EmotiCom

Connecting families

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Vital Change

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DPB100 Project 1 Design

Dear reader,

This process has been proudly executed and documented in this report by four first year bachelor students form Industrial Design.

This report includes all information you need to know about our Project 1 in the context of Vital Change.

Our coaches gave us great insights into design processes and developing the right design attitude. Thankyou Jim Steenbakkers and Joost Liebregts for making this possible.

Kind regards,

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"Because of better than ever living conditions, a large group of people can reach a higher age. But how can we stimulate this group of people to be more active and work on a healthier lifestyle so they are able to reach this higher age? "

The increasing availability of digital technologies can support living longer and healthy in-home environments. New products and services based on advanced digital technologies are available now to support people to remain physically active and socially connected.

What kind of solutions are needed to help citizens to achieve a healthier lifestyle and use technology for achieving this in a not obtrusive way?"

We decided to approach this description from a more social side, in an environment in which the elderly and younger people in a family have distanced themselves from each other, and have very limited possibilities to improve the communication via enhancing sociability.

People are getting older and older. However, with this old age comes not only a decline in people's physical health and abilities, but also a decline in the amount of social interaction they have. In many cases this results in elderly people becoming lonely. Which at its turn not only negatively influences people's mental but also their physical wellbeing.

More than 40 percent of seniors regularly experience loneliness, according to a University of California, San Francisco (UCSF) study. Over half (51%) of all people aged 75 and over live alone (Office for National Statistics 2010. General Lifestyle Survey 2008).

Lacking social interactions and thus loneliness increases the mortality rate by 26%. Research has linked social isolation and loneliness to higher risks for a variety of physical and mental conditions: high blood pressure, heart disease, anxiety, depression and in the most extreme cases even death.

Target group

Inspired by the problems surrounding loneliness amongst elderly people and the significant part of the population that consists of these people we decided to focus on these people as our target group. More specifically, our target group consists of elderly people who have trouble using modern day technology. Since the usage of this technology, being for instance a smartphone, would allow elderly people to connect with their loved ones more easily. In addition, we focus on elderly who don't see their loved ones that often, as this seem to be the main reason for loneliness.

Our design

It is our ultimate goal to enhance sociability in between families, as we believe the growth towards a more technologically advanced society and the busy times we live in has a negative influence on the connection between elderly and their loved ones. We want to create a device that is able to create this conscious moment in which the elderly and their loved one can show they think of each other and let them know they're not alone. Our design, EmotiCom is a device which sets up a fun and loving photo-communication in between families, in combination with an app which can be downloaded by the younger generations to respond to the elderly. We believe that lowering the bar, in terms of communication of emotion, will help elderly people start a conversation by being honest about how they are feeling, and this will provoke others to respond and make the elderly feel more heard and understood.

Our group

As a group we have different goals for this project , but we strive to give each other as much as freedom and possibility in achieving one's own goal and hence achieving the project goal by implementing the works done on our goals. Even Though we faced a few problems at the start , we overcame them by trying to communicate our opinions with each other and hence we completed our project smoothly. With time each of us started to take the criticisms more as a learning experience and asset rather than a mistake. Each of us worked on various expertise areas such as creativity and aesthetics, technology and realization , business and entrepreneurship and aimed to strengthen them and also learnt from the other group members. Each of us motivated each other to be organized and put in their best and by doing so we grew individually as well as a team.

The coronavirus stimulated us in showing our creativity and adaptation-skills. This was done by looking for more online ways to communicate, generate and share ideas. Online platforms as Miro, TinkerCAD and Instagram were applied in order to reach our goal, which eventually have proven to be smart, easy, and served a great purpose of creating a strong concept.

Our process

For this design process we strive towards a clear and flexible structured way of going through the process. Therefore we chose to follow a structure which quickly goes through a full design process in just a couple of weeks. Starting with research and ideation, followed up by conceptualization and eventually validation. Depending on developments made, this process can be adjusted. By quickly going through the process, we were able to keep on iterating, and be able to reflect on our process later on.

Our design process was aimed at a structured way of going through the process, that also has room for flexibility and adjustments, depending on developments made. Each step in the process should give new insights and provoke development, after which we would reflect on the current process to improve the efficiency. The table below shows the five phases, with their according descriptions and what kind of stages a specific phase contains.

Five phases	What is the phase about?	Stages (in chronological order)
1. Pressure cooker	This phase was executed the first week, in which we had one week to go through a whole design process. This helped us to select our target user and start with the initial concept.	*Research* *Ideation and conceptualization* *Prototyping* *Validation*
2.Adding color	In this phase the main starting point was developed for our concept. The gathered ideas will be narrowed down and validated afterwards	*Research* *Ideation* *Validation*
3. Adding shape and introducing simplEmotion	In this phase an idea was broadly conceptualized by adding another channel to communicate emotions. This was mostly aimed at creating a concept for the mid-term demo day.	*Research* *Ideation and conceptualization* *Prototyping* *Validation*
Mid-term demo day		
4. Facial expression and color	The facial expression phase, in this phase the feedback received from evaluation and coaches and peer reviews were organized and analysed. Eventually the chosen path was tested with users and eventually conceptualized.	*Evaluation* *User tests* *Ideation and conceptualization*
5. Redefining essence	There were a couple of problems regarding the current design. By going through a lot of iterations, the essence of our product was lost along the way. This phase was aimed at revisiting our essence, coming up with a strong concept and validating it once again.	*Evaluation* *Research* *Ideation* Prototyping (concept will be explained in 'Final Design: EmotiCom') *Validation*
Final design: EmotiCom		
Final demo day		

Table 1 – Overview of the process we went through

Pressure cooker

The project started out with walking through a full design process in just one week. This so called *Pressure Cooker* had the goal to make quick design iterations by going through a process of discovering your target user, developing a design problem, finding solutions and conceptualizing them, making a prototype and eventually evaluate this design.

While discovering the target user, we decided to focus on elderly. The design problem we came up with was: many elderly suffer from loneliness, due to their loss of mobility, of lack of understanding of modern technology which has a negative impact on both their health and social life.
Due to the elderly's loneliness, we assumed elderly felt like they lost their purpose in life and that bonding with their family and loved ones could fulfil this purpose. Furthermore, the problem we stated was that elderly would feel burdened when trying to communicate their emotions to family.

After having defined the problem, we brainstormed about possible solutions. To focus our design, a persona called *Henk* was created. This gave us the ability to better imagine their values and preferences.
After starting with an *iPad* as an initial shape, a lot of ideas were discussed. These were evaluated and clustered accordingly. In the end we thought of the idea of a so called 'Social Box', which was connected to an app. The elderly can press three colored buttons on the box that would represent his or her emotion, which would be sent to the loved one's app. The loved one can respond with an image that would be presented on a small screen on the front or with the *Galaxy* button. This would project a sky full of stars from the projector to give the elderly a sweet and comforting feeling. This product would enhance sociability between family members and make the elderly feel less lonely.

A lo-fi prototype was created to eventually be used for evaluation. The prototype was made out of six foldable black painted cardboard parts. The front was later painted with three colors and a half sphere was placed on top to represent the projector (figure 1). The goal with this prototype was to explore sizes and show the concept in a context. A technical prototype was made to give the user more insight into the inside of this concept. Three LEDs were programmed to be lit up individually once the corresponding button was pressed (figure 2).
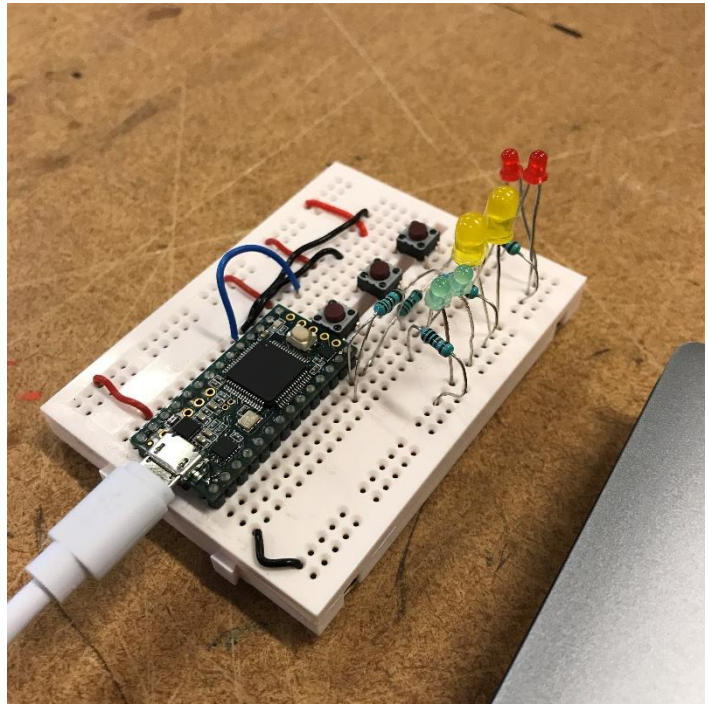
Figure 1 – The physical prototype

Figure 2 – Our technical prototype

The evaluation was performed (figure 3) according to the following setup:
The user was asked to perform to execute a task.
Via the think-aloud technique certain problems or actions were registered.
Afterwards a conversation will be held to get more extra feedback

The goal was to find out of the evaluation is to see how people interact with the product, how they experience it and if they think it'll be useful for our target group. Therefore the conversation revolved around pre-set usability and UX goals and research questions.

However, the shape needs some more refinement and the three provided colors are just too vague to be able to explain your emotions.
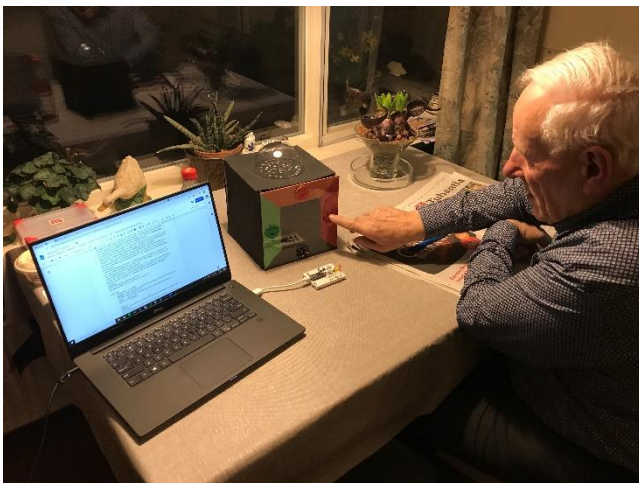

Figure 3 – User test with Timo's grandfather

Adding color

Because the main part of our pressure cooker design was communication via color, which in its current design was not positively received, we decided to declare a whole phase of doing research and ideation fully dedicated to communication via color. The box designed in the pressure cooker was left for what it is, as we first want to do research on possible ways of communicating emotions, before designing a shape around it. The goal is to find out to what extent colors are accurate enough to visualize emotions.

Research

The research included multiple elements: research on what effect color has on emotions and how emotions can be communicated. The communication on the effect of light/color and emotions was mostly focussed on color only (Color Psychology) [1], as color is a part of light and whatever channel we use to apply color, wouldn't matter that much. The results:

- Great difference between warm and cool and bright and dark colors (in respect to arousal response)
- Some colors could summon sad feelings, while others could stimulate buying choices.
- Some colors have standard associations but they seem to be different for most people.
- Color hue, which most people associate with 'the color' is the overall name. However, the value (brightness) and chroma (saturation) have a way greater influence on emotion.
- An interesting theory was the Associative Network Theory (Bower 1981). He described that emotion association was based on: the emotion itself, sensory experience and semantic meaning. The greater the similarity, the greater the connection. All this is based on experience. New nodes arise with new experiences (e.g. if someone gets hit by a blue car, he automatically has a more negative association with the color blue).

Ideation

In order to apply color to our design, a first phase of exploratory sketching was conducted. The goal of this session was to see if we could find an application of color which could be used to test the appropriateness of color. The final outcome can be seen in figure 4.

Validation

To validate the application of color, a user test was conducted within our own group. The foam parts on figure 5 were used to test the appropriateness of color to communicate emotions as they had different shapes and colors. The setup:

> After a member was told an emotion, this member should choose the foam part that would best represent this emotion according to them. Another member should guess what emotion he or she is trying to show.

We learned that some colors such as blue were often linked to sadness and red to anger. Other color often had different meanings to everyone. The shapes were often not representative at all, but gave people the feeling they were able to communicate their emotions better. Lastly, there was no way of showing a gradient of your emotion.

Our findings are that colors are broadly applicable, but a possibility of adding a gradient to the color needed to be added. Thereby, even though the current application of shapes were not representative, it is worth looking into for possible other types of applications.
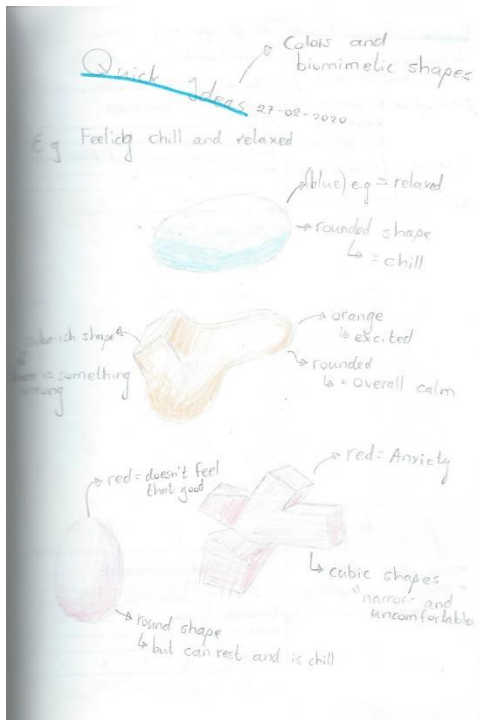

Figure 4 – Session of exploratory sketching

Figure 5 – The toys used for validation

Adding shape and introducing simplEmotion

Also here, the phase started with a new round of research. This time into shapes and emotions to see if there is a possible link. The goal of this phase was to find out to what extent shapes can be applied to communicate emotions and how these can be combined with color.

Research

The research aimed at trying to find a link between certain emotions and different shapes.

Ultimately, documents about biomimetic shapes were found[2], which described shapes that mimic certain shapes that are visible in nature. Products should provide smart functionality, ergonomic satisfaction and provoke emotional response. The investigation as described on this page revolves around three kind of shapes: human contours, plants and humanoid faces. See Appendix A for an overview of the tables. The results:

- For every shape, a greater abstraction has proven to give a greater emotional response, regarding pleasure and arousal.
- However, if shapes would become too concrete, the response would decrease, except for humanoid contours.
- The overall greatest reaction in arousal and valence came from human contours. This shape has a contact increase of emotional response when being more concrete.
- Still, the shape labelled as 'most concrete' still seemed like 'semi-concrete' shapes to us.

As a result, we concluded the used shape in our design should revolve around semi-concrete human contrours, as these are proven to be the most efficient. The assumption was made this response would also work the other way around; if human contours provoke emotion, it should also be the most effective to translate your emotions into.

Ideation

Another session of exploratory sketching was arranged. The goal was to find an application of humanoid contours which would be able to communicate emotions in combination with color. The drawing on figure 6 seemed the most interesting and we saw great potential.

This puppet needs an additional device that reads the shape and can send this message to others. Everyone drew 5 ideas regarding the combination of the humanoid puppet combined with their interpretation of how this 'device' should look like, which were broadly discussed. For an example, see figure 7.

As a conclusion, the decision was made to make a rectangular base in which a projector, adjustable sliders to select color and some buttons to respectively select colors and confirm you want to send this shape with corresponding color.

Another brainstorm session was arranged for the other end of the communication. Aside from the physical device, the loved ones needed to be able to respond. Eventually an app was chosen as the loved ones in the family are from younger age, which would mean they would most likely already be used to working with an app.
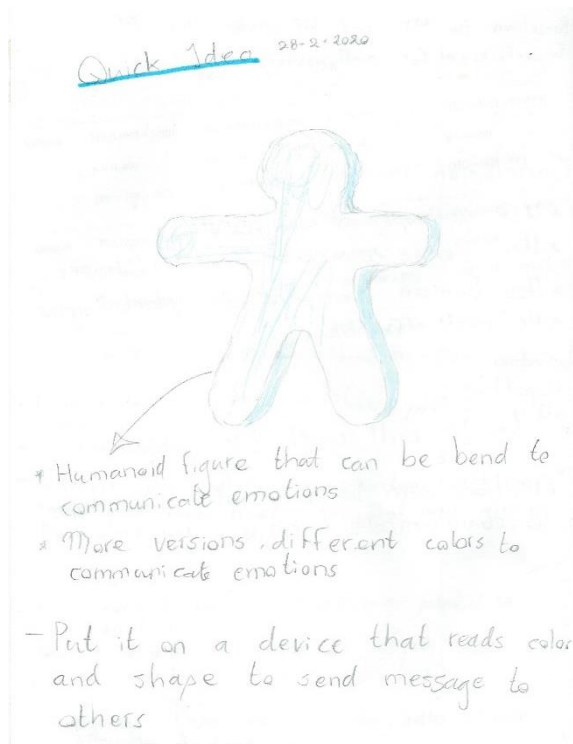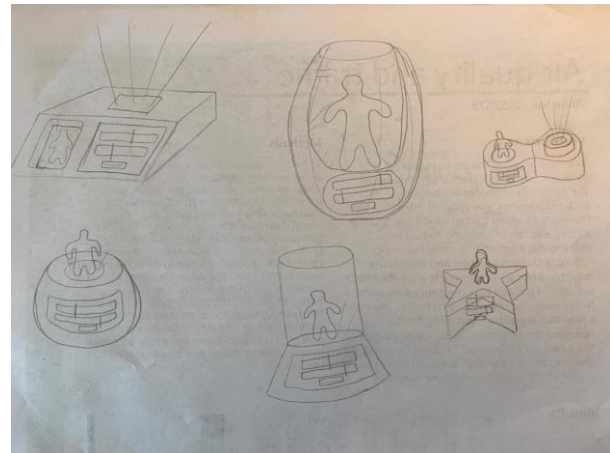
Figure 7 – Exploratory sketching session for the base

Figure 6 – The application of shape

Conceptualization of simplEmotion

The current concept was the following. We came up with a design which allowed elderly people to improve their communication with their loved ones, by lowering the threshold of communicating their emotions. The concept existed of two elements: a physical device for the elderly and an app for their loved ones.

The physical device constisted of a tangible aspect, being a small puppet, which would provoke using it. Its shape and therefore body language could be changed by the user to represent how they were feeling at that time. This puppet would afterwards be placed on a rectangular base which had various other functions. The additional selection of a representative color to fit the same emotion by moving sliders was one of them. This was the core of our concept: communication via colors, accompanied with an adequate chosen body language.

We devised the system in such a way the user could choose a specific color and color brightness to visualize emotions and the puppet would light up in this color with the chosen intensity.

The other end of the interaction, the app-users, could respond via an app which had various options: sending back an image, a voice memo, or virtual hug. The image sent via the app would be projected by a projector on the side of the physical device the and the voice memo could be played over the speaker. A sent virtual hug could be experienced by the elderly by picking up the puppet and feeling it vibrate.

A projection on the wall would give the elderly a comforting and loving feeling as their loved ones feel closer. The same goes for the voice memo. The virtual hug is another way of showing the elderly they are being thought of and understood. The ultimate goal is to make elderly and loved ones happy by improving their social connection.

Prototyping

Two lo-fi prototypes were created. The puppet prototype was made from a soft foam material (figure 8). A metal-wired skeleton was placed inside of the puppet to be able to bend it to a specific shape as visible on figure 9.

The base was made from cardboard based on a measurement sketch drawn earlier (figure 10). The goal of both of these prototypes was to make them useful for evaluation in which the user was able to handle the puppet and get a clear overview of the dimensions.

Figure 8 – The puppet itself
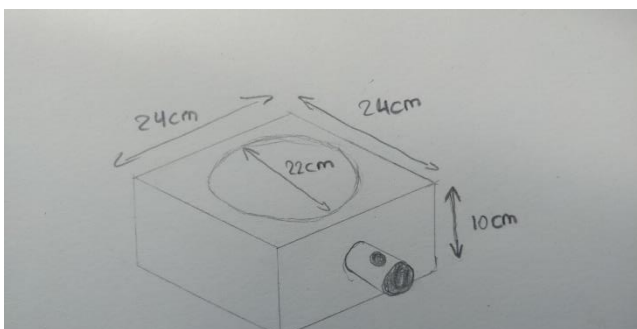

Figure 9 – The skeleton of the puppet

Figure 10 – The sketch of the base

Figure 11 – The base prototype
Note: This is still in vertigo due to the corona outbreak and could not be used for evaluation

Validation

To validate the current design, a user test was conducted among six people from our target group. As the corona virus' presence was increasing, we struggled with finding target users. To respect everyone's health, user tests within our own family or via facetime. Persona's representing the target user were applied, to try and approximate our user as great as possible, so the eventual results will focus more on the values and preferences of our target group. This was the setup:

> *The user was asked to perform a given task.*
> *Via the think-aloud technique we wanted to try and understand the users thought-process, which would be a*
> *Via the critical-incident analysis possible flaws or other important happenings were analysed.*
> *After that a question and feedback round was proposed to the user to get more feedback on the design.*

We learned that the users find it overall pretty hard how to translate their feeling into a specific body language. Even though the general emotion was often recognized, it's context was lacking. The color seemed like a great way of expression emotions, but was interpreted different in some cases. The overall design looked appealing to most people and the goal of the concept was positively received.

One evaluation pointed out the arms needed to be longer in order to give more meaning with body language. This last part was taken into account for prototyping for the mid-term demo day. However, four of the six evaluations told us they did not really believe in this concept regarding the puppet. It was simply too hard to use and they did not know how they could communicate their emotions into shape.

We will go on with the current design and after the midterm demo day we will incorporate the received feedback.

For the midterm demo day, simplEmotion was prototyped. First, it was considered how to show all the unique aspects that needed to be emphasized according to the prototyping triangle model (Houde & Hill, 1997). See figure 12. The technical equipment need to make this prototype were to advanced to make with at-home equipment, because we wanted to show all elements of this prototype in high-quality. Via this model we learned how to abstract our final design and transform it into a presentable concept and your prototype could be used to show a part of your concept instead of the whole. In this we saw potential to make a digital prototype in *Blendr*, an online 3D-modeling software program (figure 13 and 14).
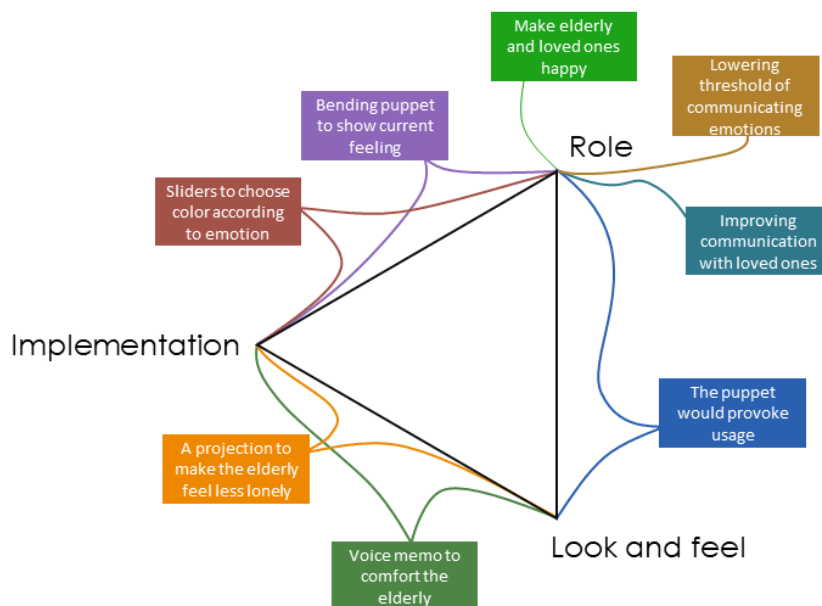

Figure 10 – The most essential and unique aspects of simplEmotion categorized in Houde & Hill's prototyping model (1997).

It helped us how to make decisions on what parts are important and how to divide them over the different media that were available for the demo day: prototype, poster, video and pitch, which could eventually communicate all these aspects. As an example, the video displays the functionalities of the concept and creates a happy feeling with its up-time and fun music, as well as what the problem is we're trying to tackle (figure 15 and 16). The next table shows the available media and their purpose of simplEmotion (table x).

The link to the video:

https://www.youtube.com/watch?v=NRaqHvup6Xs

Video	Prototype	Poster	Pitch
The overall applications of the device and the app. It emphasizes the problem statement and the positive role the concept can have on the elderly's life.	The look of the whole physical device and the app, with high-quality renders with different body positions, colors and angles.	To give an overall overview of the problem statement, our solution, and how it works. (Appendix B).	To address the benefits of simplEmotion over the current technologies out there such as mobile phones. State why our product is so important by addressing the problem statement once again. Additionally, explain all features to sustain our design choices.

Table 2 – How all aspects are divided over the possible media

Figure 13 – The digital prototype as seen from the right
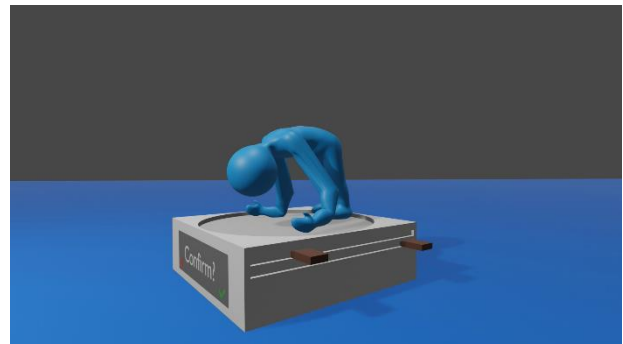

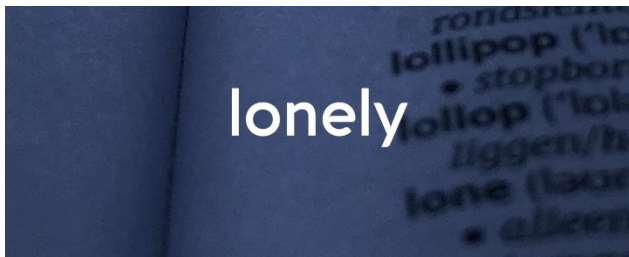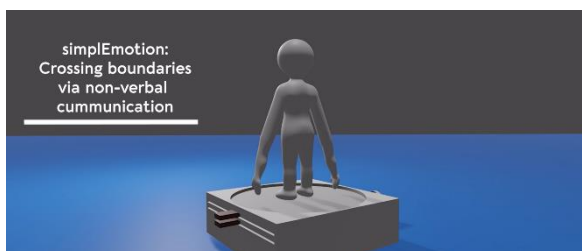*Figure 14 – The digital prototype with a different body language and color*

Figure 15 & 16 – Still from the midterm demo day video, displaying possibilities and the problem statement

Facial expression and color

Evaluation

The feedback that we started to evaluate after the midterm demo day came from our coaches and peers. However, this feedback also pushed us to look into the feedback we got during earlier validations we performed. All feedback was analysed by the means of an online affinity diagram in Miro: https://miro.com/app/board/o9J_ktUccNk=/.

An application discovered when looking for new online methods. This application gave a great overview of all problems or good points of our design. The user test evaluations weighed more, as the peer reviews are opinions, whereas the users really tested and saw the product.

One of the most heavy decisions was to fully eliminate the use of the puppet. We do recognize the fact this is a hard and tough decision to make, however we do believe this concept deserves a better medium to communicate emotions. There are a couple of reasons:

The puppet was too hard to use
It clear how to translate emotions into shape
Having a sad puppet in your room could negatively influence your mood
There were other more suitable options with more potential.

A suitable options, as found by analysing the feedback, was the application of facial expression. Facial expression is pancultural (Izard, 1980) and therefore assumed to be more universal to apply than body language.
We thought this was an interesting take and decided to dive further into this application.

The second part of the design that was changed was the color selection. The unlimited range of color selection was narrowed down to the colors of an emotion classification model[3] as proposed by Psychologist Robert Plutchik (1980) (figure 17). Colors are linked to specific emotions which would eliminate misunderstandings. The speaker was eventually left-out as facial expression in combination with a voice memo is close to a phone-call. An option that would therefore be redundant.

Figure 17 – Robert Plutchik's wheel of emotions (1980).

User tests

At this moment there are two assumptions made:

That facial expression has a better emotional recognition rate than the puppet does

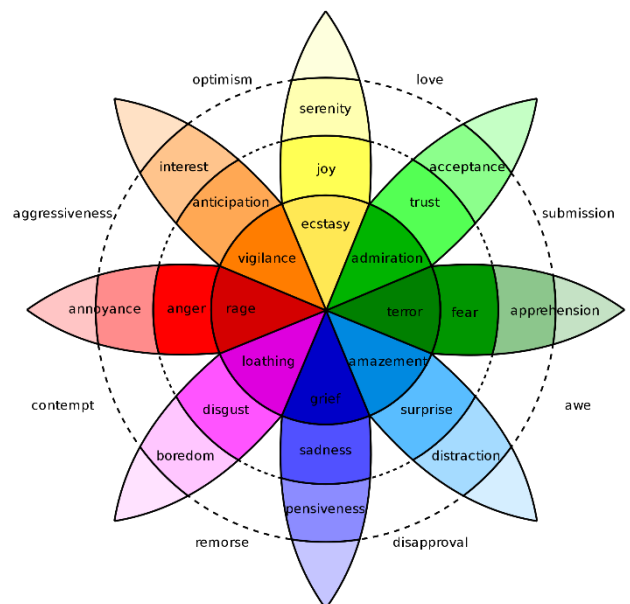*As assumed in the previous concept, elderly felt burdened when trying to communicate their emotions directly*

The second assumption would mean the elderly felt uncomfortable when taking a natural image of their face. After a round of brainstorming, two other abstractions were chosen:

Triangulated (as seen by low-poly art)
Animated (inspired by Apple's Animoji)

Accordingly two different types of user-tests were developed, which will be summarized in the table below. See https://forms.gle/Uofo6ArYdrUa6zB39 for an example of the questionnaire executed by every individual in the group.

	An online questionnaire	A personal interview with the target user
Amount of participants	309	6
Goal	Validate the assumption made that facial expression has a higher emotional recognition rate than the puppet.	Validate what type of visualization elderly would feel most comfortable sending.
Setup	18 questions in which a face (visualized with one of the three renders: normal, triangulated or animated) was shown. The user choses the most appropriate emotion.	Personal interview in which elderly had to take three pictures (each with different visualization) of themselves. A conversation was held about what they feel most comfortable with and why.
Distribution method	Instagram stories	In person. If not possible, via facetime or a call.
Analysation method	Python (from the course Data Analytics) (see Appendix C).	Critical-incident analysis and finding trends.
Results	• No differences between genders • Overall accuracy* was around 80% for the natural image, and around 60% for the other types. • Big deviations in accuracy arise among emotions.	• Elderly preferred the natural image over the other visualisations. • They felt alienated from themselves when seeing an abstraction of themselves.
Findings	Facial expression is indeed more accurate than body language of the puppet. The natural was the most accurate. Emotions had biggest influence on accuracy.	Elderly will feel most comfortable with sending a natural image.
Final demo day		

**Accuracy is defined as the amount of good given answers divided by the total amount.

Table 3 – An overview of the conducted user tests

Ideation

To accommodate the application of facial expression, the old rectangular box design did not quite fit the concept anymore. With the help of TinkerCAD, we were all able to 3D-brainstorm as a group and easily communicate our ideas with our renders. See figure 18 for the result.

By doing an initial round of prototyping, we were able to explore the movability of the current design (figure 19) and see what features need to be added or left out. The result was that the bottom panel was redundant, as it made the whole design less tangible and it was not vital for any component to be present.
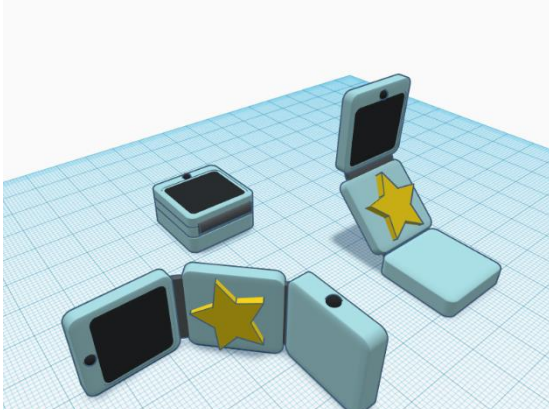

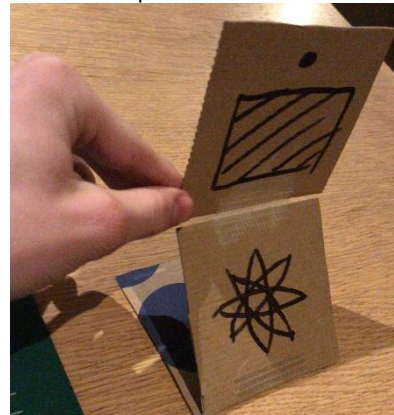*Figure 18 – The result from the first ideation session in TinkerCAD*

Figure 14 – The lo-fi prototype to explore movability

A second round of online ideation on TinkerCAD was arranged. New designs were made based on two panes instead of three. The focus here was more on the actual interface (buttons, or other control elements). We wanted to keep the option of personal preference regarding the rotation and tangibility.

Conceptualization

The concept can be seen on figure 20 and works as follows: By folding the device open, the elderly can get real-time feedback on their facial expression via the screen. A colored overlay can be added to clarify the emotion by rotating the wheel in the middle for the color hue and rotating the small cylinder on top for color value. The associated emotion, based on Plutchick's wheel of emotions (1980) will be shown on the bottom of the screen. By clicking the buttons on the side of the screen the elderly can choose a contact to send the image to. By rotating the device to an iPad-like shape. The elderly can view received messages from their loved ones on the screen. By closing the device, it will be in silent mode.

Figure 20 – The current concept design of simplEmotion

Redefining essence

Evaluation

The essence and the main feature of the current design, the tangible and rotatable device, had to be rethought. Our target user is someone that has troubles using modern day technonlogy and designed a device that has the look of a tablet or a tablet, which is kind of ironic.

Defining the main goal of the display to be connection with family in a fun and loving way to make elderly feel happy made us rethink the possibility of adding the projector once again.
We brainstormed what projectors are better at doing than a small screen and their differences, to reassure ourselves why we wanted to use it in the device. While brainstorming we realized the strongest aspect of the projector is that it can be projected on a wall, and can be looked at from many perspectives. This is what makes the elderly feel accompanied, with as goal to make them feel happy. As we focused on communication. The new name *EmotiCom* was chosen.

Ideation

A new technique called the Crazy 8 (Appendix D) was used, to explore possible shapes and division of the current aspects of the design. We did not apply this before, and we wanted to get more skilled in the ideation possibilities. This techniques allowed us to quickly generate 32 ideas in just 8 minutes. Eventually the idea of a physical contact list was invented and was later on refined so it would fit the design. We wanted to represent older technologies in the design as these are more familiar to them and we think it's going to stimulate the elderly's happiness. We were inspired by the idea of a polaroid camera and a projector.
After analyzing the arisen issues and possible improvements we concluded what features need to be included in the next and final concept (table 4).

Feature	Purpose	Goal
Color selection	Clarify emotions	Make elderly more open towards communicating how they feel with the family
Screen	Real-time feedback on your facial expression	Make elderly comfortable with what they are sending
Projector	Project the image sent by the loved one on the wall of the elderly.	Make elderly feel accompanied and happy because of the connection with the family. The ultimate goal is to make them feel less lonely.
Camera (and button)	To take a picture	Capturing the facial expression
Physical contact list (cards)	The elderly can select a family-member card depending on who they want to communicate with	Give the elderly a sense of the older technologies and make it more understandable and fun to use.

Table 4 – The overview of all aspects of the physical prototype with their purpose and goals

Via Multiple sketching iterations (Appendix D) brought us to the final design that can be seen on figure 21.
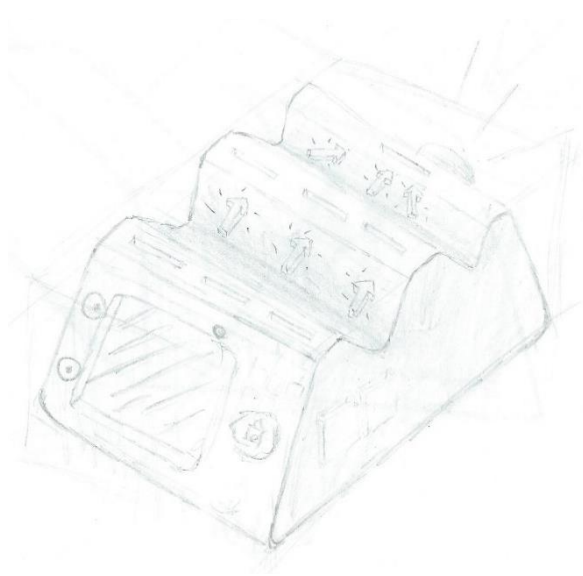

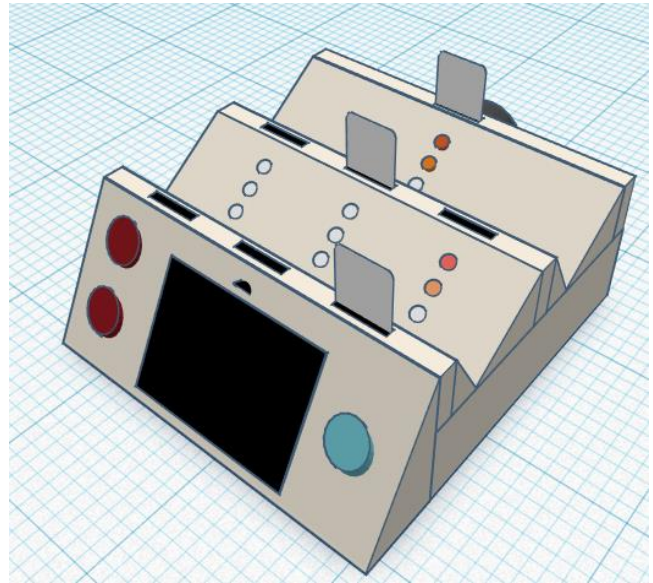Figure 21 – The current design sketch for the physical device

Figure 22 – The TinkerCAD model of the current concept

Prototyping
Aesthetics
We started thinking how we possibly could realise the design we had in mind. While creating a final building plan, we valued the pros of making a low fidelity prototype. We looked at how the video, the poster, the prototype and the pitch could make one total story, so the prototype could miss some of the main elements we wanted in our design. Here, we turned our weak points into our stronger points.

Before starting with making the shape of the prototype, its final shape was made in TinkerCAD so we could evaluate and improve its real life dimensions (figure 22).

The building plan is as follows. We started of by taking a piece of MDF wood and drawing all the needed shapes. All these shapes were cut out by using a jigsaw. This was the most accurate equipment we could use, as we had no other professional tools. Holes were drilled in the top wooden pieces to make card-slots and in the front for the sensors used. All wooden pieces would eventually all be glued together and sanded to make everything smooth. Multiple layers of vintage-colored paint were added to give the prototype a professional look and try to show its eventual aesthetical presence as good as possible. Stickers would be used to make the color selection and a black piece of plastic would represent the screen. The projector was represented by a black cap.
The prototyping phase did not go as planned. Every single piece of wood needed to be eventually sew again on a slanted angle, so every piece of wood can be placed on eachother. The jigsaw was not very accurate which eventually did not create a tight fit of all the pieces at all. This was solved by using an explanding glue, which filled up all the gaps. See Appendix E for the whole process.

Technology
To communicate certain possibilities this concept has, it was decided to make a technical prototype as well which would partly fit inside of the design. Multiple elements were used and programmed:

    Two NFC chips and three RFID cards
    Electronics as 8 LEDs, potmeters and a buttons.
    Two laptops

In processing a code was used that would show the webcam output of the laptop, together with a colored overlay to mimic the screen. In combination with the Arduino programming language the color of this colored overlay can be altered to any color the user prefers. The associated emotion will be shown on the bottom of the screen. See the output under Appendix F (figure 47 and 48).
When a card is inserted, the user can press the button to take a picture. Depending on what card is in the slot, the image will be saved under a different name.
The projection part was created somewhat the same on another laptop. There were three pre-placed images in the dataset of the code. Depending on what card was placed, one of the three images would be shown on the laptop screen to mimic the projection. The LEDs were programmed in an alternative code that could be used to be shown in the video. The programmed code of the first part can also be found under Appendix F. The second part was left out as it used the same base code.

Validation

In order to get an interpretation of the effect and influence our device has on elderly and if it would work, we wanted to do a user test on the visual presence of the elderly's loved ones in their home. To respect everyone in these hard times, user tests were performed among the elderly in our own family. It was a four-day user test in which the first two days the elderly were given a questionnaire (online or on paper, depending on their competencies) with questions regarding their daily experiences. Without them knowing, a framed picture from one of the interviewees (from the same family) was handed over to the family or sent online if necessary. This image should represent the projection of the projector. A similar questionnaire with two additional questions was sent out the last two days. See: - https://forms.gle/im6bC3EXjJ68ZUj77 for the first questionnaire and https://forms.gle/CHGrZd2BBAUGEnpdA for the second one.

The goal was to find out if receiving such a personal image would have a positive influence on their day and why. As it would be too complicated to receive signatures for every questionnaire, we decided to add a small paragraph at the beginning to which they could agree by checking the box.

The results were clear and impressive. A visit from a friend or family member was often given as one of the best things that happened that day. However, it was also often mentioned that they missed talking to their grandchildren or that having that 1.5 meter distance was very hard for them.
This verified our stated assumption that one of the elderly's priorities is communication with their loved ones. In one hundred percent of all the user tests, receiving such a personal image has been proven to have a positive influence on the elderly's day. This has proven that the possibility of our product having positive effects on the elderly's happiness will be from great influence.

7 Business model

A business model was created as it will be needed when bringing a product on the market. The model can be viewed in figure 23.

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENT
1) Manufacturers within the company to produce the necessary circuits 2) Suppliers who provide the manufacturers with the necessary components such as NFC chips, LED's, pot meters, buttons, screens, cameras, projectors. The necessary material for the outer look 3) investors who sponsor and invest money in the product for its launch and marketing	1) Creating circuits which connect NFC chips, the screen, various buttons the LED's and the projector 2) Attracting investors and later on customers with a Promotional video 3) Improving relations with partners and suppliers	We want to help connect families to maintain the relations. Helping the elderly who are not familiar with modern technology to be able to communicate with their loved ones without hesitation of ruining others moods. This provides the loved ones to maintain relations with their grandparents which have been reduced nowadays and help the elderly to feel loved and cared for.	We aim to achieve the trust of our customers as this product is related to one's emotional well-being. The elderly expect us to help them maintain their emotional well-being and to be able to assess them when issues with the product arise. The younger generations want to send their message across with an easy functioning app which provides service and feedback Most importantly work for a long lasting relationship between customers.	We are creating value for older family members that have lost connection with their family, but also for the other family members as they will improve the happiness and sociability of their loved ones. Our most important customers are the children and grandchildren of those elderly.

COST STRUCTURE
 	
Cost for manufacturing the product:
1. Cheaper materials can be used in place of wood which would cut down the cost by a margin=10 euros
2. NFC chips used at each slot=30 euros
 	
Electronics = 16 x LED's = 7.84€
  =2 x pot meter= 0.7-1.6€
  =1x button = 0.15€
Screen   = 25 €
Projector = 50€
camera = 10 €
 	
  total   134.59€
To summarize most costs will be from the realization and from manufacturing of the product, promoting the product will also
	KEY RESOURCES
	
	1) Manufacturing Facilities for the wooden product
	2) electrical components,
	3) NFC chips
	4) Industries which provide the rotatable knobs
	5) Companies which provide the screens and the projectors.
	6) Sponsors which provide the money to develop and launch the product
		Providing the confidence through our brand and status shown on posters
		
		Usability is tailored for the convenience of the elderly by putting in elements of old designs and minimal functionality
			REVENUE STREAM
			
			Online sales and
			retail sales of our
			product
				CHANNELS
				
				Awareness: Social Media, partners advertising the idea
				Purchase: Online purchases through our website, retail stores
				Delivery: Using promotional messages which deliver consistency, relevancy, ensuring high success rate by providing yearly reports of data.
				After Sales: 24/7 customer service and feedback, warranty services, returns/ replacements, benefits/ promotions/ loyalty programme, fostering a strong business-customer relationship

Figure 23 – The business model of EmotiCom

What is the problem?

An increased number of elderly people in our society feel lonely due to the lack of knowledge of modern technology or the busy times we live in. They often experience disconnection from the society and especially with their family in their daily lives. We focus especially on lonely elderly people who have trouble using modern-day technology, as this increases the difficulty for them to connect with their loved ones.

What is our solution?

We created a design that allows elderly people who have trouble using modern-day technology to connect with their loved ones. We focussed on creating a tangible design that involves components from older technologies such as a polaroid camera and projector. We do so to make the interaction with the design easier, more pleasant, and more recognizable for the elderly users. Since the physical design supports the order in which tasks are supposed to be performed, by literally following up the slanted stairs. The recognizability helps the user to understand the interactions better, but also brings forward a feeling of nostalgia. The elderly is able to send an image to specific family members and they can respond by taking a picture themselves which can be projected on the elderly's wall to create a loving an warm feeling inside the elderly's homes.

For the other end of the connection, an app has been designed as it's assumed the younger generations are more used to working with apps. The poster for the app design can be found under Appendix B.

This device can connect the elderly and their family in a loving and fun way and they don't need to feel lonely ever again thanks to our concept. See figure 24 and 25 for the final design.

Figure 24 – The final prototype of EmotiCom as seen from the front

Figure 25 – The final prototype of EmotiCom as seen from the back

How does it work?

1. The elderly chooses one or more contact cards depending on who they want to send an image to and places this card in one of the card slots on the first row. The elderly can choose to send an image to more people at once. This can be done by placing more contact cards in the first row.
2. Once the card(s) are in place. The elderly gets direct feedback on their facial expression via the screen. By rotating the knobs on the left the elderly can adjust the color value and hue. The selected color will be visible by a colored overlay which can be seen on the screen. The emotion linked to the selected color will be shown on the bottom of the screen. By pressing the camera button, the images will be placed on the cards.
3. The elderly places the card(s) from the first row to the second row. This action will be clarified by the LEDs that will start burning. By doing so the device sends the picture and color collectively to the people on the contact cards in question via the EmotiCom app. They will get notified.
4. The younger people can respond by taking a picture within the app.
5. Once responded, the LEDs on the elderly's device will start burning once again as an indication to place the card in the final slot. Once a card has been placed that was responded to, this image will be projected on the wall via the projector. The elderly can alternate between different cards to have different projections on the wall.

For the final demo day, we created EmotiCom. This time we knew how we could best show all the elements this design had to offer, divided over all the possible media. The online demo day allowed a whole new platform to be explored when it comes to showing your final design. You can view our online demo day here: https://demoday.id.tue.nl/projects/b7QywEXxoP

The video especially got a whole new meaning. Except from explaining the problem, how it works, and why we got the best solution, the online demo day desired a more personal approach within the video. Therefore, we chose to let one of us speak and really try to influence the viewers emotion by making it look like we're directly talking to them. Thereby, we needed to focus on who our target *viewer* was, as they were the people who would see the video. Therefore, we tried to make clear expressions which could enhance the overall message of the video. See figure 24 and 25

The poster needed to be catchy, as it was the front page of our demo day. We used a bright 70s color scheme to get the viewers attention. Furthermore, a cycle with the same colors was applied to explain the concept in the easiest way possible so the viewer could understand. Big texts were used to explain in a couple of words what this product was all about. The poster can be found under Appendix B.

See table 5 for the overview of all media and their purpose

Video (pitch	Prototype	Poster
State the problem. Let the viewer know how the product works and show them why this product is of such a high importance. Explain why it works.	The look of the whole physical device. It should communicate the dimensions of the prototype, as well as the aesthetic style we are working in. Together with the implementation of technology to further develop our own competencies in the Technology & Reaization area.	To give an overall overview of the circular routine the product has. To show the style we are working in and why this concept has been made.

Table 5 – Overview of all the used media and their purposes

Our goal for this project was to decrease loneliness and increase the happiness of elderly. We did this by using a device that has similarities with retro gadgets helping them communicate better by using such devices since they aren't familiarised with modern technology.

We went through many stages of iterations during the past 6 months and for every new aspect, ideation of various shapes needed to be done. We went through the design cycle many times, to try and improve our design every time. The design cycle helped us to look at the problem from different tangents and perspectives. Each time implemented the design cycle we identified the problem in more depth and researched more and started brainstorming solutions. We did a few design methods such as the crazy 8 and the pressure cooker to help with the ideation and brainstorming process. With a new iteration, we had to perform several user tests and gain feedback from the coaches as well. We went through several evaluations such as creating questionnaires and interviews, hence at each step tried to modify the idea.

Even though we did not always want to change our concept over and over again, it taught us to explore many steps in a design process in-depth and this helped improve our design and reach the project goal. As a group, we grew closer to each of us giving out ideas as well as opinions. We worked on debating our opinions and kept an open mind. We did achieve our goal with our prototype of creating a concept that makes elderly less lonely and happier. We also validated our idea and overall we are quite happy about our end result and proud of what we have achieved.

While discussing various questions to prepare ourselves for the demo day, we came across various things that could be changed if we had more resources such as time and discussions while working on the prototyping together.

We discussed the convenience of the product for the users such as a holder for the cards to be placed in when not in use. Further during the feedback session, we received feedback from another group on how it would be possibly nice for the grandchildren or children to be able to send a picture without the necessity of receiving a picture from their grandparents first. Further, we received feedback on how the physical look of the product could be more simplistic and with a less abstracted look

An interface of how the app would like was created. This interface was created mainly for the younger generations to be able to connect with their grandparents through channels they were most familiar with. It allows them to receive pictures from their grandparents to which they can reply with pictures. Since this is an addition to the communication and not a replacement, the app allows the user to only communicate through visuals.

Even Though this is just an idea of how the app would look to get the message across, there are a number of changes that need to be made such as the reduction of the number of functions it provides, the visuals of the app could be more retro and eye-catching.

COVID-19 did constrain us when it comes to finding the perfect user for our target group. However, it did boost are creativity and we are proud of our final product.

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Anusha

For the third and fourth quartile , I chose the project theme Vital Change for the course project year 1.I chose this theme since it aligned with my vision and what direction I want to aim my goals in. Vital change focuses on the health of the society and how it affects their surroundings. Relationships are built on the basis of the health of an individual and these are interconnected, hence it is such a delicate theme. Technology plays an important role in the mental and physical health of an individual. Hence, in such a project theme, we look at ideas and designs which would help improve the health but not in an obtrusive way. This is what attracted my attention and there are so many tangents we can look at to achieve this

I have come across people who suffer from many health issues and how they struggle to get the help needed and struggle to open up to others and this motivated me to give them a channel to receive this access. Since everything revolves around technology, I want to aim to provide that channel.

Hence we tackled these problems and questions as a team. Even though we did face ups and downs individually as well as a group which affected the decorum of the group. At the start we lacked organizing and planning skills. We didn't reply on time which cost us. The initial motivation slowly started to wither away and everyone lost communication. When faced with the load of work and saw how much we lacked , we decided to improve ourselves. We did so by communicating our opinions and tried to keep an open mind. We tend to criticize when we didn't agree with something, this played an important role since it helped to better our communication. We started to have weekly meetings to discuss the progress and what the next steps were. The work was divided equally and each of us would help the other when they were stuck. This improved our strengths immensely.

Taking into consideration the current situation happening all over the world, this has affected the flow of work greatly. Since I study industrial design, the measures taken due to COVID-19 have brought many activities which require meetings and workshop sessions to a standstill. But this has helped us to look at the project from a different perspective since it gave us an opportunity to explore digital prototyping and soft wares used for animation. Due to this situation, it did have a negative effect on the development of my competencies. The things I aimed at improving could not be done so.

Even though the current situation posed many problems , I tried to alter my competencies and work on improving the competencies which were available to work on. I focused more on the creativity and aesthetics part of the project, which involved the poster making and making the interface of the app and I tried to add the necessary aesthetics in it such as making it retro themed and giving a retro pallet which was a yellowish cream color to give the user a warm love like feeling.

Moreover I tried to put in my knowledge which I had in business and entrepreneurship to use. This helped in filling out the business model canvas and looked at the possible steps one would have to take if this product was to be

launched into the market. Further I explored sketching with the help of digital software called tinker cad as well as took upon the task to practice sketching on the side and this helped me to visualize my design better from all views. Moreover I slightly improved on my computing and math skills since I did take part in the prototyping region for the midterm demo day which could not be shown since it could not be retrieved from the university before the lockdown. This involved skills to picture how much space would the prototype occupy and how we could keep it minimalistic but keeping in mind the space needed for the puppet as well.

Working with a team did improve my teamwork skills and I learnt how to accommodate when needed and speak my opinions when necessary. However my communication skills could be better

Since this project theme involved a great number of user tests, I did improve on the competency of user focus and perspective. I learnt how to involve the user in the design process and how it needs to be morally and ethically correct by asking for consent before any test. I understood how our idea would be perceived by the users in an actual market and this provided a lot of opinions and feedback. However, it was not possible to improve on the competency technology and realization which was one of my priorities which I wanted to achieve but since I could not work with another team member in order to learn more about it, I was unable to achieve this goal.

Nevertheless, I have set some future goals that I want to achieve. I would want to improve my programming skills related to Arduino so I will be able to build a functioning prototype. I want to be able to challenge myself to get out of my comfort zone and to explore something new. Secondly I would like to improve on my sketching, by taking part in online courses which could help me improve there. Moreover I have planned to join a student team and take part in their design department , and by communicating with students who have more experience in this field would be more helpful. Further this would help me improve my communication and teamwork skills. Even though I did work a lot on adobe software, I would still like to improve on it more since I want to achieve a professional and sophisticated look for my layouts.

Kiki

During this course I aimed to implement and broaden my knowledge and skills in multiple expertise areas.

The first and foremost expertise area which I used during this project is Creativity and Aesthetics. This expertise area came forward during the phases in which we were ideating and conceptualizing, since I used the sketching techniques which I learned during Exploratory Sketching to help with ideating and communicating my thoughts. Another point at which this expertise area came forward was when creating visuals to communicate our final concept. I gained the needed skills to do so during workshops in InDesign and Illustrator, but further developed them by watching tutorials and generally exploring the programs like I aimed to do in my PDP. Eventually I created a poster to show the final demonstrator and visualize the interaction users have with the product and its general goal.

During the project I was able to reach my goal in terms of User and Society. As I was able to focus on designing for a changing society, in this case a society which grows older and older. Another point at which I was able to implement growth in terms of this expertise area was when executing user tests. During this process I improved my ability to create online surveys, but also learned better how to formulate questions to get the aimed results out of the validation phase.

An expertise area in which I was sadly less able to reach my goals was Technology and Realisation. I planned on developing my prototyping skills, but due to the coronavirus outbreak and its consequences one person in our group had to take the task of creating the final demonstrator upon themselves.

I believe this is also a moment which shows our teamwork. As everybody had to compensate at some point in terms of their PDP goals. Apart from that the teamwork within our group went quite well. I feel like my personal contribution to the team was being a steady factor in terms of doing what was expected from me. However, I also feel like I added creativity and a creative way of thinking and problem solving. Additionally, I was able to be decisive in situations where we were sometimes too doubting.

Delmar

This is my second reflection for Project 1 Vital Change. In this reflection, I look back at the whole last semester of Project 1. Vital Change was not one of my main choices however, the subject was interesting and I was excited to work on "real" designing.

The whole corona pandemic was also annoying for me and our group at first, because our group wanted to work with elderly and help them with loneliness and expressing emotions, but we could not go and test things with elderly anymore. However, our tutors showed us that this whole situation is an opportunity and we learned from this. We went digital with everything and thinking of solutions to our problems in these times. A lot of elderly are lonely at home right now and this gave us a bigger target group.

I was responsible for half of the midterm prototype and the research about emotions for elderly. Looking back at this I should have done more for the research part, I did not do enough and it was not very clear how elderly change over time with emotions. Next time I will put in more effort and work hard for my part in the project. For the prototype I think I did a good job, I made the base of the prototype with Anusha and we were quite satisfied with the outcome of it.

However because of Corona, the physical prototype was not useful for us anymore, so we went online because of this. I still wanted to do the prototype, because I wanted to improve on it. In our first quartile for From Idea To Design a group member of mine made a video using Blender, so I thought we could use that program as well for our prototype. I started watching tutorials and practicing how to use the program and finally, I made the prototype in Blender. Learning new things is not easy for me to do, because I am often lost where to start, but I am very satisfied with how it turned out and think that I have done a good job on this.

I think I improved a lot in the first quartile. I have learned how to do 3D sculpting and modelling in Blender. I also improved on physical prototyping with the first base that we made. I think it looked really nice and that it could actually rotate was very cool.

For the second half of the course, I wanted to work more on prototyping and work on technology & realization however, our group wanted to make a physical prototype and due to corona, we were not really able to work on it together. So I haven't improved much on that in the second half of the course.

We did so many iterations and brainstorms, where we used new techniques, for example, the crazy 8. We also validated using online methods and I think I also improved on making these online surveys and questions. I think I improved a lot in the Design, Research Process in the second half of the course because of this.

I was also partly responsible for the business part of the report. We made a business canvas model, I also follow the course business design and I think my experience from this course helped me make the business model.

I still have a hard time viewing myself as a designer however, I think my vision has changed a little bit. I want to create more fun things rather than making things to connect people again. I think I improved a lot for the prototyping in the first half of

the course, but not that much in the second half. I think I have improved some for communication and teamwork, but I can still improve more on this. I couldn't really improve on integrating technology in the second half of the course because of the corona, so I have not really improved on this. My User Focus goal has improved a lot. Because we did a lot of validating using user tests. Overall, I am happy how this project has turned out and proud of what we have made as a group.

Timo

The theme for my Project 1 was 'Vital Change'. Even though this was not my first option, I must recon I enjoyed the environment we were working on, which made me interested in the future. As my social character is aimed at socializing with other people and sharing my knowledge to help them improve their skills, I saw potential in designing for a healthier world.

Our project revolved around elderly which make a great part of the population. They often have troubles working with modern technology and we want to make it easier for them to stay in contact with their family.

The pressure cooker gave amazing insights into a design process, and the group you're working with. The time pressure taught us to be innovative and creative in a short amount of time. We learned to quickly define and understand our user, set up a research plan to test our initial concept. Furthermore, it gave a great overview of the main strengths and weaknesses of all individuals within the group, which gave me the opportunity to place people in their spot, as the task of leader was given to me.

As the project goes on, I discovered my inquisitiveness and perseverance as a designer; making constant iterations, sustaining these with research and generating a ton of ideas were my way to go. This helped me to develop my own professional and identity, which evolved into my vision of never stop learning. It helped me to define my goals, regarding aspects of a design process I wanted to learn.
My perseverance and leadership revolve around my perfectionism, which also has its downsides. I learned I had troubles leaving tasks to others. The constructive feedback of my group was that I should not do too much, and gave others a chance. It pushed myself to press my brakes and be respectful towards others' perspectives. This can eventually add up to my vision, as I can support others, instead of taking over their tasks.
However, I learned that my main interest can be found in the Technology & Realization area and Creativity & Aesthetics. I loved making the final prototype, for which I made models, a building plan to eventually be able to integrate the technology. Applying a 70s aesthetic proved to be a challenge, but nonetheless stimulated my inquisitiveness.

The ideation and iteration process helped me to understand how this groups likes to work and what my role was. By taking the lead, I was able to inspire others into thinking more creatively and out-of-the box, which I now recon as one of my greatest strengths.

My coaches helped me a lot in finding the right design attitude. Instead of going over the problems, I needed to look at creative solutions, because I am the designer. This motivated me to keep on exploring new possibilities of online brainstorming, keeping notes and prototyping. They gave great insights how to best perform a design process and for example smart design ideation methods such as crazy 8 or the design sprint in general. I believe these tools can help me in the future to become more efficient and creative when it comes to out-of-the box thinking.

I did want to focus more on the Business & Entrepreneurship side of the project, which was not possible, as starting over after demo day seemed to be a way tougher task than anticipated and thus needed a lot of iterations again. Nonetheless, I believed we made the right choice. By pushing our competencies to the edge, we came up with a strong concept, that fits and satisfies the target group.

Even though I am still relatively new to design, I do believe this project has helped me in figuring out my professional identity and vision as a designer. This project made it clear what character traits need improvement and what traits I can improve in order to become an even better designer. As a designer, you need to stay original, but you also need to stay true to yourself, and dare to go further than others, but most importantly: to challenge yourself and to keep on learning.

Appendix A: Research

Biomematic shapes 28-02-2020

↳ products need smart functionality, ergonomic catisfaction and provoke emotional response

Emotions → * sensory instinctive
* behavior emotions
* in tension reflection

Biomimicry/anthropomorphic → human elements in non-human objects

An investigation was done ↘

Type of Biomimicry

Degree of concrete level	Plants	Human contours	Humanoid Faces
L1 Very abstract			
L2 Abstract			
L3 Concrete			
L4 Very concrete			

↳ were shown to 62 part. (31♂, 31♀)

— 3 independent variables
— emotional response (pleasure & arousal) dependent values
   ↳ tested with likert scale (1-9)

these were the results → reliability 0.910

Plants form
— — valence
...... arousal
→ drop
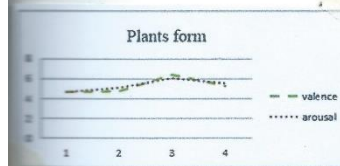
effect stimuli plant shapes on emotions

Human contours
...... valence
— — arousal
→ rising
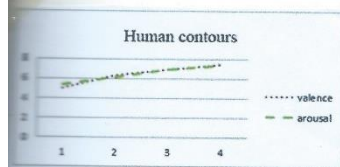
effect stimuli human contours on emotions

Humanoid faces form
...... valence
— — arousal
→ drop
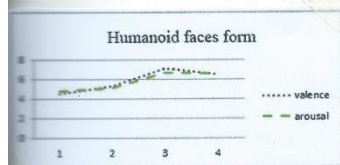
effect humanoid faces on emotions

	L1	L2	L3	L4
Valence	$F_{(2,5.167)} = 1.351$ $p = 0.267$ (PF = HF = HC)	$F_{(2,41.699)} = 13.321$ $p < 0.001$ (HC > HF > PF)	$F_{(2,8.860)} = 3.130$ $p = 0.46$ (PF = HF = HC)	$F_{(2,76.167)} = 26.662$ $p < 0.001$ (HC > HF > PF)
Arousal	$F_{(2,7.597)} = 2.058$ $p = 0.131$ (PF = HF = HC)	$F_{(2,23.070)} = 6.879$ $p = 0.001$ (HC > HF > PF)	$F_{(2,11.812)} = 4.342$ $p = 0.14$ (HC = HF > PF)	$F_{(2,53.629)} = 24.831$ $p < 0.001$ (HC > HF > PF)

↳ PF = Plant form, HF = human facial, HC = Human contours

→ Responses to L1, L2 and L3 were overall pretty much the same
→ Significant differences on L4
→ Responses (emotional) to human contour stimuli were greater than human facial stimuli, that were greater than plant texture stimuli

— More concrete biomimetic forms stronger potential to evoke emotions
— Values plant and facial shapes drop slightly
   ↳ see inverted U-shape Berlyne's (1970)
      ↓
      concrete shapes more complex, better chance
      ↳ evoke emotions
— No drop at HC can be due to not realistically making it enough

Figure 27,28 and 29 – Research done one biomimetic shapes

Appendix B: Posters

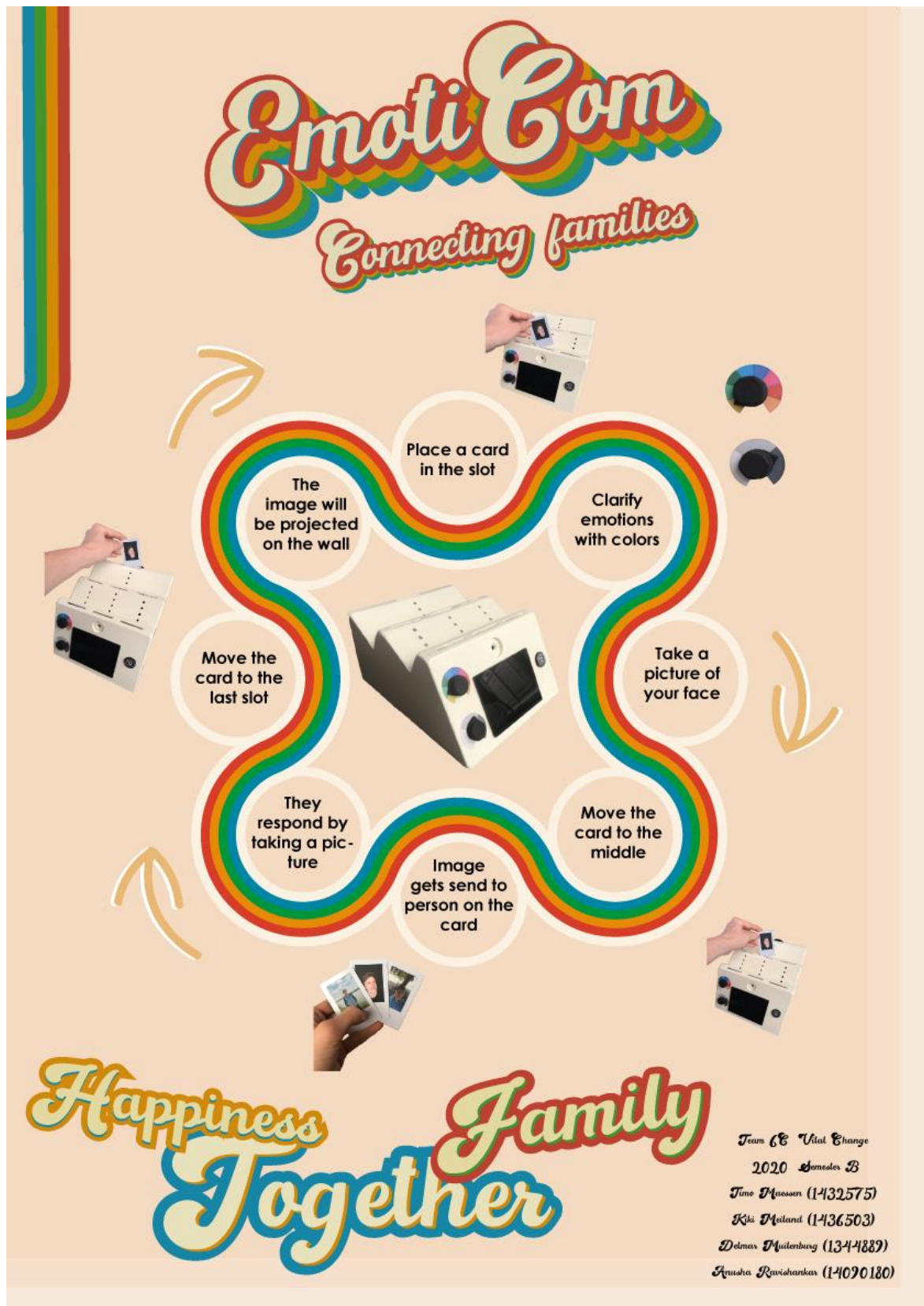Figure 30 – The poster for the midterm demo day

Figure 31 – The poster used for the final demo day
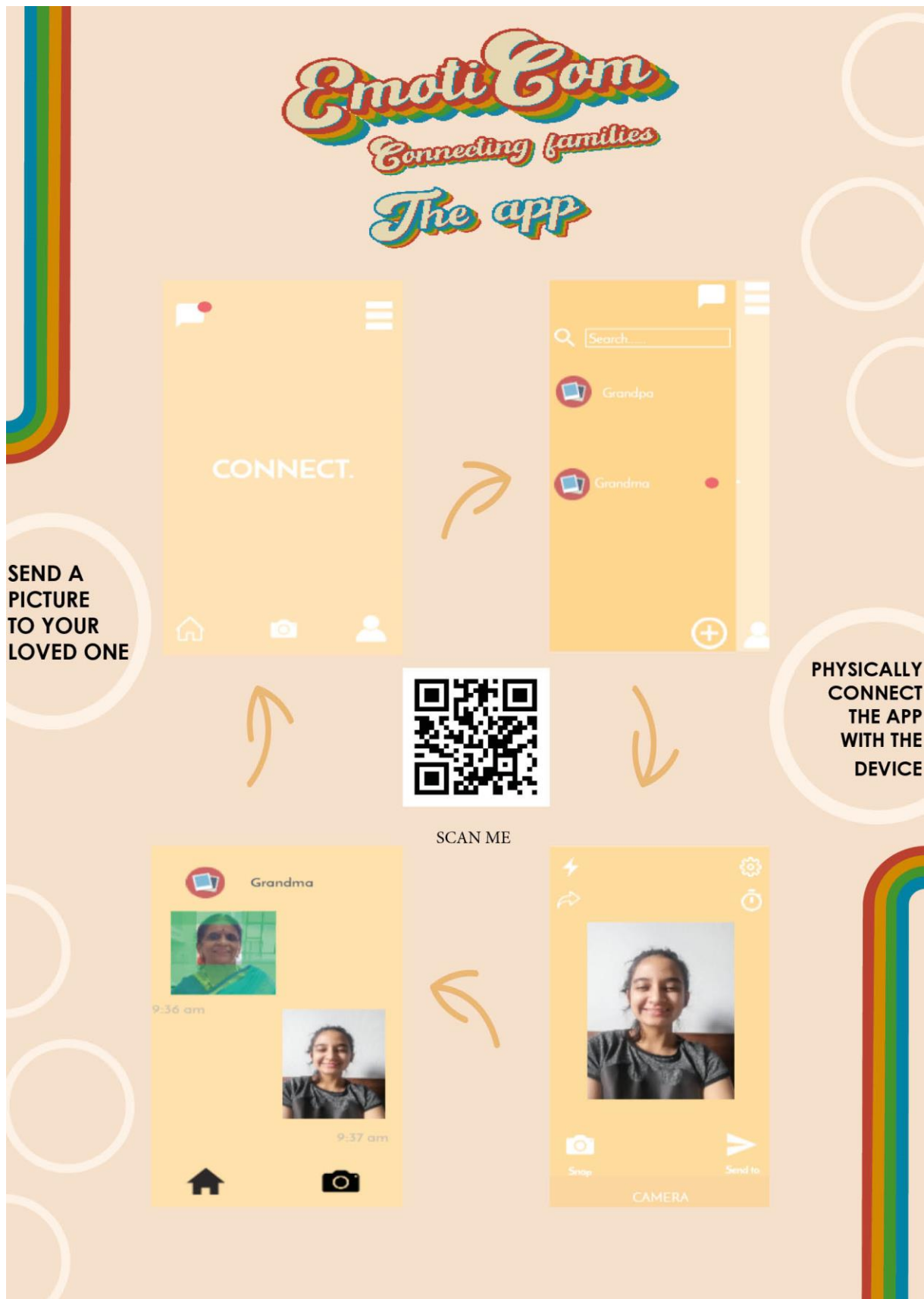
Figure 32 – A poster made to visualize the app

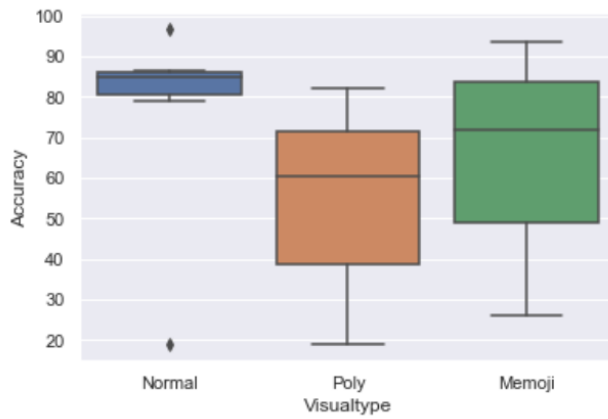## Appendix C: Data visualization

Figure 33 – Accuracy of the visual types
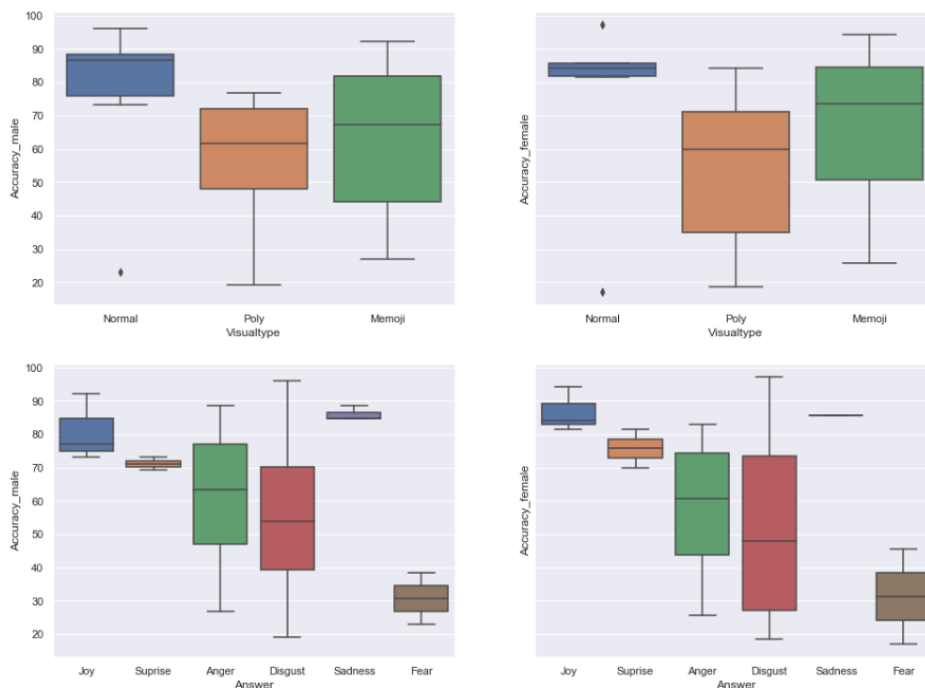

Figure 33 – Accuracy of the emotions

Figure 34 – Differences in accuracy between male (left) and female (right)
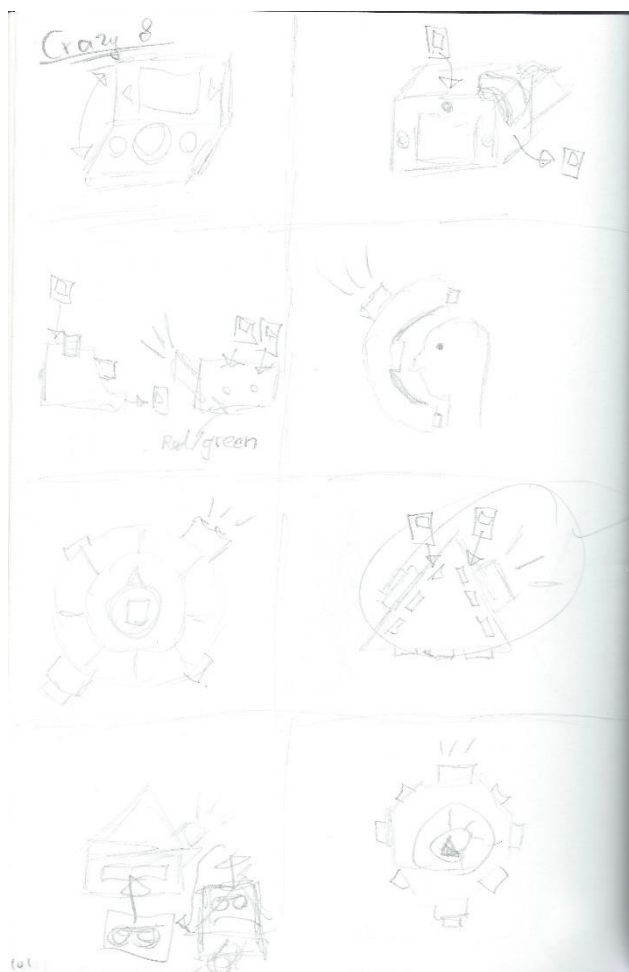
Appendix D: Sketching

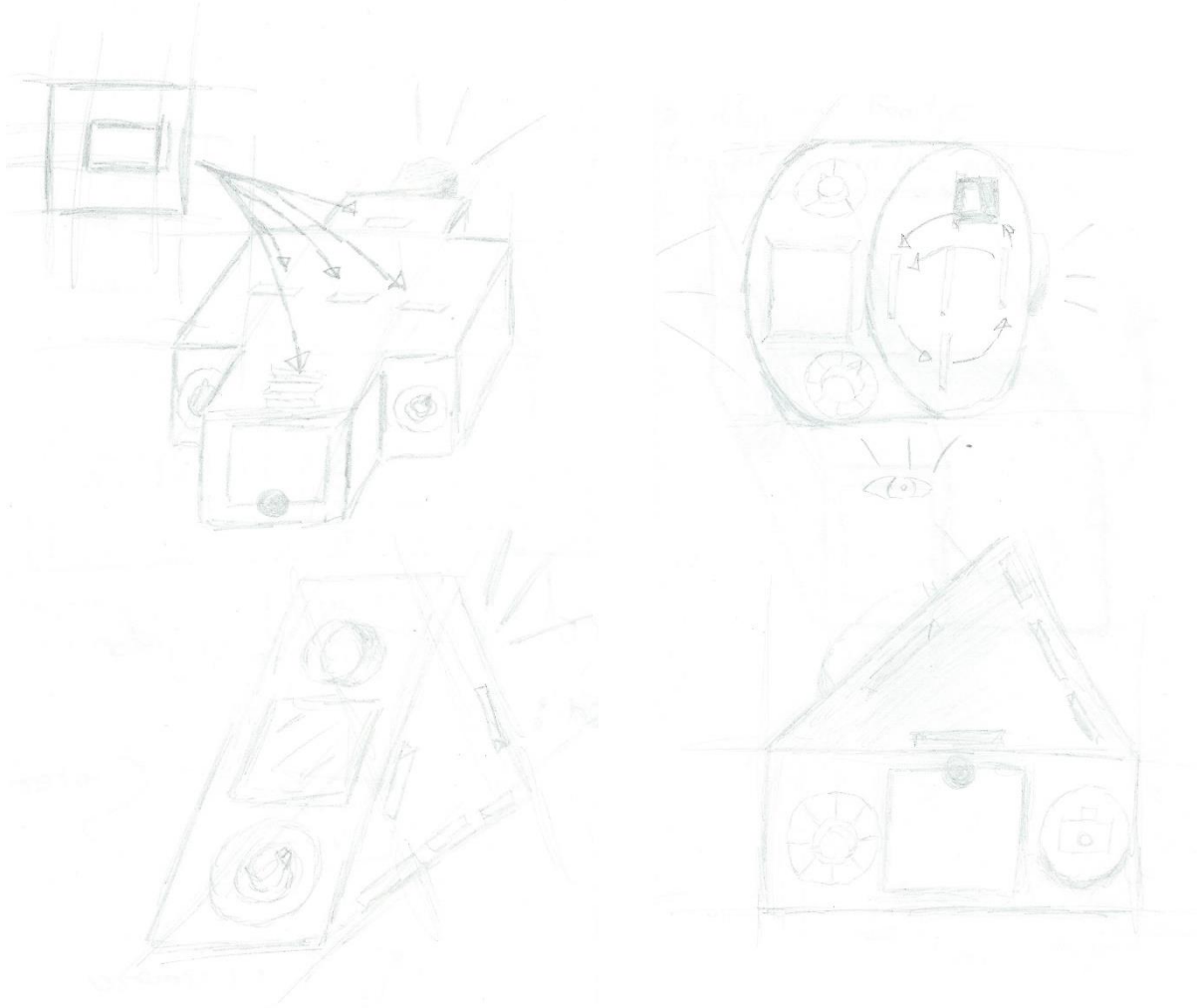*Figure 35 – An example of one of the crazy 8 pages*

Figure 36 and 37 – Idea sketching for our final prototype
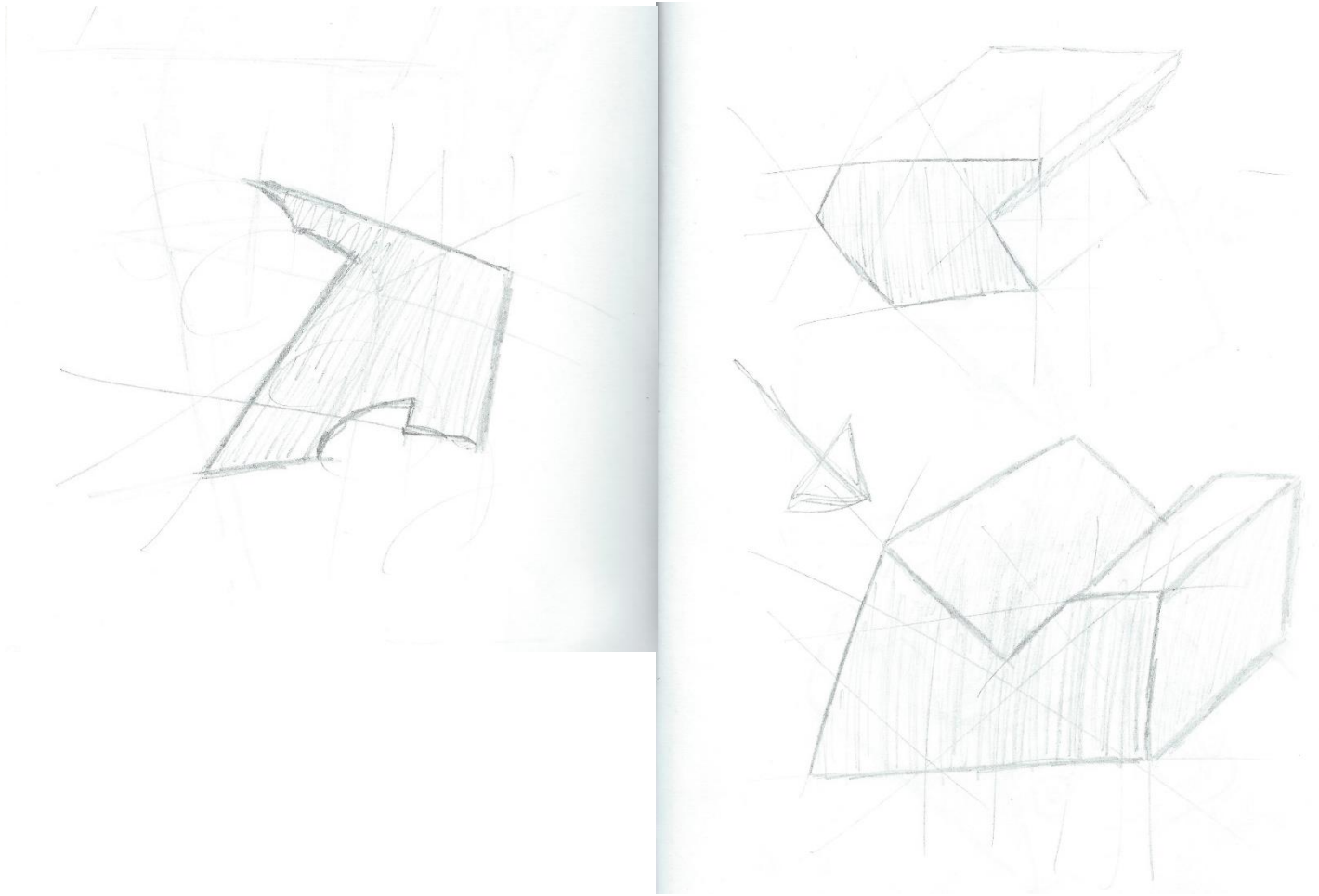
Figure 38 and 39 – Exploring shapes with new sketching ideation techniques

Appendix E: Prototyping

Figure 40 – Cutting the wood

Figure 41 and 42 – Making sure the wood is in place and glue-ing them together
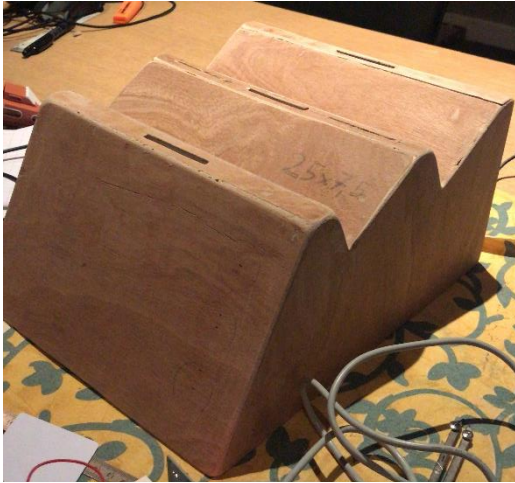
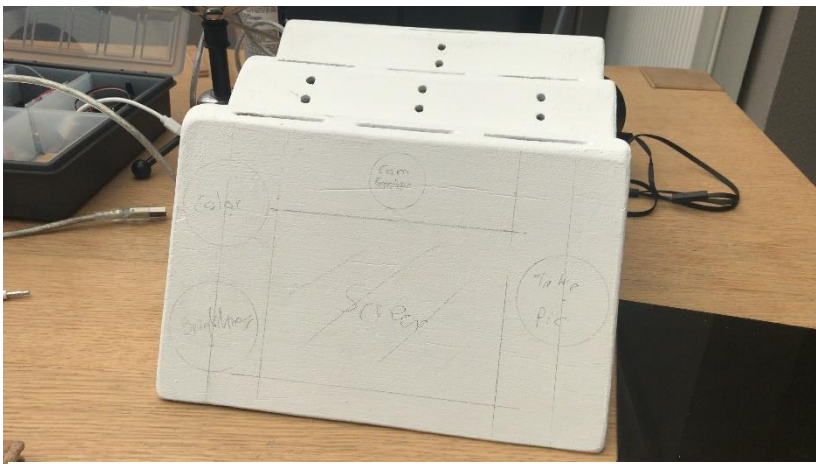*Figure 43 and 44 – Sanding and painting the prototype*

Figure 45 – Drawing the important elements on the front

Figure 46 – Prototyping the family member cards

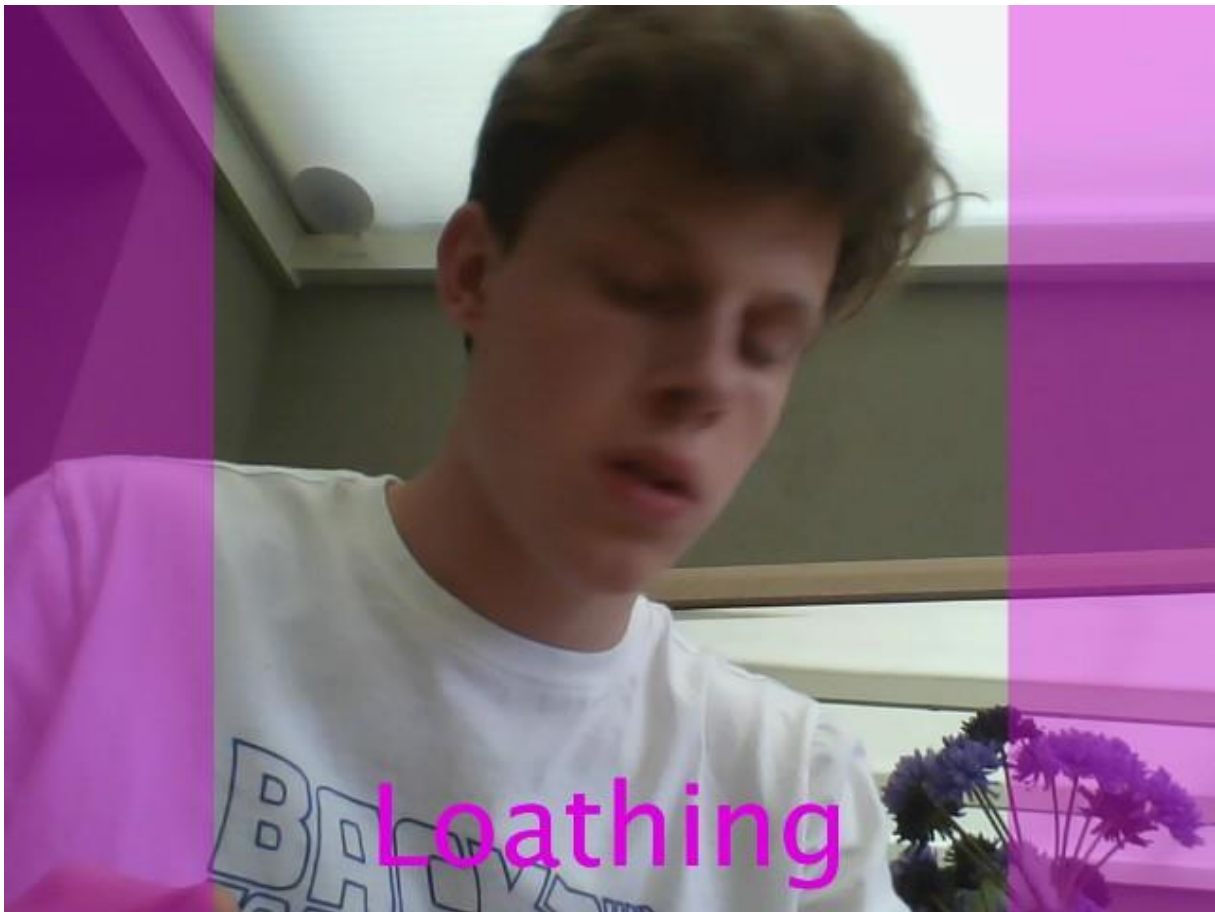## Appendix F: Programming and Technology

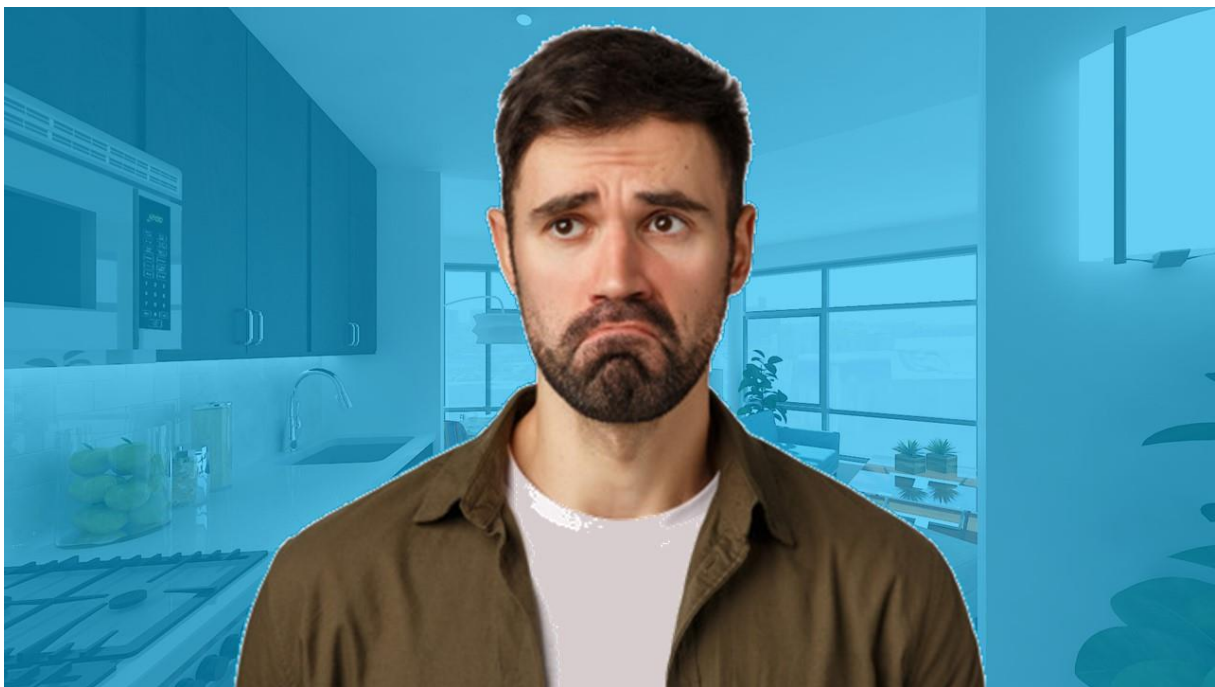Figure 47 – The programmed overlay of the webcam output with text for the emotion loathing

Figure 48 – The overlay which we aimed at making. A transparent coloured background, with the natural face. [9] [10]

First the Processing code for adding color, taking a picture and saving the image:

```
import processing.video.*;

import processing.serial.*;

Serial portAP;

float input;

int imageCount;

boolean zero;

boolean one;

boolean two;

int blackop = 255;

boolean doblackbackground;


color[][] myColors = { { #ffffb1, #8cff8c, #8cc68c, #d5eeff,
#8c8cff, #ffc6ff, #ff8c8c, #ffc48c },

                       { #ffff54, #54ff54, #009600, #59bdff,
#5151ff, #ff54ff, #ff0000, #ffa854 },

                       { #ffe854, #00b400, #008000, #0089e0,
#0000c8, #de00de, #d40000, #ff7d00 } };

int colorHue;

int colorValue;


Capture webcam;


void setup() {

  size(640,480);

    portAP = new Serial(this, "COM5", 9600);

  // Keep reading the output of this port

  portAP.bufferUntil('\n');

  webcam = new Capture(this,640,480);

  webcam.start();


}


void serialEvent(Serial myPort) {

  input = (float (myPort.readStringUntil ('\n')));
```

```
    }

    void draw() {
      if (webcam.available() == true) {
        webcam.read();
        image(webcam ,0,0);
        textAlign(CENTER);
        textSize(1450);
        fill(myColors[colorValue][colorHue],100);
        text("[]",width/2,height+150);


      }
        if (input == 4) {
          colorHue = 0;
      }
      else if (input == 5) {
          colorHue = 1;
      }
       else if (input == 6) {
          colorHue = 2;
      }
       else if (input == 7) {
          colorHue = 3;
      }
       else if (input == 8) {
          colorHue = 4;
      }
       else if (input == 9) {
          colorHue = 5;
      }
       else if (input == 10) {
          colorHue = 6;
      }
       else if (input == 11) {
```

```
        colorHue = 7;

}


if (input == 12) {
  zero = true;
  one = false;
  two = false;

}
 else if (input == 13) {
    zero = false;
    one = true;
    two = false;

}
 else if (input == 14) {
    zero = false;
    one = false;
    two = true;

}




if (zero == true) {
  colorValue = 0;

}
if (one == true) {
  colorValue = 1;

}
if (two == true) {
  colorValue = 2;

}

    fill(myColors[colorValue][colorHue]);
    textSize(60);
    stroke(255);
```

```
strokeWeight(10);

if (colorHue == 0 & colorValue == 0) {
  text("Serentity",width/2,height-25);
}
if (colorHue == 0 & colorValue == 1) {
  text("Joy",width/2,height-25);
}
if (colorHue == 0 & colorValue == 2) {
  text("Ecstasy",width/2,height-25);
}
if (colorHue == 1 & colorValue == 0) {
  text("Acceptance",width/2,height-25);
}
if (colorHue == 1 & colorValue == 1) {
  text("Trust",width/2,height-25);
}
if (colorHue == 1 & colorValue == 2) {
  text("Admiration",width/2,height-25);
}
if (colorHue == 2 & colorValue == 0) {
  text("Apprehension",width/2,height-25);
}
if (colorHue == 2 & colorValue == 1) {
  text("Fear",width/2,height-25);
}
if (colorHue == 2 & colorValue == 2) {
  text("Terror",width/2,height-25);
}
if (colorHue == 3 & colorValue == 0) {
  text("Distraction",width/2,height-25);
}
if (colorHue == 3 & colorValue == 1) {
  text("Suprise",width/2,height-25);
```

```
  }
if (colorHue == 3 & colorValue == 2) {
  text("Amazement",width/2,height-25);
}

  if (colorHue == 4 & colorValue == 0) {
  text("Pensiveness",width/2,height-25);
}

  if (colorHue == 4 & colorValue == 1) {
  text("Sadness",width/2,height-25);
}

  if (colorHue == 4 & colorValue == 2) {
  text("Grief",width/2,height-25);
}

  if (colorHue == 5 & colorValue == 0) {
  text("Boredom",width/2,height-25);
}

  if (colorHue == 5 & colorValue == 1) {
  text("Disgust",width/2,height-25);
}

  if (colorHue == 5 & colorValue == 2) {
  text("Loathing",width/2,height-25);
}

  if (colorHue == 6 & colorValue == 0) {
  text("Annoyance",width/2,height-25);
}

  if (colorHue == 6 & colorValue == 1) {
  text("Anger",width/2,height-25);
}

  if (colorHue == 6 & colorValue == 2) {
  text("Rage",width/2,height-25);
}
 if (colorHue == 7 & colorValue == 0) {
  text("Interest",width/2,height-25);
}
```

```
  if (colorHue == 7 & colorValue == 1) {
    text("Anticipation",width/2,height-25);
  }
   if (colorHue == 7 & colorValue == 2) {
    text("Vigilance",width/2,height-25);
  }


 if (input == 1) {


        saveFrame("C:/Users/User/Desktop/first.jpg");
        background(255);
  }
else if (input == 2) {
    saveFrame("C:/Users/User/Desktop/second.jpg");
    background(255);
}
else if (input == 3) {


    saveFrame("C:/Users/User/Desktop/third.jpg");
    background(255);
}
}
```

The Arduino code that corresponds to this (credits to https://www.hackster.io/Aritro):

```
int imageButton = 2;
int imageButtonValue;
int brightnesspot = A1;

int led = 3;
int serialvalue = 0;
int colorpot = A2;
String Red = "0";
String Green = "0";
String Blue = "0";

#include <SPI.h>
#include <MFRC522.h>

#define SS_PIN 10
#define RST_PIN 9
MFRC522 mfrc522(SS_PIN, RST_PIN);   // Create MFRC522 instance.

#define LED_PIN  6
#define NUM_LEDS  4
CRGB leds[NUM_LEDS];

boolean doledloop = false;

void setup()
{
  Serial.begin(9600);   // Initiate a serial communication
  SPI.begin();      // Initiate  SPI bus
  mfrc522.PCD_Init();   // Initiate MFRC522

  pinMode(imageButton,INPUT);
  pinMode(led,OUTPUT);
  pinMode(colorpot,INPUT);
```

```
}
void loop()
{

 // Serial.print("UID tag :");
  String content= "";
  byte letter;
  for (byte i = 0; i < mfrc522.uid.size; i++)
  {
    content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : "
"));
    content.concat(String(mfrc522.uid.uidByte[i], HEX));
  }
 // Serial.println();
  content.toUpperCase();



if (mfrc522.PICC_IsNewCardPresent() == true)
  {
Serial.println(100);

int colorpotvalue = analogRead(colorpot);
    if (colorpotvalue < 128) { //
      Serial.println(4);  // Yellow Joy
    }
    else if (colorpotvalue > 127 && colorpotvalue < 257) {
      Serial.println(5);  // Light Green Trust
    }
      else if (colorpotvalue > 256 && colorpotvalue < 385) {
      Serial.println(6);  // Green Fear
    }
     else if (colorpotvalue > 384 && colorpotvalue < 514) {
      Serial.println(7);  // blue
    }
     else if (colorpotvalue > 513 && colorpotvalue < 642) {
```

```
        Serial.println(8);  // dark blue

    }
     else if (colorpotvalue > 641 && colorpotvalue < 770) {
      Serial.println(9);  // purple

    }
     else if (colorpotvalue > 769 && colorpotvalue < 899) {
      Serial.println(10);  // red

    }
      else if (colorpotvalue > 898) {
      Serial.println(11);  // orange

    }


    int brightnesspotvalue = analogRead(brightnesspot);
      if (brightnesspotvalue < 342) {
        Serial.println(12); //Light mild


      }
      else if (brightnesspotvalue > 341 && brightnesspotvalue < 685) {
        Serial.println(13); //Normal medium
      }
      else if (brightnesspotvalue > 685) {
        Serial.println(14); //Dark intense


      }


    int imageButtonValue = digitalRead(imageButton);
        if (imageButtonValue == HIGH) {


          if (content.substring(1) == "20 F6 C7 30") {
            Serial.println(1);
          }
          else if (content.substring(1) == "10 C6 82 30") {
            Serial.println(2);
          }
```

```
      else if (content.substring(1) == "10 60 B4 30") {
        Serial.println(3);
      }
    digitalWrite(led,HIGH);
    doledloop = true;
  }


  else {
    digitalWrite(led,LOW);
  }


  if ( ! mfrc522.PICC_ReadCardSerial())
  {
    return;
  }
}
  else {
    Serial.println(101);
  }
}
```

The code for making the LEDs light up:

```
#include <FastLED.h>


#define LED_PIN 4

#define NUM_LEDS 4

CRGB leds[NUM_LEDS];


void setup() {
  // put your setup code here, to run once:
FastLED.addLeds<WS2812, LED_PIN, GRB>(leds, NUM_LEDS);
//Initialize all the LEDs
  for (int i = 0; i < NUM_LEDS; i++) {     //Go through all the LEDs
    leds[i] = CRGB(0,0,0);                 //Turn off all the LEDS
  }
  FastLED.show();
}


void loop() {
  // put your main code here, to run repeatedly:
  for (int i = 0; i < 4; i++) {
      if (i == 0) {
      leds[0] = CRGB(0, 0, 0);
      leds[1] = CRGB(0,0,0);
      leds[2] = CRGB(0,0,0);
      leds[3] = CRGB(20,10,0);
      }
       if (i == 1) {
      leds[0] = CRGB(20,10,0);
      leds[1] = CRGB(0,0,0);
      leds[2] = CRGB(0,0,0);
      leds[3] = CRGB(0,0,0);
      }
       if (i == 2) {
```

```
        leds[0] = CRGB(0,0,0);

        leds[1] = CRGB(20,10,0);

        leds[2] = CRGB(0,0,0);

        leds[3] = CRGB(0,0,0);

        }

         if (i == 3) {

        leds[0] = CRGB(0,0,0);

        leds[1] = CRGB(0,0,0);

        leds[2] = CRGB(20,10,0);

        leds[3] = CRGB(0,0,0);

        }

        delay(200);

      FastLED.show();


        }

    }
```