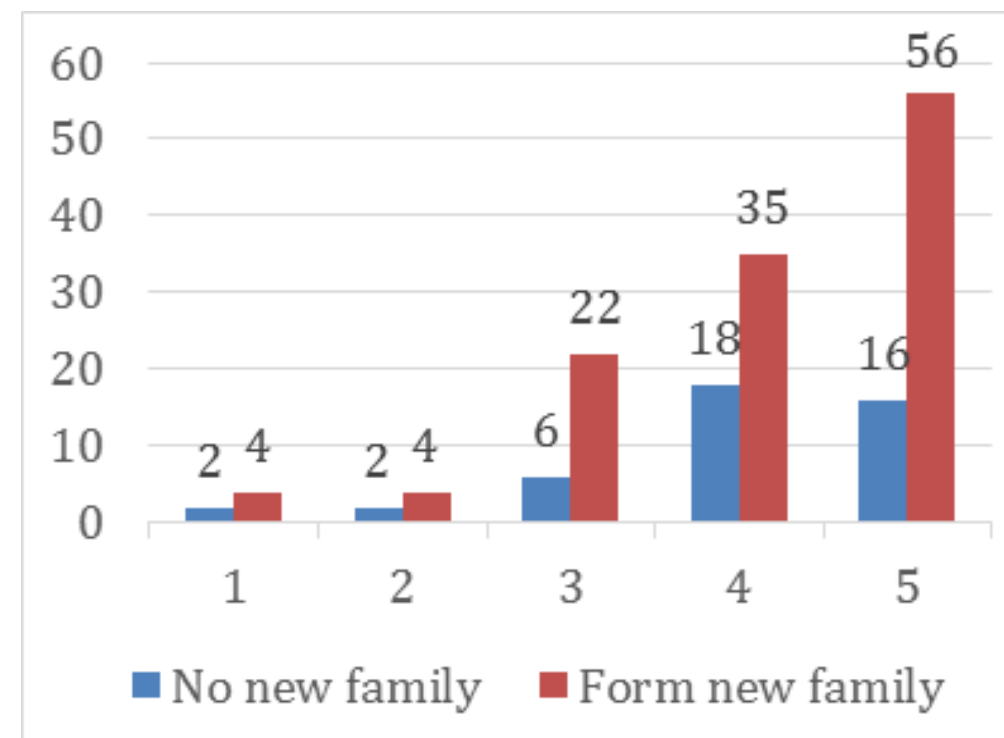


Figure 5. Results of question 5

6. (Only for whom have formed new family) I wish to have more communication with my spouse and child(ren). (Scale 1-5: Strongly Disagree – Strongly Agree)

Mean married:	4.27	Median married:	5
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Table 6. Table of the result of mean and median for question 6

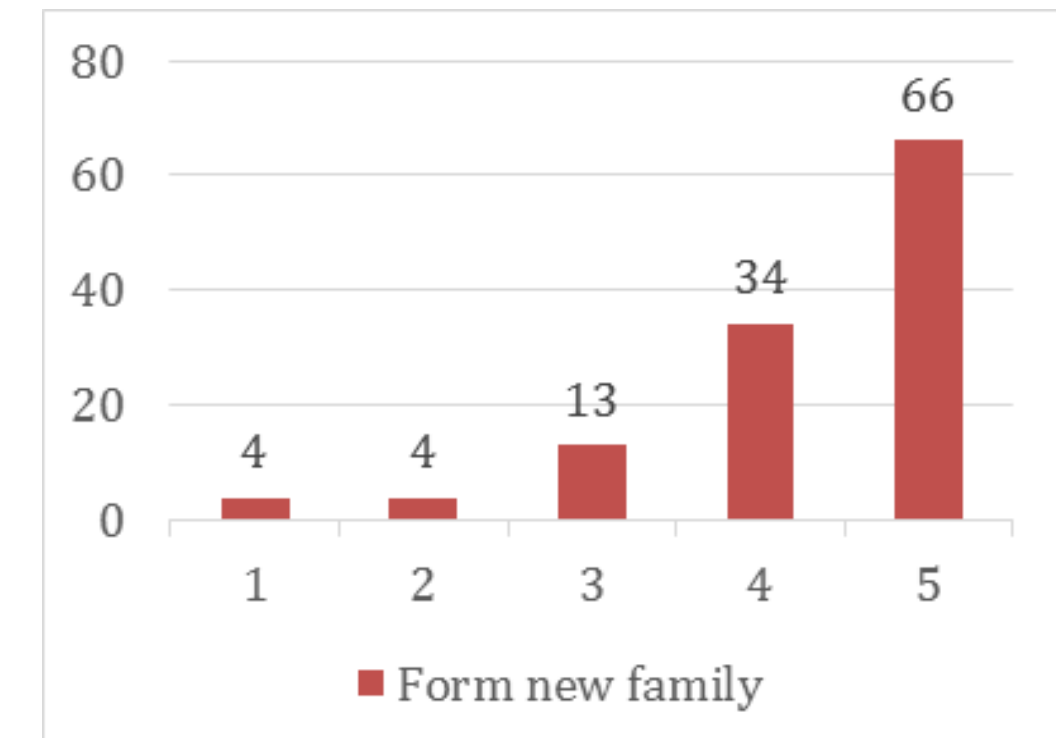


Figure 6. Results of question 6

7. Do you prefer direct communication (instant two-way communication) or indirect communication (non-real time e.g. Facebook) with your family members? (Scale 1-5: Always Direct - Always Indirect)

Mean not married:	2.48	Median not married:	2
Mean married:	2.83	Median married:	3
Mean Total:	2.73	Median Total:	3

Table 7. Table of the results of means and medians for question 7

5.1.1.1.2. Findings

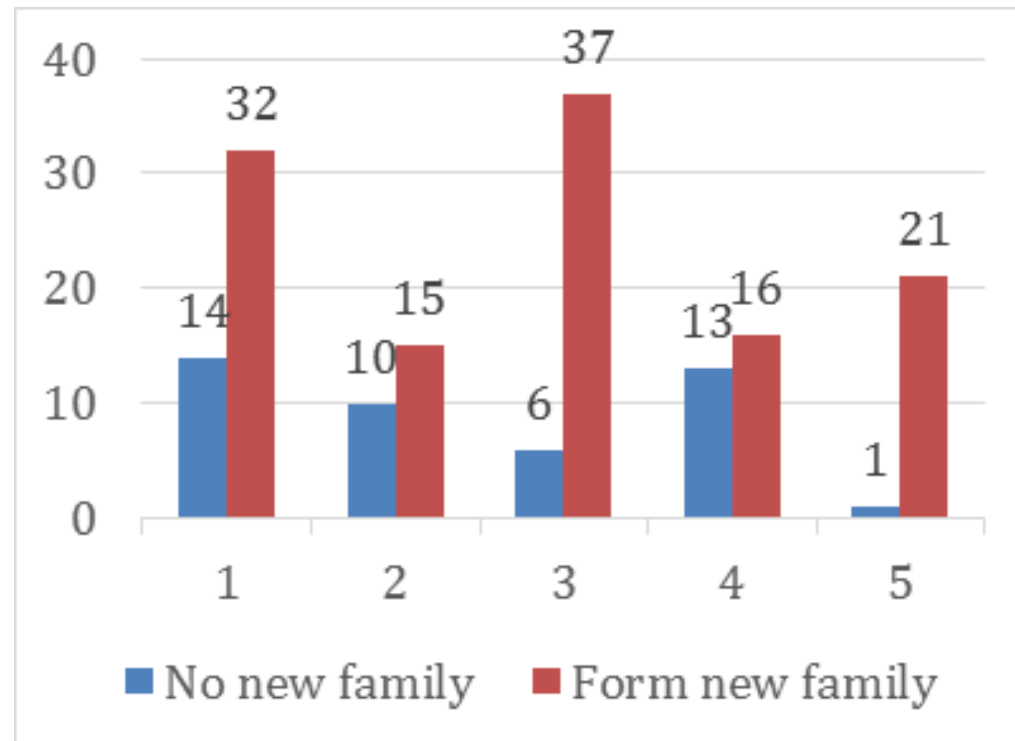


Figure 7. Results of question 7

8. Did you try any methods to enhance the communication with your family? If yes, please tell me more in the blank line! (No, I don't need it. / No, but I want to. / Yes)

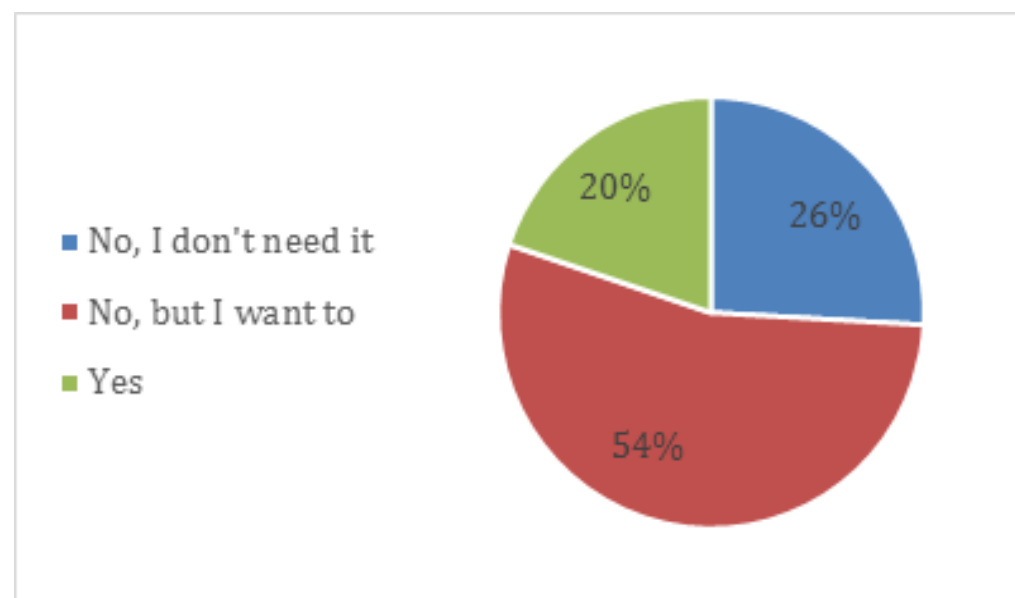


Figure 8. Results of question 8

Common Things for Both Groups:

From question 3, both groups of people show a positive results on this question. It's interesting to see that although most people who are married chose neutral while most people who are not married chose number 4, there are 22% people who are married chose 5 while there are only 13.6% people who are not married chose 5.

From question 4, the results show that the communication within a family is always not about important things but just want to know they are doing well. This shows the need for people to chat with their family about the little things in life.

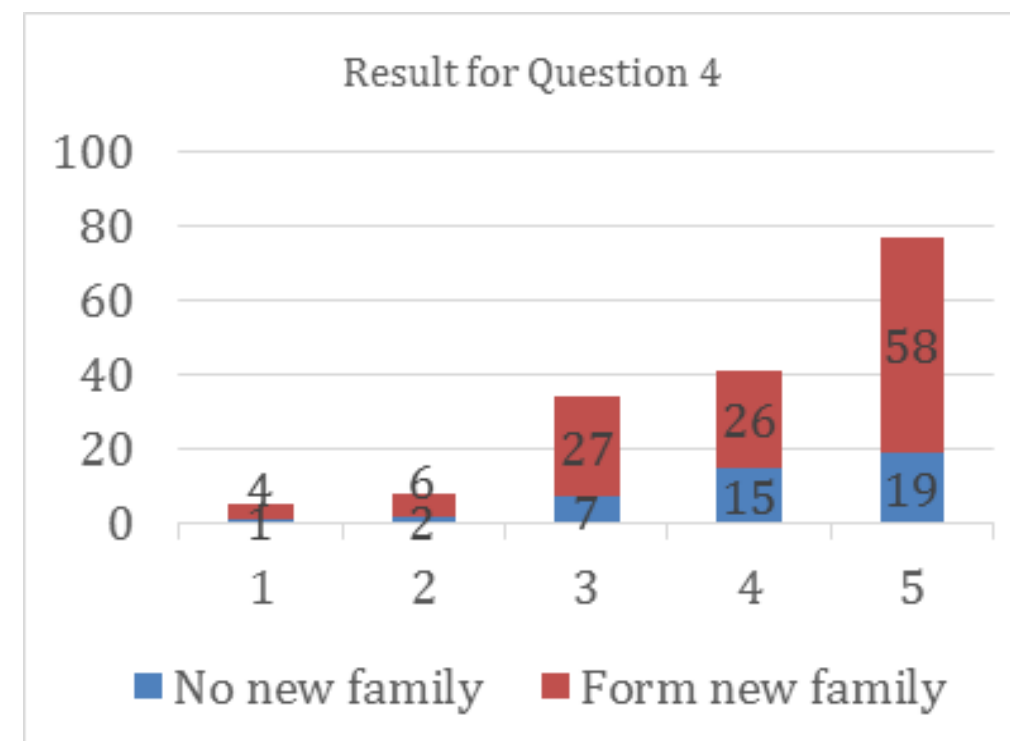


Figure 9. Results of question 4 in combined bar chart

The results from question 5 shows that majority of the people want to have more communication between their family members. What's more we can see from question 6 people who have formed their new family wish to have more communication with their spouse and/or children than that with their parents, brothers and / or sisters.

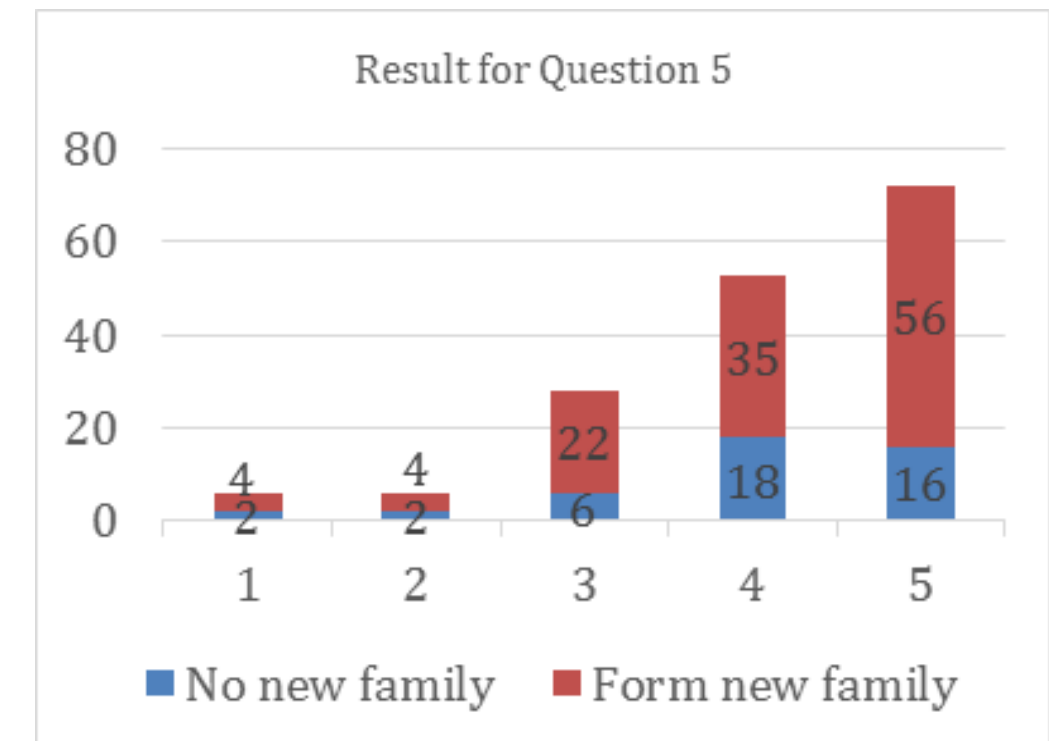


Figure 10. Results of question 5 in combined bar chart

From the result of question 7, both groups of people prefer to have a little more direct communication. Yet people who are married show more neutral opinions than people who are not married. The trend to one side is not very obvious, and the median of the total is neutral. So I could say that especially for people who are married prefer to have direct communication but they didn't show a necessarily need of it.

Difference between Two Groups:

From question 1, we can see that over 88.4% of the people who have married chose 3 and above 3, while the people who haven't married showed more neutral around 3. So probably we can say that people who are married are more willing to spend their time with their family when they are at home rather than staying alone.

From question 2, about 44.6% people who are married and 34.1% people who are not married chose neutral. Yet for people who are married seems to think that they get more enough communication with their family than those who

are not married.

From the comparison of the results of question number 5 and 6, we can see that over half of the people chose strongly agree in question 6, and the mean is higher than that in question 5. So it seems that people who have married want to have even more communication between their new family members (spouse & children) than with their original family.

General Findings:

The result from question 8 shows that only a quarter of people don't want to try any methods to enhance the communication within their family, this may be because they already have a pretty satisfied bonding with their family. Majority of the people want to enhance the communication and 20% of them tried some methods before but over half of the people didn't.

Besides, I received many remarks and feedback from the questionnaires, there are some ways they tried to enhance the communication, they are mostly spending time together with their family which including watching movies, readings, travelling together, family picnic, family conference, etc. They also mentioned to be calm and honest to the family, showing appreciation to each other. Always try to be in the presence of each other, as long as they can feel each other's love, no matter what kind of methods of communication are used.

Furthermore, some people expressed their problem in the communication, for example, some people said they can't find a proper way to communicate with their daughters/sons, or they don't have common topics when they want to chat together. One said, "Talk as much as you can with your parents, talk partially to your partner, tell as little

as possible to your children." This really caught my eyes and I start thinking why he/she thinks like this. There's another one said that the distance between parents and children becomes further and further after a while, both sides don't know or understand each other, then they just reduce the conversations and become estranged from each other. This results in a vicious circle of lack of knowing of each other and less talks afterwards.

5.1.1.1.3. Conclusion

Looking back of the questions I set before the questionnaire, I could conclude some possible answers from the results.

1.Q: Are there problems exist in family communication?

A: Yes, and these problems differ from each family.

2. Q: What are the problems and what cause these problems?

A: Problems include many people think they don't have enough communication between family members, this may due to little common topics between parents and children, or they don't spend enough time together to know each other because they live apart. Besides, most people are willing to communicate but they, especially parents, sometimes couldn't find a suitable way to communicate with their children. Lack of understanding may often lead to quarrelling when they want to communicate.

3. Q: How do people feel and how they react to this kind of problems?

A: Most of them are willing to improve the quality of communication. However, only 20% of the people tried some methods to enhance the

communication. Majority of them choose to stay with the current situation because they don't know how to improve these problems. Quarrelling can easily happen when they can't find a proper way to communicate.

5. Q: How to improve current situation?

A: They mentioned some ways they tried to enhance the communication, they are mostly spending time together with their family which including watching movies, readings, travelling together, family picnic, family conference, etc. They also mentioned to be calm and honest to the family, showing appreciation to each other. Always try to be in the presence of each other, as long as they can feel each other's love, no matter what kind of methods of communication are used. I wanted to research deeper on this question because the results on the questionnaire didn't gave me enough information about this part.

5.1.1.1.4. Discussion

This questionnaire may contain some constraints and should be noticed for further use.

The first thing is that most people who filled in this questionnaire were Chinese, if these results are going to be used for future studies, the cultural difference may need to be considered. To my experience and studies, parents in the western countries act more like a friend to their children, and usually stand on a relatively same level as their children when they talk to them. Most Parents in Eastern countries especially China, stand on a higher position when they talk to their children. Therefore, children in western countries may have more chance to express their opinions than children in China, and their opinions may count more

important than that in China.

Furthermore, some people may answer the question to meet the expectation of what other people think are

right, they may be afraid to tell the true answer they think in their minds.

Besides, I looked back to the questions afterwards, and some questions may have a little deviation to a side. So as an improvement for the future studies, more natural questions should be set up.

This questionnaire gave me enough proof that some problems did exist among the communication in family. Also, it's very interesting to see that most people are willing to improve but why the communication just didn't work? Therefore I wanted to research deeper on the reasons of the "bad" communication for my next step.

5.1.1.2. Interview

After obtaining the quantitative findings from the questionnaires, I wanted to research deeper on the reasons of "bad" communication. Moreover, since I found the communication problems were commonly happens between parents and their children, and people showed greater willing to have more communication between their parents or children, rather than brothers and sisters. So I decided my direction in the communication between parents and their children.

Therefore, I interviewed four people, a 22-year-old male, a 21-year-old male, a 25-year-old female and a 22-year female. They are all international students who are studying overseas. The 25-year-old female considered herself had a very good communication within the family, while the other three had more or less some communication problems within their families. This was set up to have a comparison between different families and I wanted to find out the characteristics present in good communication. Following are some interesting notes during the interview.

5.1.1.2.1. Interesting Notes from Interviews

The 22-year-old male's parents divorced when he was young. He lived with his mother most of the time and he had a good relationship with her mother. They talked to each other occasionally and they like to discuss about many social problems in the presents. He said his mother cherished his opinions when he grew older and liked to share things happened around her. However, his father act very different from his mother. He always want to talk to his father and know more about him but his father only contact him when it's festival. I asked him what reasons he thought caused this situation, he said probably his father thought he's just a child and didn't see a need to let him know his life, also he may think that it will lose his face to show his weakness to his son.

The mother of the 21-year-old male sometimes will hold a family conference to talk about the recent situation and incoming tasks to do. His mother shows a leading position in his family, and he likes to talk with his father about his recent situation occasionally. The communication in his family is ok but he think that he is not able to express all his thoughts sometimes. The communication from his mother is relatively one-way, and his mother is not a good listener, even if she listens, she will still ignore his opinions and convinces everyone to her opinions.

The relationship is pretty good between the parents of the 25-year-old female. She said her parents are willing to talk to her and share their life to her, and so does she. She said her father would talk to her if he had arguments with her mother, he treated her like a common grown-up and listened to her opinions. Therefore she really likes to chat with her

parents and almost contact them every day even she's abroad. Maybe because she likes to talk with her parents very much, sometimes she still think their communication is not enough.

The parents of the 22-year-old female have an excitable nature. They often argues with the little things and shouted quite loud. His father loves to express his love but she doesn't know how to reply to him. Maybe it's because he always think it's disrespectful when she talks back to him when he's mad, thus she's a little afraid to talk to his father now. Her mother shows more respect to her opinions, but sometimes she's very stubborn and doesn't want to listen to others' opinions. So when everyone is not listening, a conflict will occur.

5.1.1.2.2. Conclusion

From the interviews, I concluded five important elements that form a good communication between parents and children:

1. Calm:

The basic element to have a communication is to be calm. I found that an effective communication can be continue only when everyone is calm and can listen to each other patiently. Otherwise, the communication will be one-way, only one side is shouting and the other side is impatiently listening, or both sides are shouting to each other but no one is really listening. Therefore, the communication will not work out unless everyone can calm down and start listening to each other.

2. Respect:

During the interviews, I found that many parents were standing in a higher position when they were talking to their children. Many talks are more like

an order. "My mum will host a family conference occasionally and assign different tasks I should do in this month," said the 21-year-old male. Parents may get used to help their children managing their life for years. So when the child grew up, they still act as a "boss" to their child, this may cause conflicts because the child want to manage his/her own life and express their own feelings. So if both sides are communicate standing in the same level of position (e.g. like friends), the talk can be much smoother than before.

3. Share

Sharing is established on the first two elements, and can bring the family to a closer relationship. From the interviews with the 22-year-old male and the 25-year-old female, I found when their parents start to share their life or insights with them, they are willing to share their opinions back. So sharing with each other can help both sides to know more about their own life.

4. Understand

After getting know more about each other, they can start to think from different perspectives, so they can understand each other's thinking more. Children can also know that parents are doing those things that they couldn't understand before because of their different ways of expressing their love.

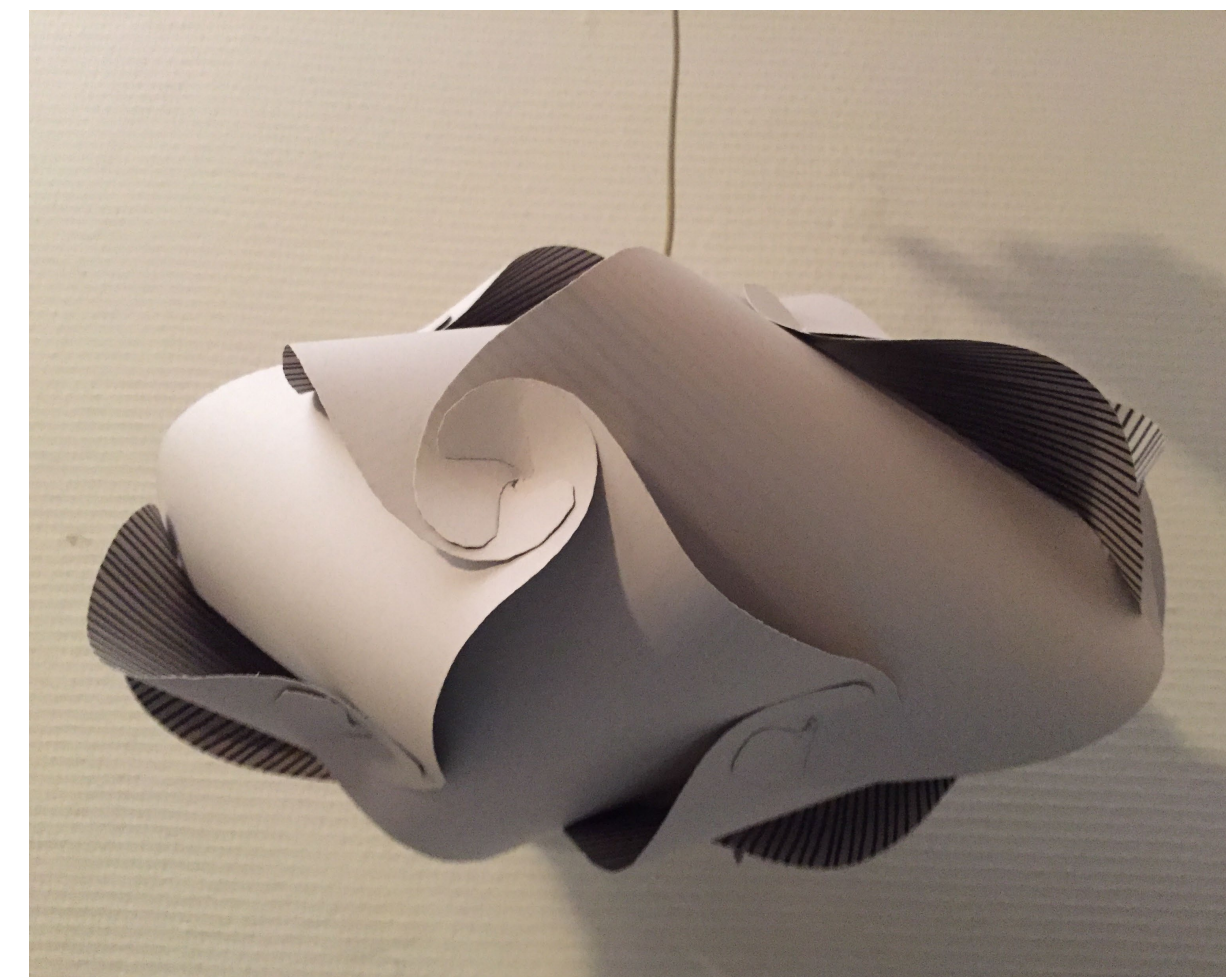
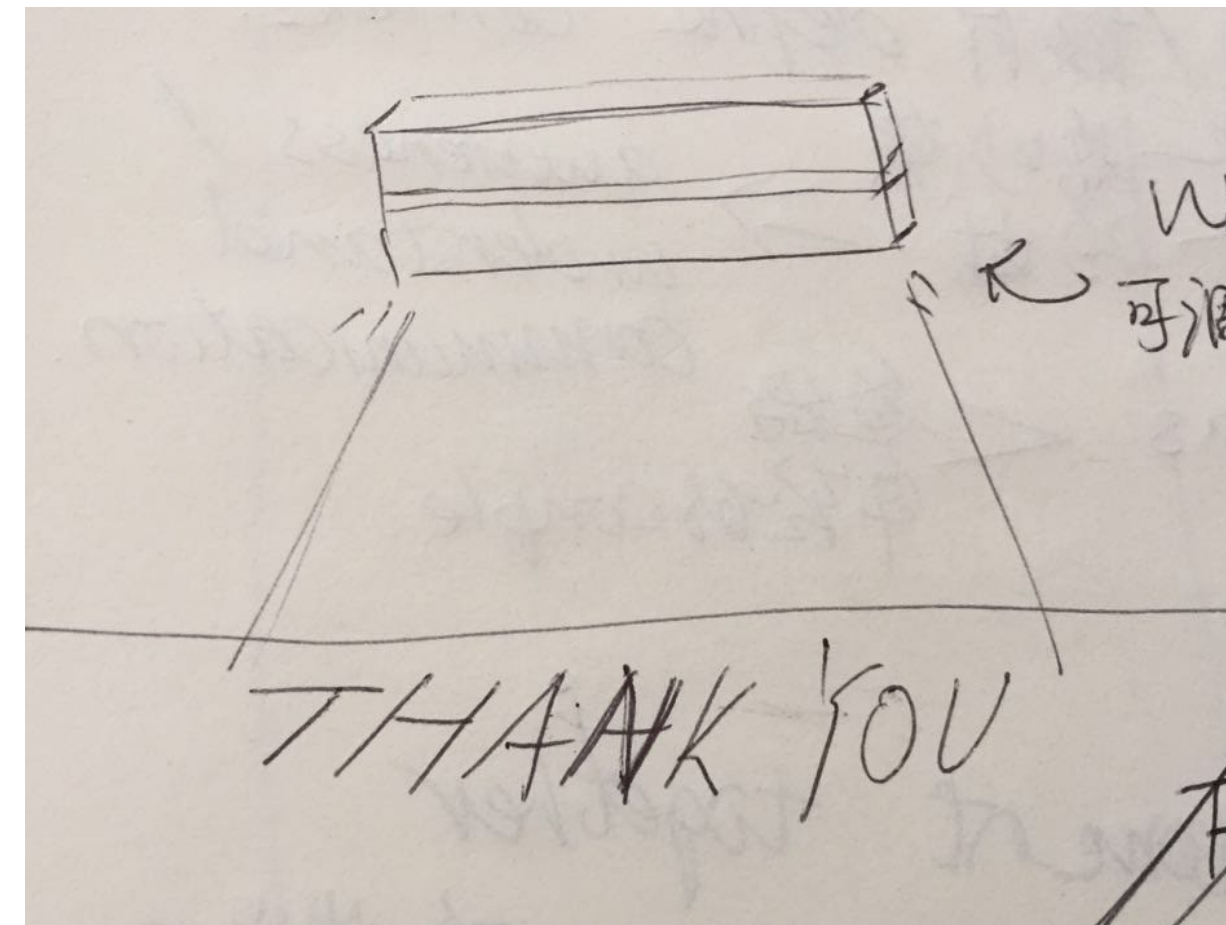
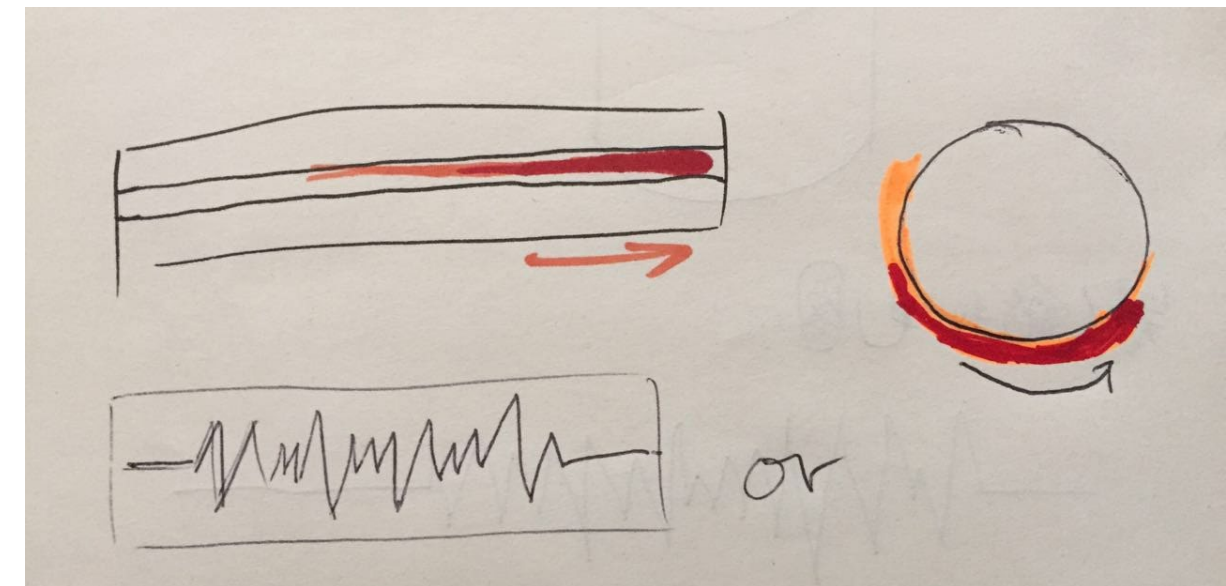
5. Appreciation

We show thankful to a stranger for getting a cup of water for us but we seldom appreciate all things our family do to us. Start showing appreciation will definitely help to smooth the relationship between the families. This also show the parents that their children are already grown up and they can start enjoying their own life than always taking care of their children.

5.1.2. Concept Form and Prototypes

From the information I got from the research, I put the results to the concepts. Since I wanted to focused on a strong context, I chose quarrelling. Arguing is a very common communication problem in the family. However when this arguing becomes too often and serious, it may break the close bonding of the family. We often quarrel because of the impulsion, and we feel so bad afterwards. This is not what we want, so I wander is there a way to prevent hurting each other because of quarrelling about trivial things?

Based on the data I collected from the prior research, I drew up several concepts for decreasing the chance to quarrel. Including showing the heart beats on the wall, projecting apologizing messages after quarrelling and etc.



5.1.2.1. Description of First Concept

The concept “Cloud 9” was chosen to be developed further. Following is a description of this concept:

Most of us have been through such situation: Arguing with our beloved ones about trivial things, hurting each other’s feelings and feel so bad afterwards. Argument is always not our intention, but sometimes we just can hardly control our emotions. Wouldn’t it be great that some means can help us to calm down and start listening to each other patiently?

Cloud 9 is inspired by the phenomenon that weather can influence our emotions, what if we can also influence the weather in reverse? Will we try our best to maintain a good weather in our home environment?

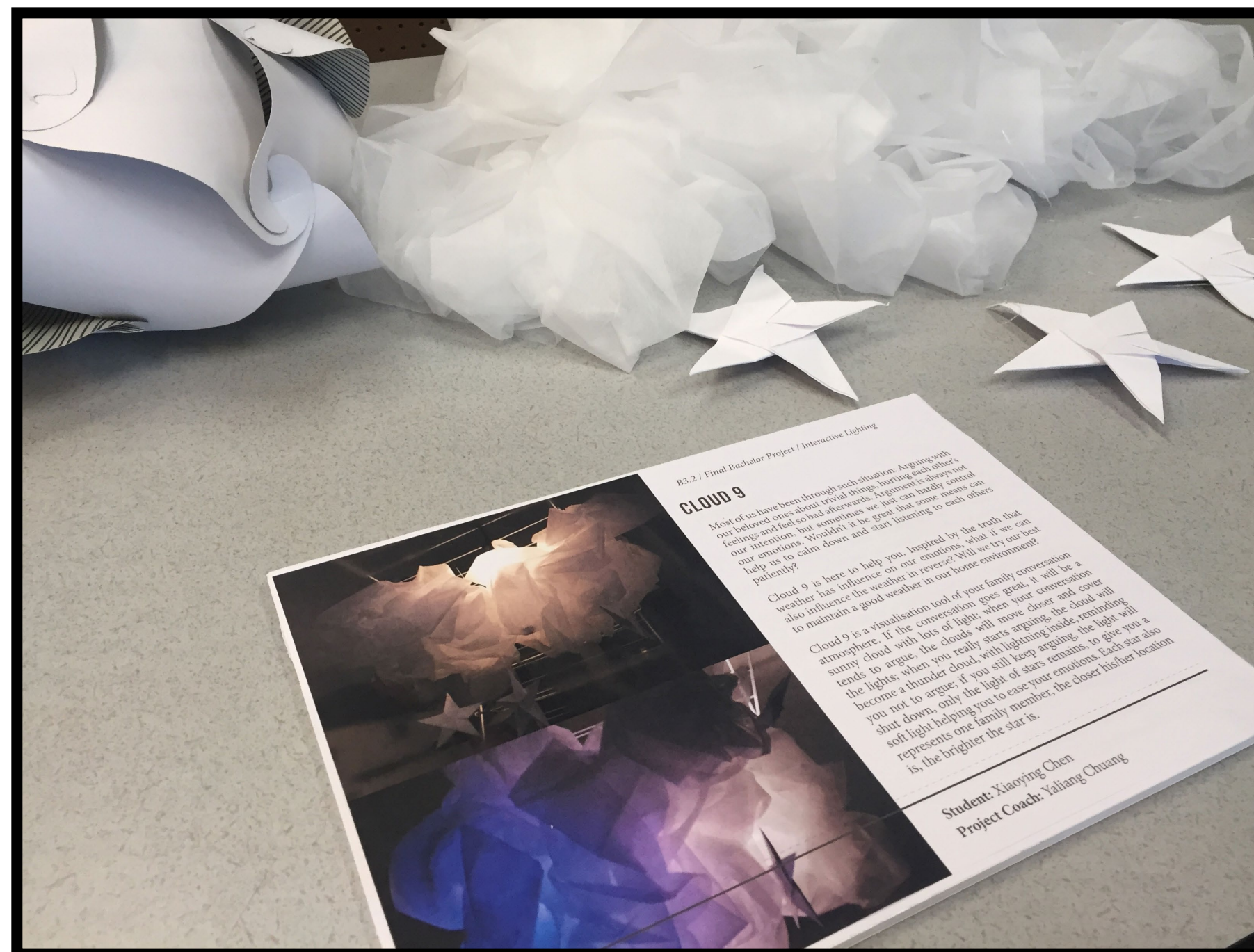
Cloud 9 is a visualization tool of your family conversation atmosphere. If the conversation goes great, it will be a sunny cloud with lots of light; when your conversation tends to argue, the clouds will move closer and cover the lights; when you really starts arguing, the cloud will become a thunder cloud, with lightning inside, reminding you not to argue; if you still keep arguing, the light will shut down, only the light of stars remains, to give you a soft light helping you to ease your emotions. Each star also represents one family member, the closer his/her location is, and the brighter the star is.



5.1.2.2. Feedback for the First Concept

From the Mid-term demo day I got a few valuable feedback and I wished to improve in these fields.

1. There's no interface involved in the system, it's hard to automatically sense whether the conversation is bad or good. Some arguments may be useful to solve a problem and no need to interfere with it.
2. There's too little meaning in the changing light, when people are quarrelling, they will probably ignore the light and continue quarrelling.
3. The thunder lightening effect may lead them to a negative results and make the arguments even more intense.





5.2. Iteration 2

The second iteration describes the main activities I did after Mid-Term Demo day. After getting the feedback, I carried out a contextual experiment. Through this experiment I narrowed down my focus on the problem of parents quarrelling in front of their children. Final concept was formed and an evaluation of the concept was done.

5.2.1. Contextual Experiment

With the feedbacks from Mid-Term Demo day, I decided to do a contextual experiment to see whether and how the lighting can help the quarrelling.

5.2.1.1 Goal and Setting

The aim of this experiment is to see how the dynamic lighting can help during a quarrelling. Since it was hard to actually make people quarrelling with each other, I found a movie clip includes a serious quarrelling between parents and let the 2 participants watch it and judged the situation under two different changing of light. The first one was a soft warm dynamic light which shines and dim every 10 seconds, like the breathe rhythm. The second one was how cloud 9 reacts, a thunder lightening effect which blinks blue lights rapidly.

The changing of lighting on the first scenario was set based on the studies on how (dynamic) lights help aggressive people to calm down. [9] The second changing of lighting was

based on my first concept, because I want to validate the usefulness of the lighting.



Figure 11. A set up for the contextual experiment

5.2.1.2. Results and Conclusion

The first participant said that he didn't know why the first kind of lighting can smooth the talk so he thought it will not help anything at first. After I told him that some research showed that smooth dynamic lighting can help aggressive people to calm their emotions [10,11,12], he thought maybe it can help because I told him this information, since then he would keep in mind that this would help. For the second lighting, he thought he

would just ignore it and may be even more annoyed by the "stupid" light.

The second participant thought both of the lighting would not help when he's quarrelling. He thought if he was really angry about something he would quarrel no matter how the environment changes.

Therefore, I asked them, what if this lighting was controlled by the children in the family, and it was used to express his upset feelings about the quarrelling situation. Both of them thought a while and said it may be better because the lighting had some meanings now. The parents should have thought of the children when they were quarrelling, and they may try to stop it to prevent further bad consequences.

5.2.2.Final Concept and Prototypes

From the results I obtained from the experiment, I decided to give this light a meaning because I realized the strongest persuasion should come from the one you cared the most. The simple dynamic lighting cannot influence the quarrelling situation much. I started thinking, who were the most important persons to the parents? They should be their children.

This made me think back to my younger ages, my parents often quarrel when I was young, and some of the quarrels were really serious in my memory and I was so scared that some bad things would happen like they would divorce. However, I was too afraid to interfere that bad situation so all I could do was hiding into my room and waited for the storm to pass. Although I already grown up and I can start to express my feelings when they are quarrelling now. I found those bad memories influenced me throughout my childhood and seemed to be a nightmare in my early ages. Therefore, I started researching the influence

of parents on children, and I found a lot of information about domestic violence. I realized the serious problems of domestic violence and verbal abuse was also an important element which would influence the children a lot. Quarrelling may not as serious as verbal abuse, but it is the origin of it. If this is not preventing properly, quarrelling may develop to a serious verbal abuse among family. The most important thing is, children will be influenced easily, learning and repeating the behaviour of their parents.

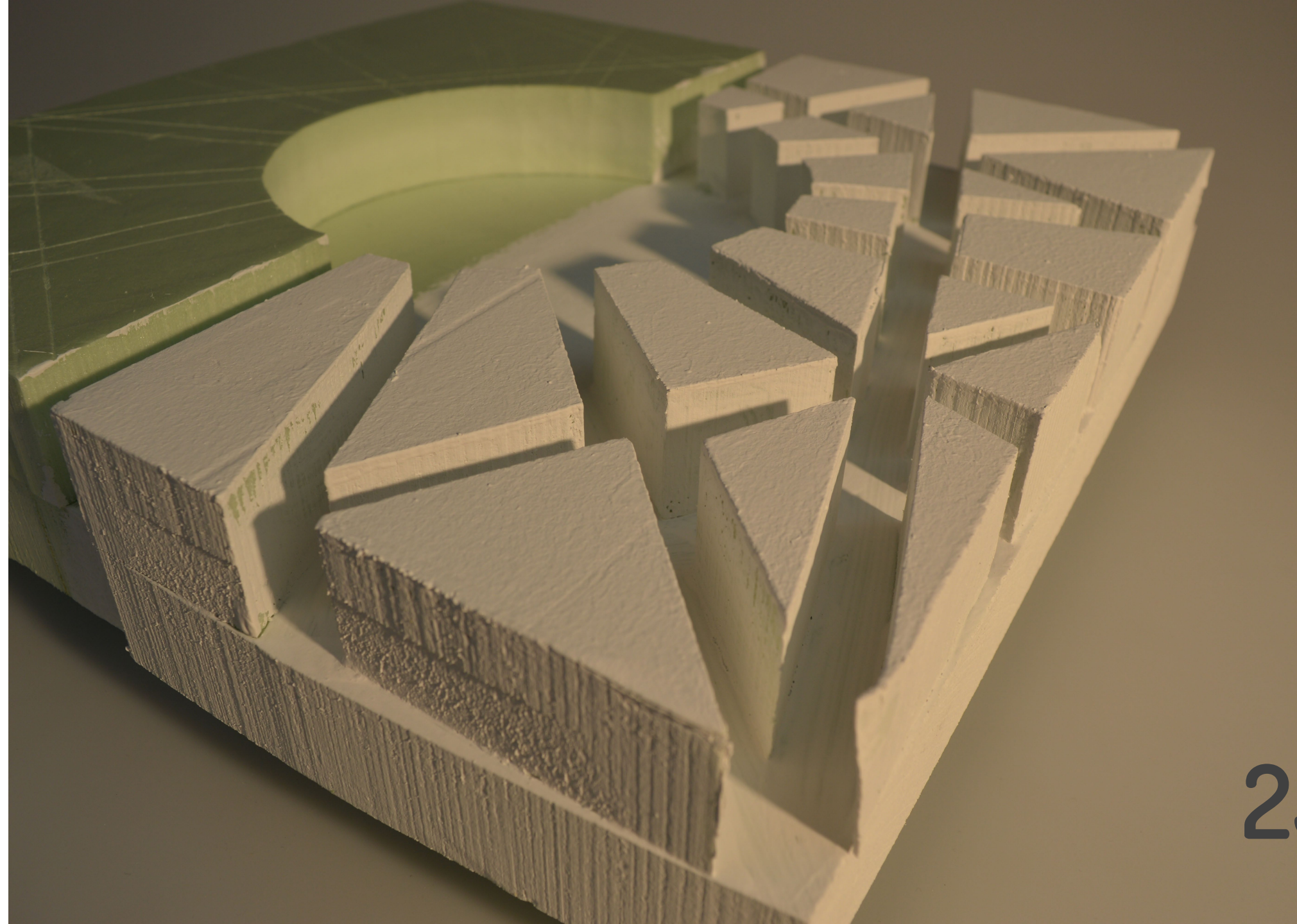
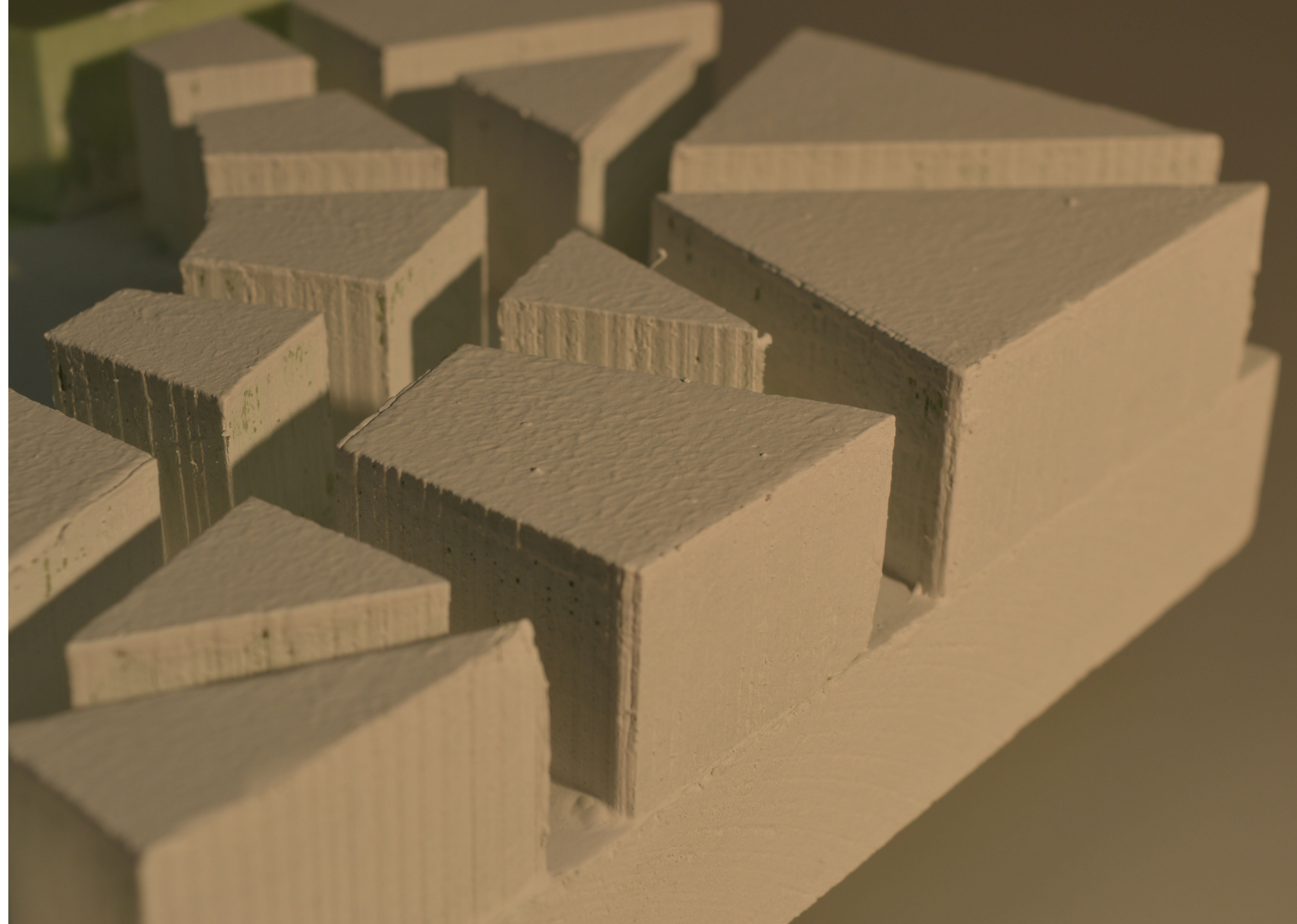
Parents may quarrel to solve some problems in the life, adults have a stronger heart and may forget the bad effects of quarrelling after a while. However, children will remember all of the quarrelling and they will be influenced for a long time, even a life time.

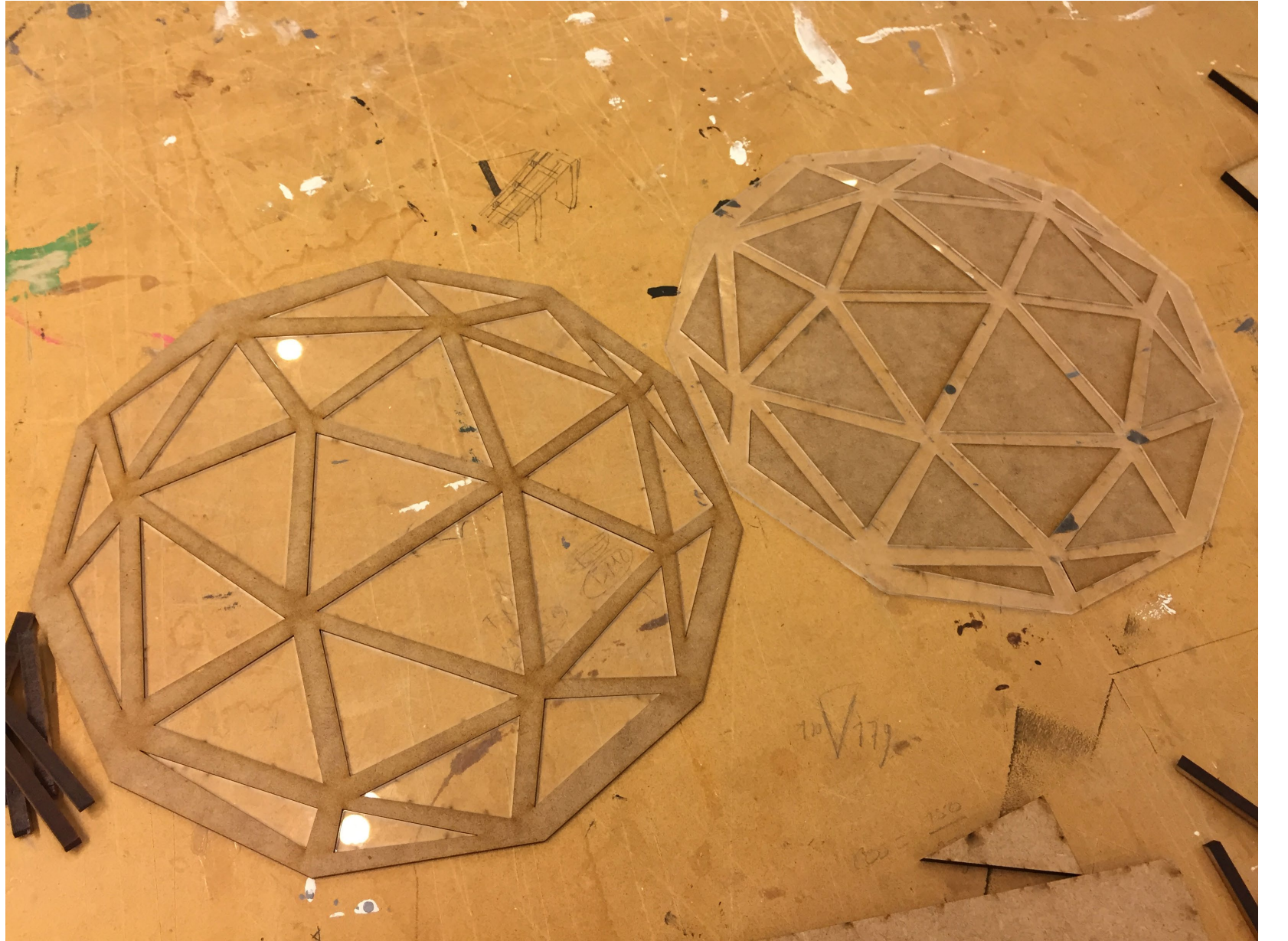
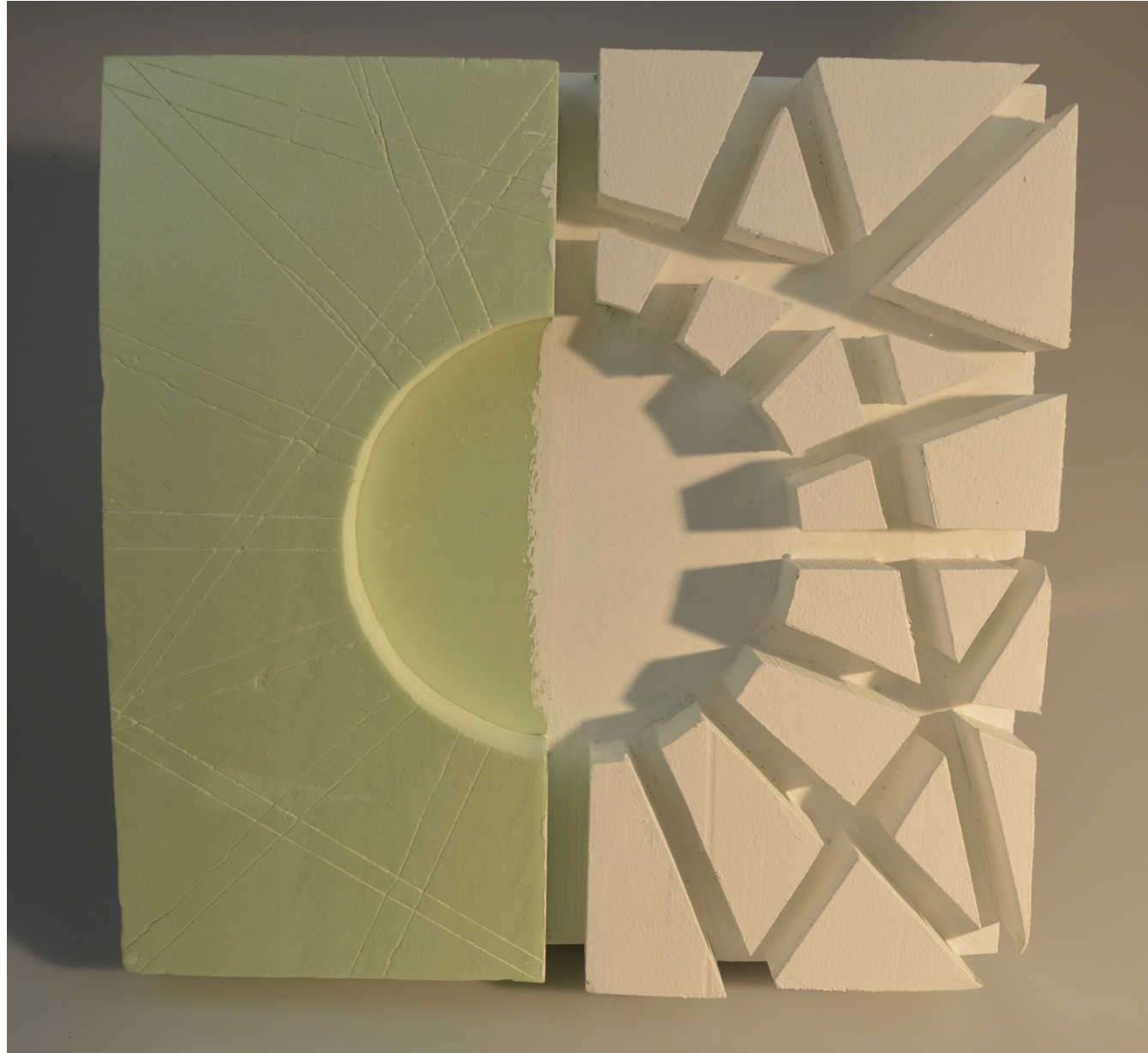
Therefore, I wanted to give the children like the young myself an opportunity to express their fear to the parents and

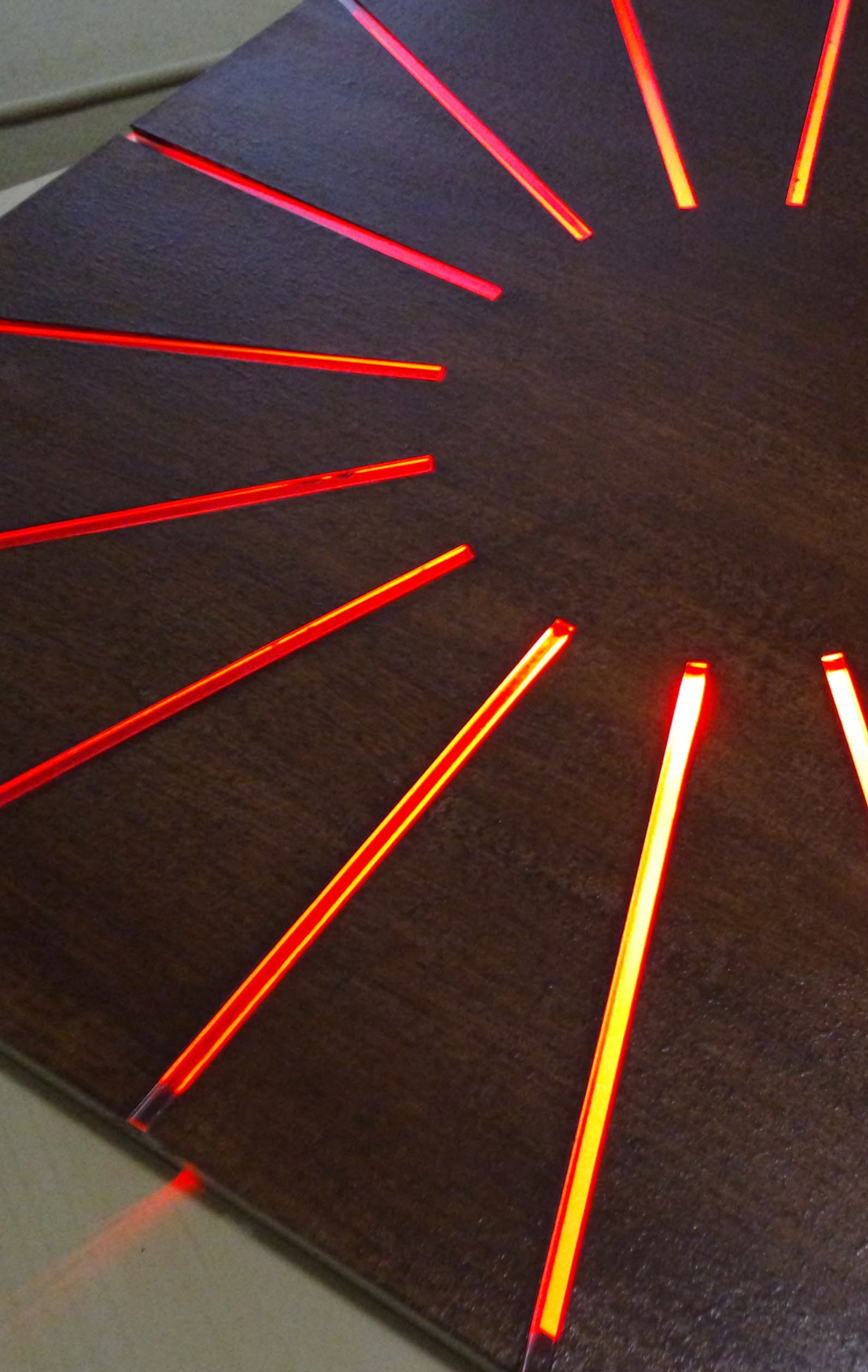
interfere the quarrelling. Besides, let the parents aware of the fear and see the actual damage they were doing to the family. So my final concept was focused on emotion visualization for children and getting parents aware of the bad effects under quarrelling situation.

5.2.2.1. Prototypes

Before finalizing the concept, I made several prototype to see which one could envision my concept the most. These were some pictures of the prototypes.







5.2.2.2. Final Concept Description

Family is always the harbour for us to rest, but this harbour often experiences different types of thunderstorms which will break the harbour at the end. One of the common storms is quarrelling. Parents often arguing about trivial things, hurting each other's feelings and feel so bad afterwards. Quarrelling is always not their intention, but sometimes people just can hardly control their emotions.

When I was still a child, I felt so scared when my parents start quarrelling, all I could do is to run into my room and hold my teddy bear tightly. However, I want to give the children like my young self an opportunity to express their fear and interfere the quarrelling between their parents.

Sundache is a wall lamp to visualise emotions for a family. It is in a shape of the sun, which represents the family, shine for us and support us. Rays of light shine out with great brilliancy when the bonding in the family is close and strong. However, when quarrelling happens, the rays will lose their brightness little by little and the light will blink unstably. Meanwhile, when the child run into his room and hold his teddy bear tightly, the light will know. A crack will slowly grow onto the wall from the lamp indicating that the quarrelling is hurting this family silently. It's just like a wound which will form inside other's heart when you quarrel with each other. More cracks will grow if the quarrelling doesn't stop, and the more cracks grow, the longer time it takes for the light to turn back to the original bright state. Just like the wound in people's mind, the deeper the wound is, the longer time it takes to recover. Sundache is to remind and warn the parents when they want to quarrel, they are creating cracks in their children's hearts unconsciously.

5.2.2.3. Inputs from Prior Research to the Final Concept

From the questionnaires and interviews I found quarrelling was a very common communication problem among the family. The reason of quarrelling were different but these problems could also be solved by other methods. For example, sit down and listen to each other's opinions calmly. No one want to quarrel but these often happen because of impulse. Therefore I wonder how to smooth the intense situation and reduce unnecessary quarrelling. From the contextual experiment, I found that the most useful person to persuade the people who were quarrelling was the person they cared the most. Therefore, in my context, this person is the child of the parents. After studying deeper on the domestic violence, I saw the importance of preventing serious quarrelling among parents in front of children.

The blinking effects was similar to the lightening effects in my first concept to visualize an intense and unpleasant situation. Overall, they formed my final concept.

5.2.3. Evaluation of the Concept

5.2.3.1. Final Demo Day

I presented my concept on the Final Demo Day and got some useful feedback that can improve the concept. The feedbacks included:

1. Should I let the children know clearly they can use the toy to express their feeling towards their parents when quarrelling?
2. What about the quarrelling situation when the children is not at home? Maybe it should include two modes.
3. Some user tests should be done to validate the design.



5.2.3.2. Technology Acceptance Model (TAM, Davis 1993)

Gaining from the feedback from Final Demo Day, I made a questionnaire based on the Technology Acceptance Model to evaluate the design. This model includes three part, Perceived Usefulness, Perceived Ease of Use and Attitude towards use. This explained people's acceptance of the product in professional context. Besides, whether this would work and arouse their awareness under quarrelling situation. I presented this questionnaire to 12 people that had already been a father or mother, and explained my ideas to them via presenting the description and the demo video. 8 of the people have children under 16 and 4 of them have children equals to or above 16. Full contents of the questionnaire can be found in appendix B.

5.2.3.2.1. Results and Conclusion

The questionnaire was scaled from 1 to 5. For the first two parts, 1 means strongly disagree, 3 means neutral, and 5 means strongly agree. For part 3, each scale has separate meaning.

Part 1. Ease of Use

1. I can understand clearly how Sundache works.
[Mean = 4.50]

2. Learning to use Sundache is easy for me.
[Mean = 4.58]

3. It is easy for me to remember how Sundache works.
[Mean = 4.67]

4. It is easy for me to understand the meaning of the interaction of Sundache (different lighting states).
[Mean = 4.42]

5. Overall, I find Sundache easy to use.
[Mean = 4.25]

Part 2. Useful of use

1. Using Sundache can help me get aware of my child(ren)'s feelings while quarrelling.
[Mean = 4.42]

2. I would like to decrease the frequency of quarrelling after knowing Sundache.
[Mean = 4.50]

3. Using Sundache can actually help me decreasing the frequency of quarrelling in front of my child(ren).
[Mean = 4.08]

4. Using Sundache can help me to enhance my relationship between my family members.
[Mean = 4.25]

5. Overall, I find Sundache useful when I'm quarrelling in the family.
[Mean = 4.17]

Part 3. Attitude towards Use

All things considered. The using of Sundache in my family is:

1. Bad = 1, Good = 5 [Mean = 4.42]
2. Foolish = 1, Wise = 5 [Mean = 4.42]
3. Unfavourable = 1, Favourable = 5 [Mean = 4.50]
4. Harmful = 1, Beneficial = 5 [Mean = 4.67]
5. Negative = 1, Positive = 5 [Mean = 4.58]

After analysing, I found all results are above 4, which mean a positive feedback from the users. Therefore I thought this product can probably do arouse the awareness of parents quarrelling in front of children. There are some people choose 3 on question "Using Sundache can help me to enhance my relationship between my family members.". This may because Sundache was not directly focused on enhancing relationship within a family. Overall this result was only based on 12 people which was not a large experimental population so it needed further research.

06. DISCUSSION

I got valuable feedback from the final demo day and the other evaluation questionnaire. So I will discuss some valuable points based on these evaluation.

1. Should I let the children know clearly they can use the toy to express their feeling towards their parents when quarrelling?

I had done some research to support my design, people tend to clench fists when they are nervous [13,14], and children will hug their toy if the toy is a big toy to them. So I thought it may be good for the children to unconsciously hold their toys because they would do so when they were afraid and nervous. Yet I thought afterwards that it may not work as useful as I explained the meaning of interaction with the toy to them. Therefore this could be a possible improve in the future. For example, designing a toy accessory like a lighting button or bracelets that can be attached to the toy and indicating the link to Sundache. This may help the children more to express their feelings directly to their parents through their toys. Besides, this probably can encourage them to actually express their feelings among their parents.

2. What about the quarrelling situation when the children is not at home? Maybe it should include two modes.

Since my project is mainly focused on the situation of parental quarrelling in front of children, I didn't want to add extra usage to blur my focus. However, if this product is going to be put into the market. Extra usage

should be considered to attract the consumers. This product can also be used to arouse general awareness of the bad influence of quarrelling among the family, because we are also hurting the person we are arguing to. Hence for further consideration, extra mode(s) can be input, for example, Sundache will give different changing when the quarrelling is happening between different family members.

Sundache still can be improved from a lot of aspects. What I wanted to do the most is to test the usefulness for children. Due to personal and time constraints, I could only did evaluation from the adults' / parents' perspective. The evaluation of the interaction for children was only based on theoretical studies. Another thing I wanted to do is to put the prototype into a real family to test whether this would work, because I know the user test results may be very different from what I expected in a real context. Furthermore, the current changing of lighting may be not as powerful as I wanted, a changing of shape may be more powerful and can catch their attention more. So the third iteration is carried out, I would like to focus more on the dynamic shape changing of the product. The last but not least, the technology part should be more solid, and I would focus more on it as well.

07. CONCLUSION / REFLECTION

Looking back to the beginning of this project, I can say that I integrate my vision and identity into this project a lot. Pushing myself to have a prototype in every iteration helps me understand the balance of making and thinking in design process. My vision on family re-bonding is greatly shown on the project. By wireframing quickly for each concept and asking feedbacks from experts, other students and stakeholders, I gain more experience in interaction design.

7.1. Competency Development

Design and Research Process, Creativity and Aesthetics and User and Society are three competencies that are developed most in this project. The studies such as the questionnaires and user interviews help me put myself into the users' shoes. It teaches me to design with the user by involving them proactively in the design process. Rapid iterations helped me to do in a design circle rather than a linear design process, this educated me that a good design needs several iterations to polish. Trying to make as many prototypes as possible gave me the chance to improve it step by step.

In addition, other competencies are developed throughout the whole design process. I continuously discussed my idea with my coach and other students showed me the importance of involving others' opinions to think from other perspectives. This also trains my skills on teamwork and communication. Coding the light strips and working on connecting them improves my practical skills on electronics. Analysing the

experiment outcomes with Excel and SPSS strengthen my skills in dealing with big data. At last, seeking knowledge proactively from the papers and research raised my awareness of self-directed and continuous learning.



7.2. Contribution from other learning activities

The research learning from my B2.2 research project teaches me about the way and the importance of researching. Different methods were used from my studies throughout this three years. My experience in the internship teaches me to seek for the details of the product, so I focused narrowly in this project and tried to go deeper in the topic.

7.3. Overall development as an industrial designer

This project contributed to my identity as a user experience designer in both practical level and research level. I learned to design simple and understandable interaction by reading papers and doing user tests to improve the product. I learned to run experiment to validate design assumption and therefore know what experience the design can deliver to the users. One of the things that I prefer to do in the future project is that I should conduct different activities in parallel. For example, I can conduct the evaluation activity and conceptualization activity in parallel to design the process itself to be more efficient. Skills on UX design and different researching methods are gained to support my future career as a user experience designer. From the learning in this project, I found myself like to dive deeper in the researching field of user experience and would like to conduct different experiments. So I decided to continue my master study in TU Delft to gain more theoretical knowledge in interaction design.

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Thank you!

10. APPENDICES

Family Communication 家庭间的交流

这份问卷是关于我今年的灯光交互毕业设计，请您抽出宝贵的两分钟时间帮我完成一份问卷！感激不尽！This is a study for my final bachelor project in the field of interactive lighting. I appreciate a lot for your kindly participation!

1.How old are you? 您的年龄段是？ *

- 16 - 25 yrs
- 26 - 35 yrs
- 36 - 45 yrs
- 46 - 55 yrs
- >= 56 yrs

2.Are you the only child in your family? 您是否是独生子女？ *

- Yes 是的
- No 不 我还有兄弟姐妹呢

3.Other than your family of origin (your parents and brothers and sisters), do you have your own new family (spouse &/ children)? 除去您的原生家庭（父母和亲兄弟姐妹）外，您是否有自己的新生家庭（配偶/子女）？ *

- Yes 有
- No 没有



4. When I'm at home, I always spend my time with my family members rather than alone. 当我在家的时候我总是跟我的家人呆在一起，而不是一个人呆着。 *

Strongly Disagree 非常不符合 1 2 3 4 5 Strongly Agree 非常符合

5. I think I have pretty enough communication with my family members. 我觉得我跟家人间的交流已经十分足够了。 *

Strongly Disagree 非常不认同 1 2 3 4 5 Strongly Agree 非常认同

6. I always get enough response when I try to communicate with my family members. 我跟家人沟通的时候总能得到足够的回应。 *

Strongly Disagree 非常不符合 1 2 3 4 5 Strongly Agree 非常符合

7. When I contact with my family, I don't really have something important to talk, I just want to know they are doing well. 其实我跟家人沟通的时候并不是有多重要的事要说，只是想知道他们过得一切都好。 *

Strongly Disagree 非常不认同 1 2 3 4 5 Strongly Agree 非常认同

8. Do you wish to have more communication with your family of origin? 您是否希望能跟自己的兄弟姐妹及父母间有更多的交流呢？ *

Strongly Disagree 非常不希望 1 2 3 4 5 Strongly Agree 非常希望

9. Do you wish to have more communication with your spouse and child(ren)? 您是否希望能跟自己的配偶及孩子间有更多的交流呢？ *

Strongly Disagree 非常不希望 1 2 3 4 5 Strongly Agree 非常希望

10. Do you prefer direct communication (instant two-way communication) or indirect communication (non-real time e.g. Facebook) with your family members? 在跟您的家庭成员交流时，您偏向于直接交流（有即时的双向对话）还是间接交流（不用即时反馈，比如朋友圈）呢？ *

Always Direct 总是直接交流 1 2 3 4 5 Always Indirect 总是间接交流

11. Did you try any methods to enhance the communication with your family? If yes, please tell me more in the blank line! 您是否有尝试过什么方法去提高家庭间的沟通呢？如果有，请在横线上简短说明谢谢！ *

No, I don't need it. 没有，我也不需要

No, but I want to. 没有，但是我想要这样做，只是还没找到什么好方法

其他:

12. Anything you want to comment? 如果您有什么想法和建议我会非常开心珍惜的！谢谢！

提交

Evaluation User Test - Sundache

I am a student from Department of Industrial Design, TU/e.

To support my design process and evaluate my product, I sincerely invite you to take part in my user test.

Please fill in this questionnaire and thank you for your participation! :)

Before fill in the questionnaire, please read the description of Sundache, and watch the demo video below.

Description of Sundache

Family is always the harbour for us to rest, but this harbour often experiences different types of thunderstorms which will break the harbour at the end. One of the common storms is quarrelling. Parents often arguing about trivial things, hurting each other's feelings and feel so bad afterwards. Quarrelling is always not their intention, but sometimes people just can hardly control their emotions.

When I was still a child, I felt so scared when my parents start quarrelling, all I could do is to run into my room and hold my teddy bear tightly. However, I want to give the children like my young self an opportunity to express their fear and interfere the quarrelling between their parents.

Sundache is a wall lamp to visualise emotions for a family. It is in a shape of the sun, which represents the family, shine for us and support us. Rays of light shine out with great brilliancy when the bonding in the family is close and strong. However, when quarrelling happens, the rays will lose their brightness little by little and the light will blink unstably. Meanwhile, when the child run into his room and hold his teddy bear tightly, the light will know. A crack will slowly grow onto the wall from the lamp indicating that the quarrelling is hurting this family silently. It's just like a wound which will form inside other's heart when you quarrel with each other. More cracks will grow if the quarrelling doesn't stop, and the more cracks grow, the longer time it takes for the light to turn back to the original bright state. Just like the wound in people's mind, the deeper the wound is, the longer time it takes to recover. Sundache is to remind and warn the parents when they want to quarrel, they are creating cracks in their children's hearts unconsciously.

Demo Video of Sundache



Part 1. Perceived Ease of Use

This part is about the ease of use of Sundache. The answer is scaled from 1 to 5. 1 means strongly disagree, 3 means neutral, and 5 means strongly agree.

I can understand clearly how Sundache works.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Learning to use Sundache is easy for me.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

It is easy for me to remember how Sundache works.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

It is easy for me to understand the meaning of the interaction of Sundache (different lighting states).

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Overall, I find Sundache easy to use.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Part 2. Perceived Usefulness

This part is about the usefulness of Sundache. The answer is scaled from 1 to 5. 1 means strongly disagree, 3 means neutral, and 5 means strongly agree.

Using Sundache can help me get aware of my child(ren)'s feelings while quarrelling.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

I would like to decrease the frequency of quarreling after knowing Sundache.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Using Sundache can actually help me decreasing the frequency of quarreling in front of my child(ren).

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Using Sundache can help me to enhance my relationship between my family members.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Overall, I find Sundache useful when I'm quarreling in the family.

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Part 3. Attitude towards Use

All things considered. My using Sundache in my family is:

	1	2	3	4	5	
Bad	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Good
	1	2	3	4	5	
Foolish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Wise
	1	2	3	4	5	
Unfavorable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Favorable
	1	2	3	4	5	
Harmful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Beneficial
	1	2	3	4	5	
Negative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Positive

This is the end of the questionnaire! Any other remarks?

您的回答

Appendix C: Code of Light Strips

```
#include <Adafruit_NeoPixel.h>
#ifdef __AVR__
  #include <avr/power.h>
#endif

#define PIN 6

void setup() {
  #if defined (__AVR_ATtiny85__)
    if (F_CPU == 16000000) clock_prescale_set(clock_div_1);
  #endif

  strip.begin();
  strip.show(); // Initialize all pixels to 'off'
}

void loop() {
  colorWipe(strip.Color(255, 0, 0), 50); // Red
  colorWipe(strip.Color(0, 255, 0), 50); // Green
  colorWipe(strip.Color(0, 0, 255), 50); // Blue
  theaterChase(strip.Color(127, 127, 127), 50); // White
  theaterChase(strip.Color(127, 0, 0), 50); // Red
  theaterChase(strip.Color(0, 0, 127), 50); // Blue

  rainbow(20);
  rainbowCycle(20);
  theaterChaseRainbow(50);
}

void colorWipe(uint32_t c, uint8_t wait) {
  for(uint16_t i=0; i<strip.numPixels(); i++) {
    strip.setPixelColor(i, c);
    strip.show();
    delay(wait);
  }
}

void rainbow(uint8_t wait) {
  uint16_t i, j;
```

```

for(j=0; j<256; j++) {
  for(i=0; i<strip.numPixels(); i++) {
    strip.setPixelColor(i, Wheel((i+j) & 255));
  }
  strip.show();
  delay(wait);
}

void rainbowCycle(uint8_t wait) {
  uint16_t i, j;

  for(j=0; j<256*5; j++) { // 5 cycles of all colors on wheel
    for(i=0; i< strip.numPixels(); i++) {
      strip.setPixelColor(i, Wheel(((i * 256 / strip.numPixels()) + j) & 255));
    }
    strip.show();
    delay(wait);
  }
}

void theaterChase(uint32_t c, uint8_t wait) {
  for (int j=0; j<10; j++) { //do 10 cycles of chasing
    for (int q=0; q < 3; q++) {
      for (uint16_t i=0; i < strip.numPixels(); i=i+3) {
        strip.setPixelColor(i+q, c); //turn every third pixel on
      }
      strip.show();

      delay(wait);

      for (uint16_t i=0; i < strip.numPixels(); i=i+3) {
        strip.setPixelColor(i+q, 0); //turn every third pixel off
      }
    }
  }
}

void theaterChaseRainbow(uint8_t wait) {
  for (int j=0; j < 256; j++) { // cycle all 256 colors in the wheel
    for (int q=0; q < 3; q++) {
      for (uint16_t i=0; i < strip.numPixels(); i=i+3) {
        strip.setPixelColor(i+q, Wheel( (i+j) % 255)); //turn every third pixel on

```

```
}
strip.show();

delay(wait);

for (uint16_t i=0; i < strip.numPixels(); i=i+3) {
  strip.setPixelColor(i+q, 0);    //turn every third pixel off
}
}
}
}
```

```
uint32_t Wheel(byte WheelPos) {
  WheelPos = 255 - WheelPos;
  if(WheelPos < 85) {
    return strip.Color(255 - WheelPos * 3, 0, WheelPos * 3);
  }
  if(WheelPos < 170) {
    WheelPos -= 85;
    return strip.Color(0, WheelPos * 3, 255 - WheelPos * 3);
  }
  WheelPos -= 170;
  return strip.Color(WheelPos * 3, 255 - WheelPos * 3, 0);
}
```

Appendix D: Link of Demo Video

<https://youtu.be/w1WGa5ILK6I>