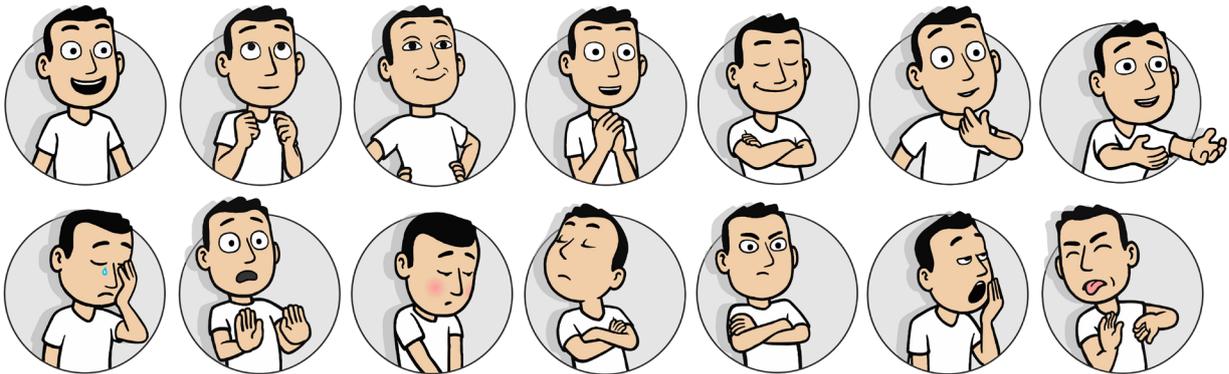# PrEmo

Graduation Report
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PrEmo

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EXECUTIVE SUMMARY

The thesis describes the process and the design of a new version of PrEmo graduation project which is initiated by the IDE-Delft-based Delft Institute of Positive Design (DIOPD) in collaboration with Rotterdam-based design consultancy agency Emotion Studio (E/S). This graduation project aims to develop a new PrEmo that combines the ease of physical interfaces and animations.

Based on previous PrEmo studies, the requirements of offline version PrEmo are proposed. Some other emotion measure instruments are analyzed as well to find possibilities to improve the product. Related technologies that could be applied in are also introduced.

With all results before, and the inspiring how-to session was organized to produce different new design directions for the new product. Many interesting ideas came up and there are five concepts finally adopted. They are RFID, AR, soundbox, page flip animation, and sounder.

To investigate where users' expectations lay and how users feel about new directions of new PrEmo, a qualitative study was conducted. Eight participants involved and what strengths and weaknesses of the previous version were asked. All results are recorded, analyzed and organized. Then requirements and four qualities came out: easy, convenient, accurate and sustainable, which can rule the new concepts on track. Finally, AR technology was chosen for further development.

Following the requirements got from the research, components were explored and then iterated several times fast during the study. Afterward, a usage inspection with the other two emotion design experts was organized. New components were added. The final PrEmo product consists of physical cards with emotions, a manual introducing the whole product, a sheet showing the relationship of 14 emotions and an application connecting the cards and animations.

To evaluate how new PrEmo performs through design studies, 5 participants were recruited with the final product separately. They were asked to use PrEmo in their interviews and feedback was also collected through interviews after they using it. From their feedback, the usability of PrEmo is ensured and some improvements are listed in the recommendation chapter.

CONTENT

CHAPTER 1
INTRODUCTION

This chapter shows the background as well as current problems of the product. What is more, the study aim and the approach are also described.

1.1 Background

This project is one graduation project of the master's program Design for Interaction. The student made a new version design to improve the emotion measurement instrument.

Emotions play important roles in our lives as well as the market place. Emotion research between products and their users is becoming more and more popular nowadays as people found the emotions triggered by products improve the pleasure of buying, owning, and using them (Hirschman & Holbrook 1982). This increase of interest in empirical experience was accompanied by the development of various emotion measure instruments, which can back the research of the relationship between product design and user experience, enhance our understanding of interaction design.

The Product Emotion Measurement Instrument (PrEmo), who uses 14 different characters to access the emotion triggered by product, was one of the most famous pictorial (non-verbal) instruments (Desmet, 2003; Desmet et al., 2012). Except for feelings measurement, PrEmo can also evaluate the emotional influence of a design, which can be applied in quantitative as well as qualitative research. This tool was currently verified in all over the world and was popular among different design researchers as well as students globally.

The self-running online report toolkit goes like this: The 14 emotion characters of PrEmo are shown on computer screens, as the choices of a normal questionnaire with guiding instructions. According to animations that need to be activated by clicking, participants can degree the emotion animations (three, five or seven-point) to according to what they feel about different products.
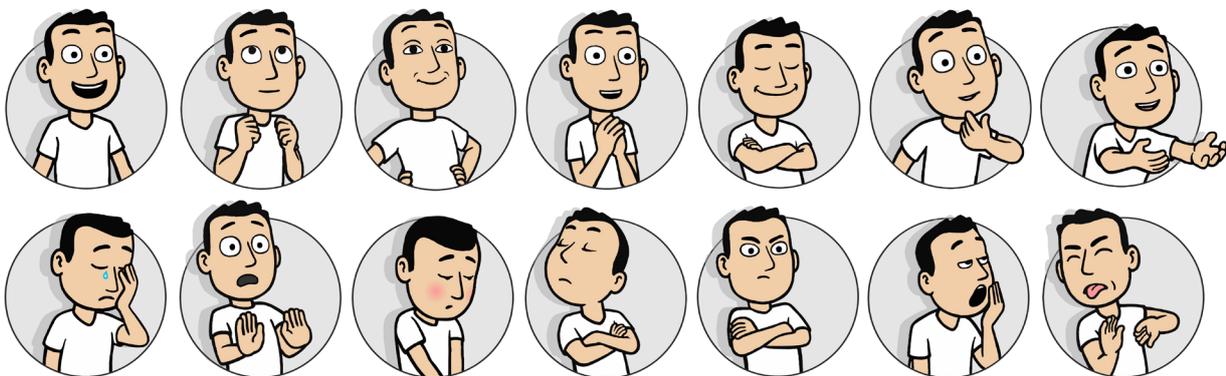
Figure 1 Stills of the 14 PrEmo characters

1.2 Problem statement

As the wider application of PrEmo, the online version of PrEmo has proven to be complicated, not sufficiently flexible, and does not support quick in-context measurements for researchers. PrEmo is also often used in studies in which stills of the characters are shown to respondents instead of the animated characters. The advantage of using stills that this does not require the use of a screen (the stills can be presented in print). The main disadvantage is, however, that the reliability of the animates can only be guaranteed when using the animated characters. Researchers need an offline version of PrEmo that works in wide contexts as well as ensures the reorganization.

1.3 Study aims

The current study aims to develop a form of PrEmo that combines the advantages of animated characters as well as print-based character stills. It should be a modern, effective and efficient emotion measurement with the use of the original PrEmo animations. Besides, it should be affordable (i.e. it should be made available for max 10 euro) and usable for design researchers across the globe.

1.4 Mythology

In the research part, the report first describes the background that how other emotion measure instruments work. Then PrEmo development will be explained in more depth. Furthermore, an analysis of potential forms of the future product will be executed, leading to a how-to session that finds 5 directions of design. Based on the results of the session, interviews will be conducted and new insights will come up. New concepts will also generate in the design part and be evaluated through usage inspection first and then user test. After this, all information gotten until this point will be translated into the final concept and it will be assessed through a user test. The report ends with a reflection where the recommendation will be given to further research.

1.5 Stakeholder

This project is initiated by the IDE-Delft-based Delft Institute of Positive Design (DIOPD) in collaboration with Rotterdam-based design consultancy agency Emotion Studio (E/S). DIOPD has developed the PrEmo instrument. E/S will be responsible for disseminating the toolkit that will be developed in this project. In that capacity, E/S will participate as an external stakeholder. Pieter Desmet (who developed the previous PrEmo versions) will act as a project chair.

1.6 Deliverables

The deliverable of this report has a report describing the process and results of the project, a final product, and a video introducing the product

Figure 2 Example of a series of drawings that forms a premo animation (contempt)

CHAPTER 2
RESEARCH

To collect ideas for developing the product, research was done to explore emotion measure context. The first part reviews different types of emotion measure instruments. The second part shows the PrEmo as well as the development of it. The third part illustrates relevant studies, theories, and literature that could be applied in the design. The fourth part is a how-to session searching for possible directions. The last part made an explanation for an interview that aims to get insights from the researchers about the new product.

2.1 Approaches to measuring emotion

2.1.1 Various measures
There were different instruments to measure emotions, ranging from simple questionnaires to brain wave and eye movement detecting equipment. The techniques used for emotion measurement can be categorized by facets of emotion (Laurans, Desmet & Hekkert,2009). And the major difference is made between autonomic measures and self-reported measures (Desmet, 2003). There are also moment-to-moment ratings as one emotion instrument for interaction experience, which is out of our scope in this paper (Laurans & Desmet,2012).

2.1.2 Autonomic measures to measure emotions
Each emotion has its specific facial, vocal and postural respond (Ekman 1994). For example, when you were angry, you would always have physiological reactions like a fixed stare, contracted eyebrows, compressed lips and a raised voice (Ekman & Friesen 1975). Based on this theory, people develop two different emotion-measure instruments: facial-measuring instruments such as the Facial Expression Analysis Tool (FEAT; Kaiser & Wehrle 2001) and vocal ones like IBM's emotion mouse (Ark, Dryer, & Lu 1999). During the measurement, key signals like microexpression or physiological indicators from the participants will be collected and then analyzed to get to the emotion. There are 3 advantages of autonomic measures: First, instruments can be applied in the various cul-
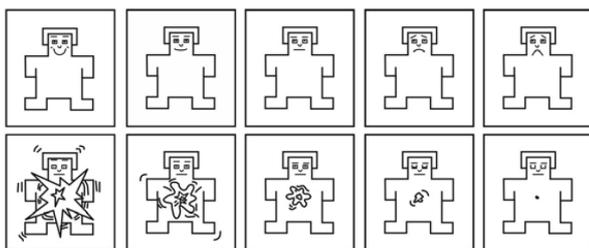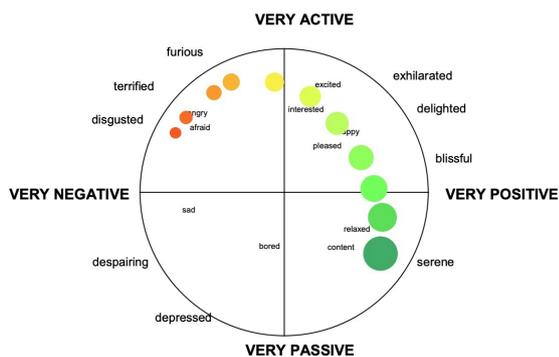
tural backgrounds due to their language dependence. Second, it can measure continuous emotion because participants are not disturbed through the process. Third, all the indicators are objective and they are less influenced by participants' evaluation compared to self-report emotion measure instruments. The drawbacks are also obvious: these tools cannot distinguish mixed emotions. What is more, the recognition accuracy is not that high, around 60%-80% and the assessable emotions are limited (such as anger, fear, and surprise).

2.1.2 Self-reported measures to measure emotions
Every emotion has a certain basic and subjective feeling (Titchener 1908) and they can only be measured through self-report. Self-reported measures rely on respondents accessing their feelings on self-report by using a set of items that are defined before to describe the emotions they subjectively feel. There are also two main categories of presentation: adjectives (simple words or lists of words) and visuals (stylized facial displays or cartoons) (Desmet, 2016). Compared to autonomic measures, self-reported measures can assess mixed emotions. While there would be language barriers when applying verbal self-report instruments on different cultures. A 'straight' translation is impossible and consequently, a pictorial self-report instrument without a cognitive burden is more popular in design research among designers and students. (e.g., Desmet, 2002)
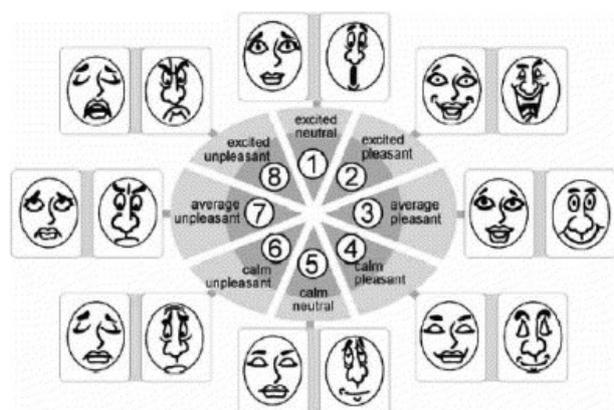

Figure 3 SAM

Figure 4 FeelTrace

Figure 5 Emocards

Figure 6 Smileyometer

2.1.3 Pictorial self-report to measure emotions
Among the various pictorial self-report instruments, the most famous one is SAM (Figure 3), measuring emotions through dimensions: pleasure (valence), arousal and dominance (Bradley and Lang, 1994). While it is still limited to its extra verbal explanation. 'FeelTrace' [Figure 4, Cowie et al., 2000] uses a spot to score how pleasant and arousal people feel while 'EmoCards' [Figure 5, Desmet et al., 2001] assesses pleasure and arousal this two dimensions through 16 cartoon facial expressions. Compared to the 'Smileyometer' [Figure 6, Read, 2008) which is also based on emoticon-based, 'AffectButton' [Figure 7; Broekens and Brinkman (2013)] could express all three dimensions as SAM. The mediate of the 'Photographic Affect Metre' (Figure 8; Pollak et al., 2011) is 16 photos located in pleasantness-arousal space, however, the 'sensorial evaluation approach' [Figure 9; SEI; Isbister et al. (2006)] utilizes eight abstract three-dimensional objects to reflect participants' emotional effect.
There are also two mood measure instruments: Russkam, accessing 29 different mood sand emotions [Figure 10; Sánchez et al. (2006)], and MAAC which is aimed for the youth [Figure 11; Manassis et al. (2009)].
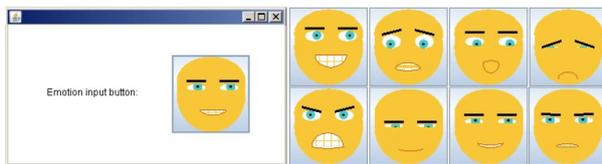

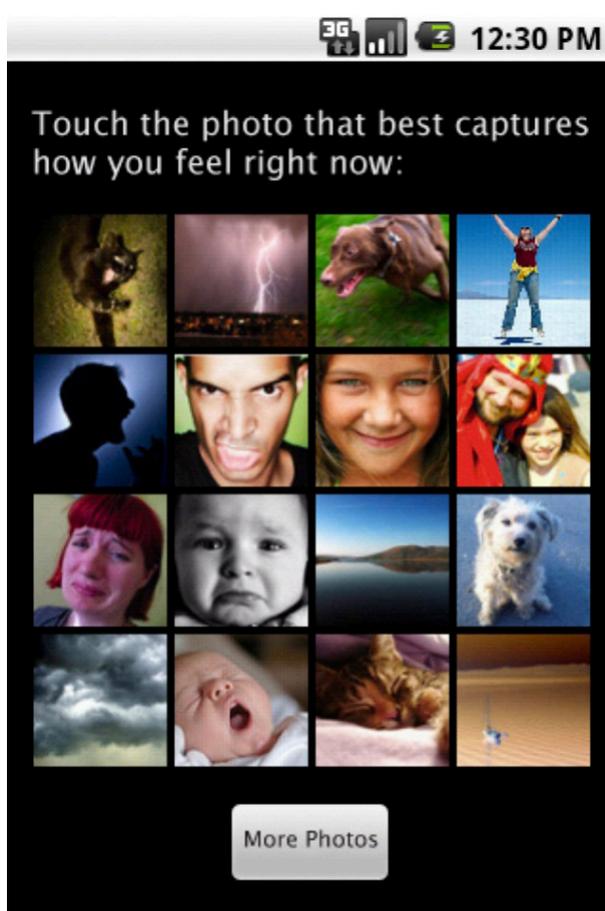**Figure 7** AffectButton

Figure 9 SEI

Figure 10 Russkam

Figure 8 Photographic Affect Metre

Figure 11 MAAC

2.2 PrEmo

2.2.1 Product description
As one of the most famous pictorial self-report instruments, the PrEmo combines the advantages of both autonomic measures and self-reported measures. It can not only measure distinct and mixed emotions (compared to pleasure arousal-dominance space instruments) each time but also be applied in a cross-cultural environment without expensive equipment. What is more, the experience of using it is pleasant and enjoyable for participants (Desmet, 2003).

The PrEmo, aiming to access emotions elicited from the design of every day produces at first, broaden its scope of use to other fields of design by adopting a more systematic appraisal emotion proposed by Ortony, Clore, and Collins (1988). And the 14 emotions devised which are more appropriate to cover a general product experience are defined into 4 emotion domains and they are (1) general well- being emotions (joy, sadness, hope and fear), (2) expectation-based emotions (satisfaction and dissatisfaction), (3) social context emotions (admiration, contempt, shame and pride), and (4) material context emotions (attraction, aversion, fascination and boredom).

The animations' development of PrEmo follows the procedure introduced by Desmet (2002). The cartoon characters were drawn by cartoonists after discussion regarding emotion general patterns with the researcher and the materials they utilized are from 6 professional actors' independent 14-emotion performance. Vocalizations were then recorded to synchronized the animations. And the free depictions by actors were then found to match closely to the literature description (Desmet,2017).

The emotions are conveyed by cartoon animations and the this is based on following three reasons: First, it was proved that dynamic facial displays perform better on reorganization than still faces (Arsalidou, Morris & Taylor, 2011) and clearer mimicry effects induction (Sato, Fujimura & Suzuki, 2008). And animations were more intuitive as well as enjoyable to participants (Desmet, 2003). Second, voice included in animations can be efficient information because recent research indicates that different emotions can be widely recognized among different populations through abstract vocalization cultures (Sauter, Eisner, Ekman & Scott, 2010). Third, the cartoon character drawn from the waist in a limited space can emphasis more on key expression information to improve the recognition (Rosset et al., 2008), especially for pride or shame (Tracy and Robins, 2007).

2.2.2 PrEmo development timeline
Based on the research of Ettcoff and Magee (1992) that facial expressions sometimes are more effective than the verbal expression on emotion communications among people, PrEmo, the 14-emotion pictorial self-report with dynamic facial and vocal expressions was developed in an iterative process. Each iteration is based on the evaluation of the previous version which defines the strengths and weaknesses of PrEmo, aiming to eliminate flaws of it. During the process, different versions of PrEmo also promoted different insights generation as well as emotional impact evaluation of new concepts. Here is the timeline table of publications representing the development steps (Figure 12).

To sum up, we found that the current improvement of the product was mainly focused on the content of the instruments rather than a medium that carries the expressions. How respondents perceive the products and what kind of forms may be more suitable for the majority of them still need to be explored, which gives designer opportunities to improve their work.

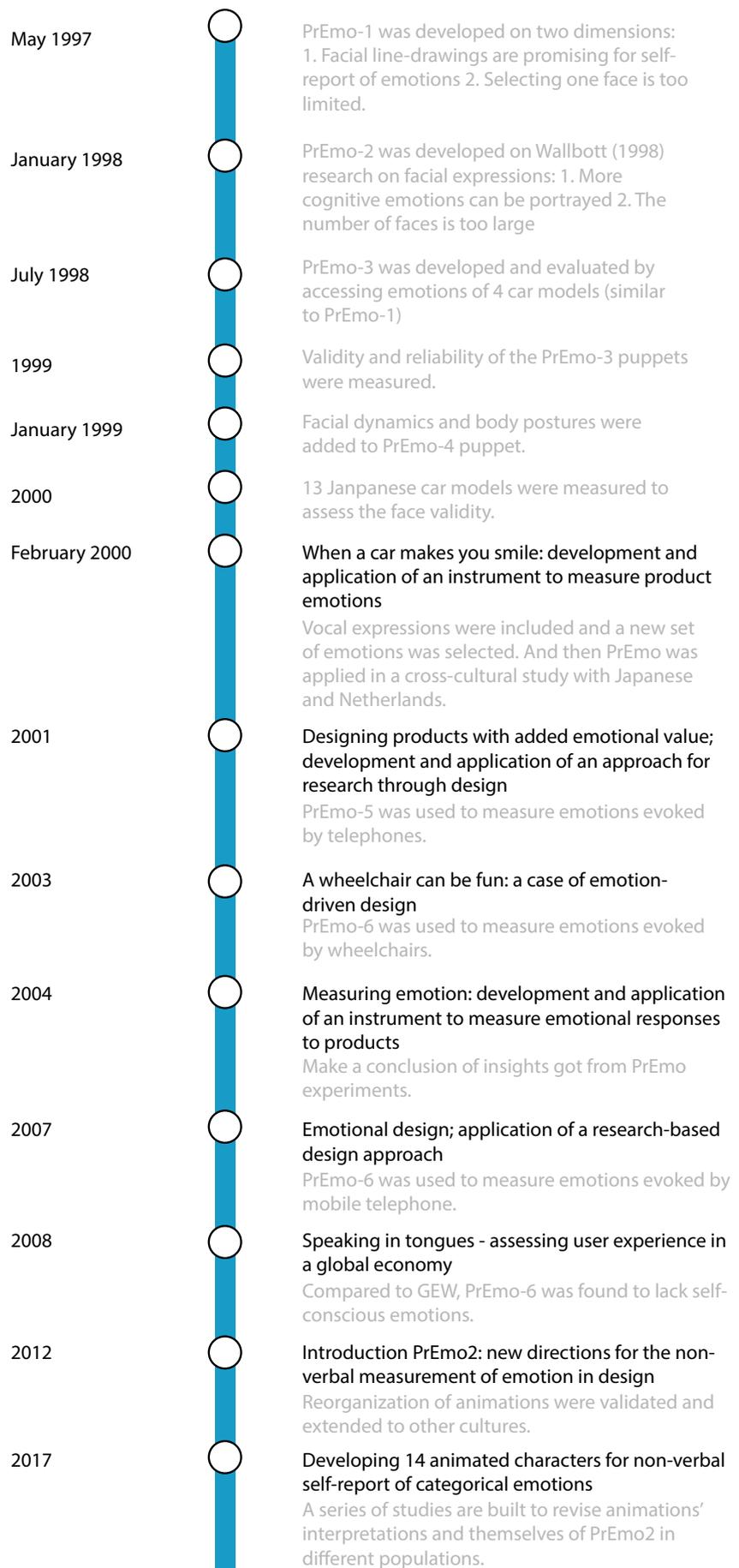| Date	Description
May 1997	PrEmo-1 was developed on two dimensions: 1. Facial line-drawings are promising for self-report of emotions 2. Selecting one face is too limited.
January 1998	PrEmo-2 was developed on Wallbott (1998) research on facial expressions: 1. More cognitive emotions can be portrayed 2. The number of faces is too large
July 1998	PrEmo-3 was developed and evaluated by accessing emotions of 4 car models (similar to PrEmo-1)
1999	Validity and reliability of the PrEmo-3 puppets were measured.
January 1999	Facial dynamics and body postures were added to PrEmo-4 puppet.
2000	13 Janpanese car models were measured to assess the face validity.
February 2000	When a car makes you smile: development and application of an instrument to measure product emotions Vocal expressions were included and a new set of emotions was selected. And then PrEmo was applied in a cross-cultural study with Japanese and Netherlands.
2001	Designing products with added emotional value; development and application of an approach for research through design PrEmo-5 was used to measure emotions evoked by telephones.
2003	A wheelchair can be fun: a case of emotion-driven design PrEmo-6 was used to measure emotions evoked by wheelchairs.
2004	Measuring emotion: development and application of an instrument to measure emotional responses to products Make a conclusion of insights got from PrEmo experiments.
2007	Emotional design; application of a research-based design approach PrEmo-6 was used to measure emotions evoked by mobile telephone.
2008	Speaking in tongues - assessing user experience in a global economy Compared to GEW, PrEmo-6 was found to lack self-conscious emotions.
2012	Introduction PrEmo2: new directions for the non-verbal measurement of emotion in design Reorganization of animations were validated and extended to other cultures.
2017	Developing 14 animated characters for non-verbal self-report of categorical emotions A series of studies are built to revise animations' interpretations and themselves of PrEmo2 in different populations.

Figure 12 Development Timeline

2.3 Related works

2.3.1 Lenticular technique
The lenticular printing technique was introduced as an intermediate method that can keep the convenience of the print-based character stills as well as increase its reliability in previous work. (Desmet &Yancheng, 2019) Lenticular lenses were made to print images that can show movements while people see it from different angles. The tests concluded that still, cards have a higher recognisability on emotions than lenticular cards on average. There should be some other interactions involved in solving this problem.

Figure 13 Lenticular technique

2.3.2 Tangible and graphical interfaces
It was found that the tangible products and graphical on the screen were equivalently understandable for people (Horn, M. S., Solovey, E. T., Crouser, R. J., & Jacob, R. J, 2009), while they have their advantages: tangible characteristics would have tactile and offer participants with the ease of manipulation; software on the screen provides rich information through voice, animations as well as playful interactions. (Heikki Tyni, 2016). There seem to be opportunities for combining the traditional tangible method with information on the screen. Some technologies were introduced as follows.

a. Card set
There are various kinds of cards inspiring designers as well as improving the design. And the reason is usually that a card set is easy to be used through a design process. Secondly, the flexibility the card set has fitted the design process very well. (Rozemarijn, 2017) What is more, it can provide useful information that researchers gained conveniently. (Robin and James, 2019)
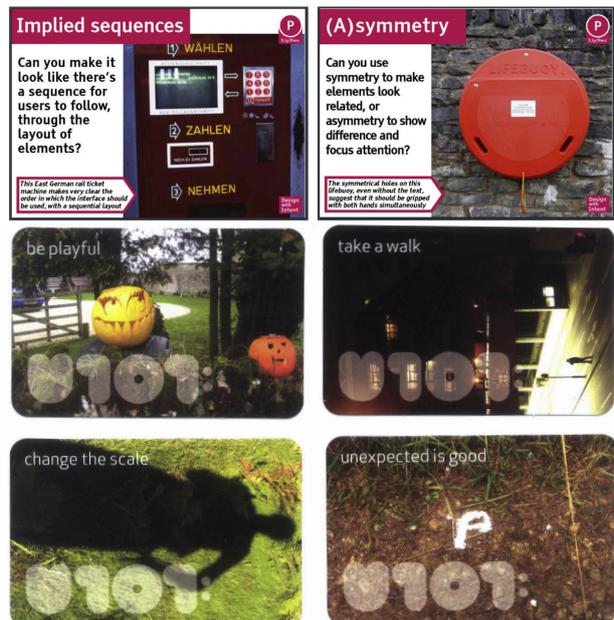
Figure 14 Card sets

b. AR

Augmented reality is a view of a physical, real-world environment where elements are augmented by computer-generated sensory input (Maartje,2017). The most used hardware of the AR system is the phone, which makes it convenient for people to use it in daily life. The appearance of AR technology offers opportunities for adding factors to the environment and improving the interaction. As a result, there are more and more AR applications on smartphone nowadays.
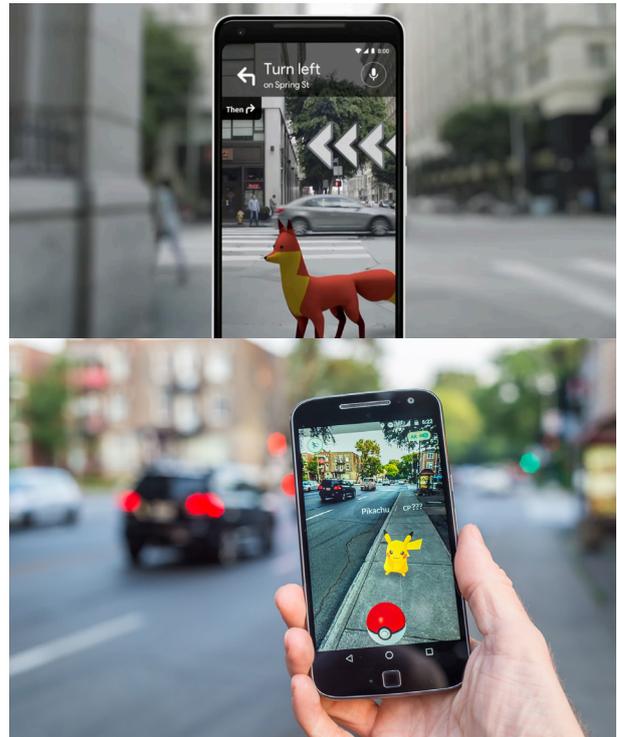

Figure 15 AR applications

c. RFID

Radio Frequency Identification (RFID) is a wireless communication technology that uses radio signals to identify specific targets and read and write related data without the need to identify mechanical or optical contact between the system and a particular target (Wikipedia). An RFID system consists of a reader and tags. The tags are divided into active tags and passive tags, while the passive ones are more widely used due to its low price and small volume. The working principle of RFID is: after the tag enters the magnetic field of the reader, it can send the information stored in the chip. RFID is widely used in different applications like credit cards and passports. The advantage of RFID is its fast speed and easy usage.
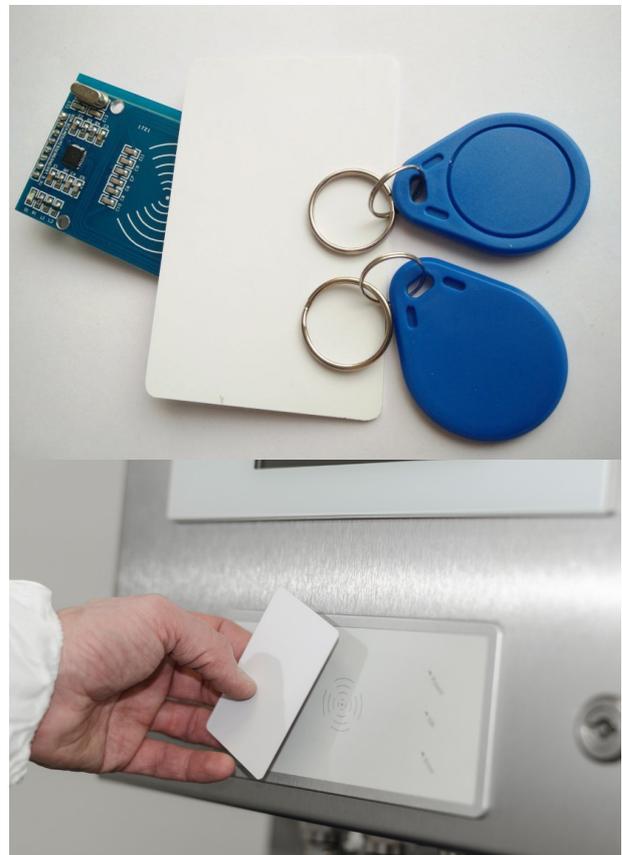

Figure 16 RFID

2.4 How-to session

2.4.1 Session goal
To generate different ideas that can meet the requirements of the offline PrEmo

2.4.2 Session process
Five design students from TUDelft were invited to participant in the session and their tracks covered all three masters. The session consists of three phases: 15-minute-long introduction, 20-minute-long idea generation and 25-minute-long discussion.

a. Introduction

Every participant was allocated to one booklet which describes background information as well as requirements of the product (Appendix 1). The moderator also presented to answer questions from the young designers.

b. Idea generation

After the introduction, they were encouraged to write down their thoughts on the blanks of the booklet. There are also some pictures of board games and interesting ideas from previous tests to inspire them.

c. Discussion

Finally, participants were asked to explain their ideas and the principles of designing them. Their ideas were well organized and put into the conclusion.

2.4.3 Results
Four booklets full of different ideas were generated. And after combining the solutions for the initial ideas, five directions came out.
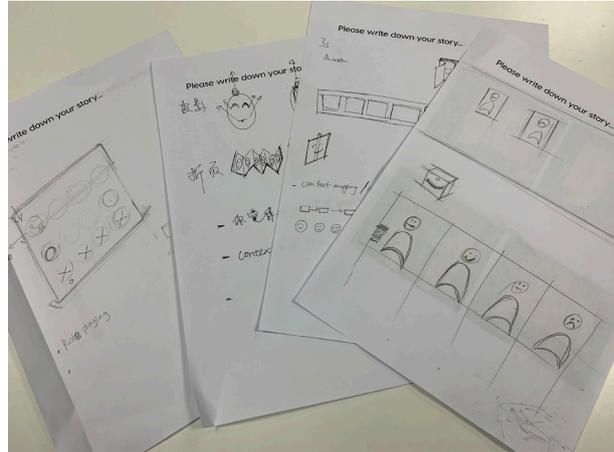

Figure 17 Booklets

Figure 18 Session process

Design Direction 1: Rfid Technique Card Set

1. Radio Frequency Identification (RFID) is a wireless communication technology that uses radio signals to identify specific targets and read and write related data without the need to identify mechanical or optical contact between the system and a particular target.
2. In this concept, emotions are made into a round acrylic card set.
·3. By approaching the cards to the RFID reader, animations corresponding to each emotion will be displayed on the screen.
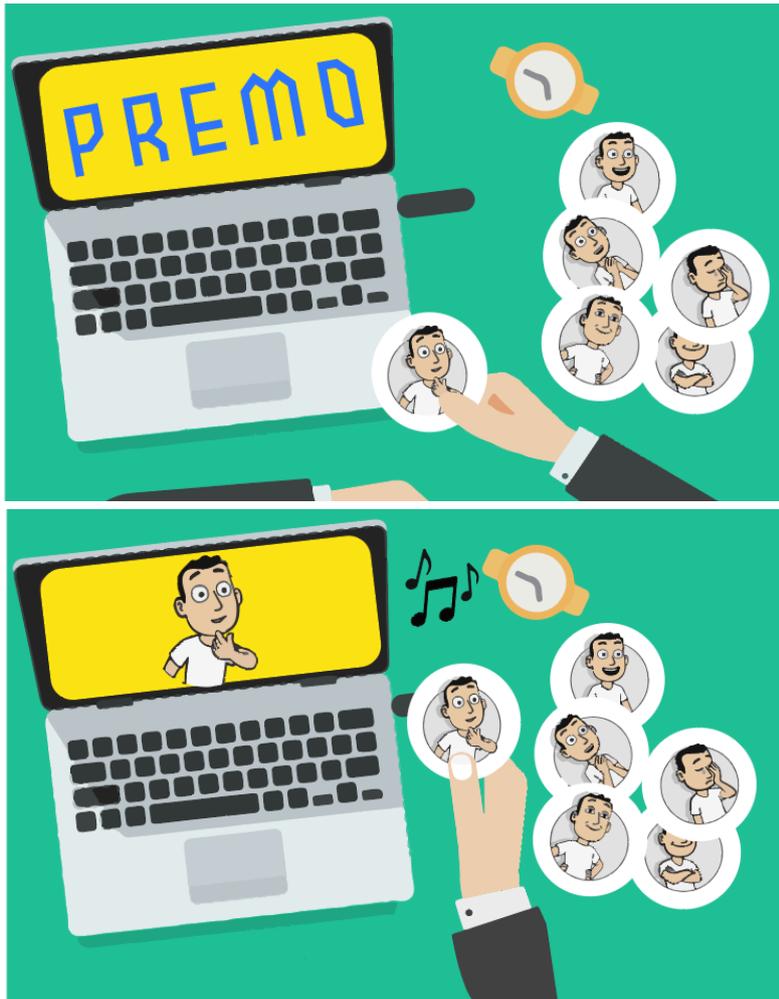
Figure 19 Design direction 1

Figure 20 Design 1 prototype

Design Direction 2: Ar Technique Card Set

1. AR technology is an emerging technology that overlays computer-generated virtual information into the real world where users are located.

2. In this concept, emotions are printed on a normal card set.

3. Participants need to download a specific AR application first and then scan each card to watch according to animations and sounds.
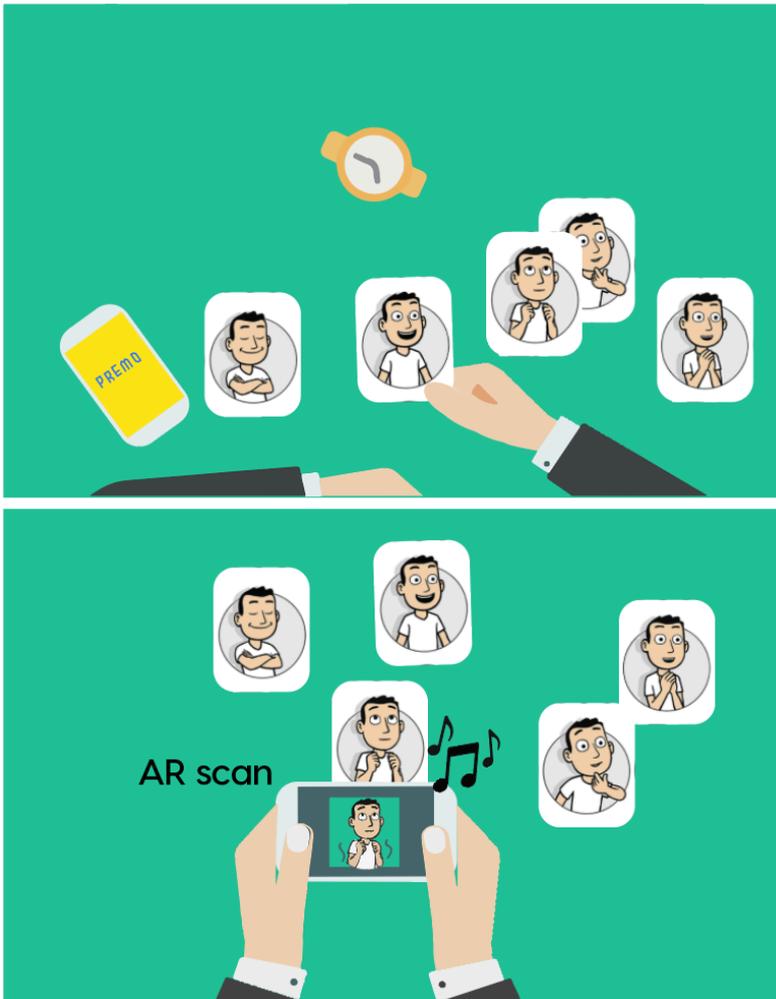

Figure 21 Design direction 2

Figure 22 Design 2 prototype

Design Direction 3: Sound Box + Ar Tech

1. All emotions are half-inserted on the surface of the toolkit and the participants can open the PrEmo toolkit like a small suitcase.
2. It will also be convenient for participants to take each emotion out from the toolkit.
3. Sounds will be made when participants push each emotion to increase the reorganization.
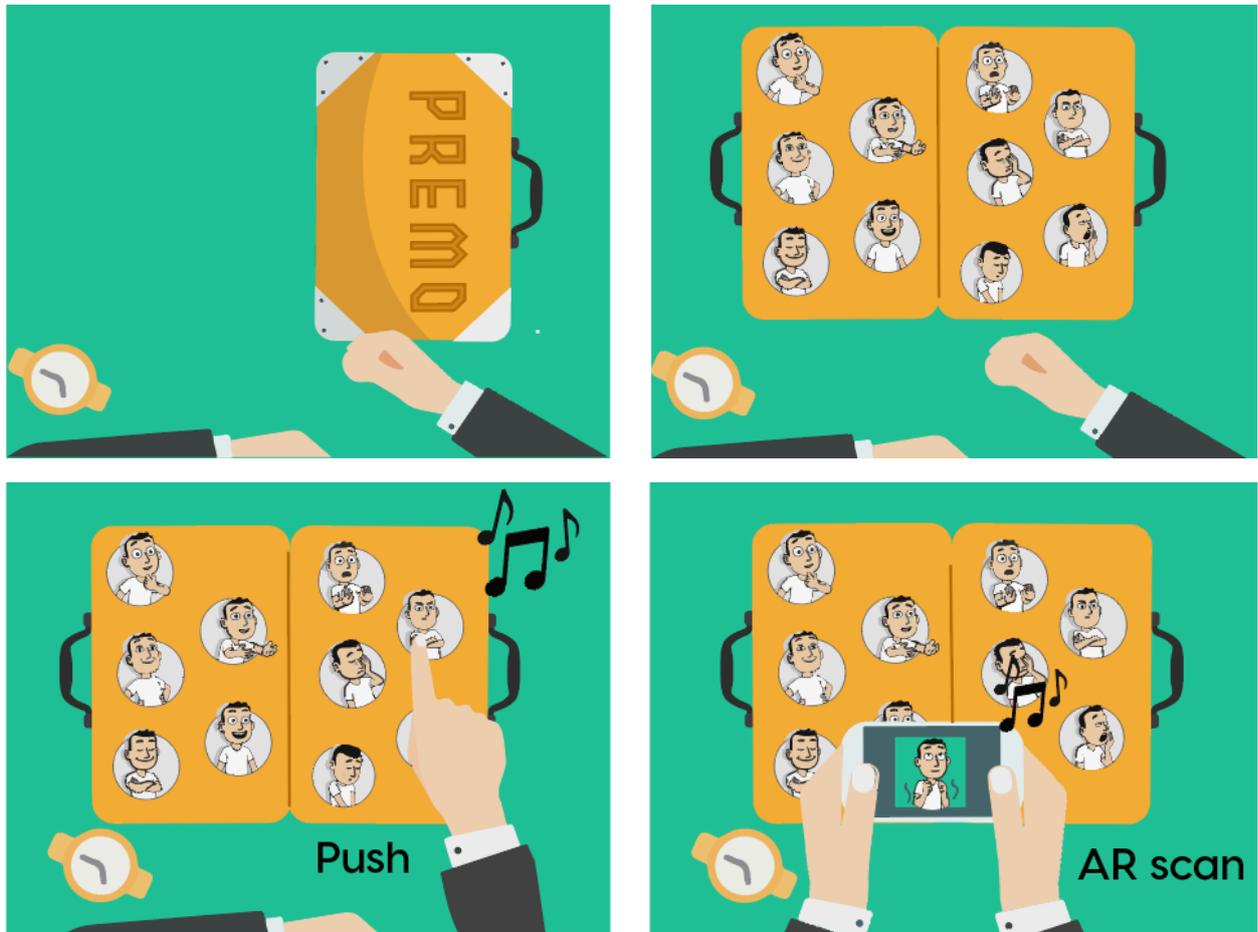4. AR technique can also be applied here to display the animations.

Figure 23 Design direction 3

Figure 24 Design 3 prototype

Design Direction 4: Page flip animation

1. In this concept, each emotion is transferred into one booklet and every booklet contains all the frames of the animation.
2. The final frame of the animation will be on the first page of the booklet, so participants can see the emotion on the first page from the front.
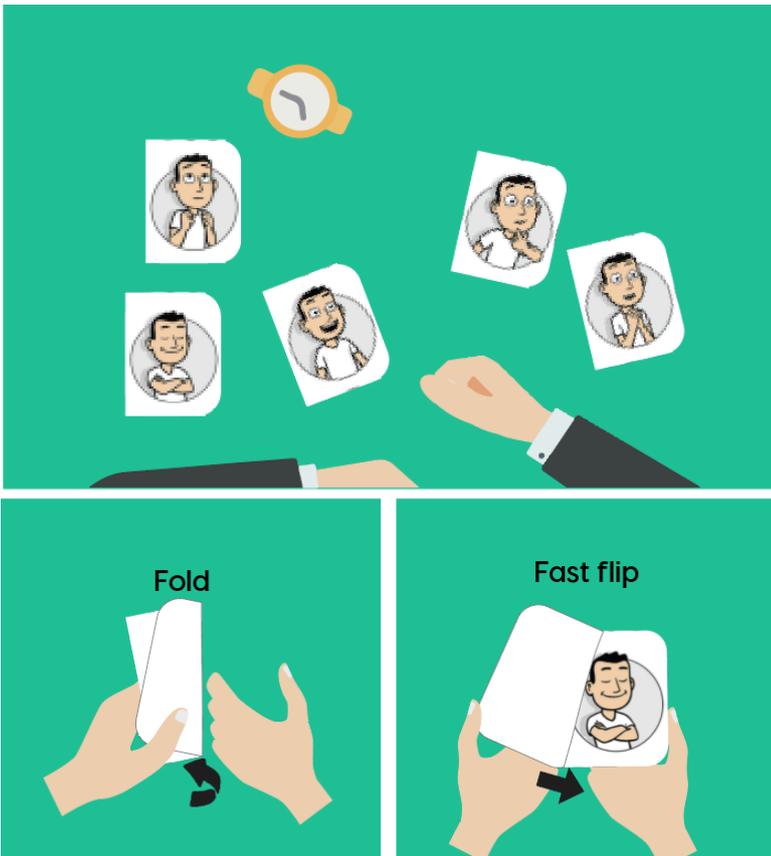3. When they do a fast page flip from the last page of each booklet, the animation will be displayed.

Figure 25 Design direction 4

Figure 26 Design 4 principle

Figure 27 Design 4 prototype

Design Direction 5: Premo Sounder + Rfid Techniques

1. In this concept, emotions are made into keychains and there will be speakers inside.
2. When they push each emotion keychains, corresponding sounds will be made.
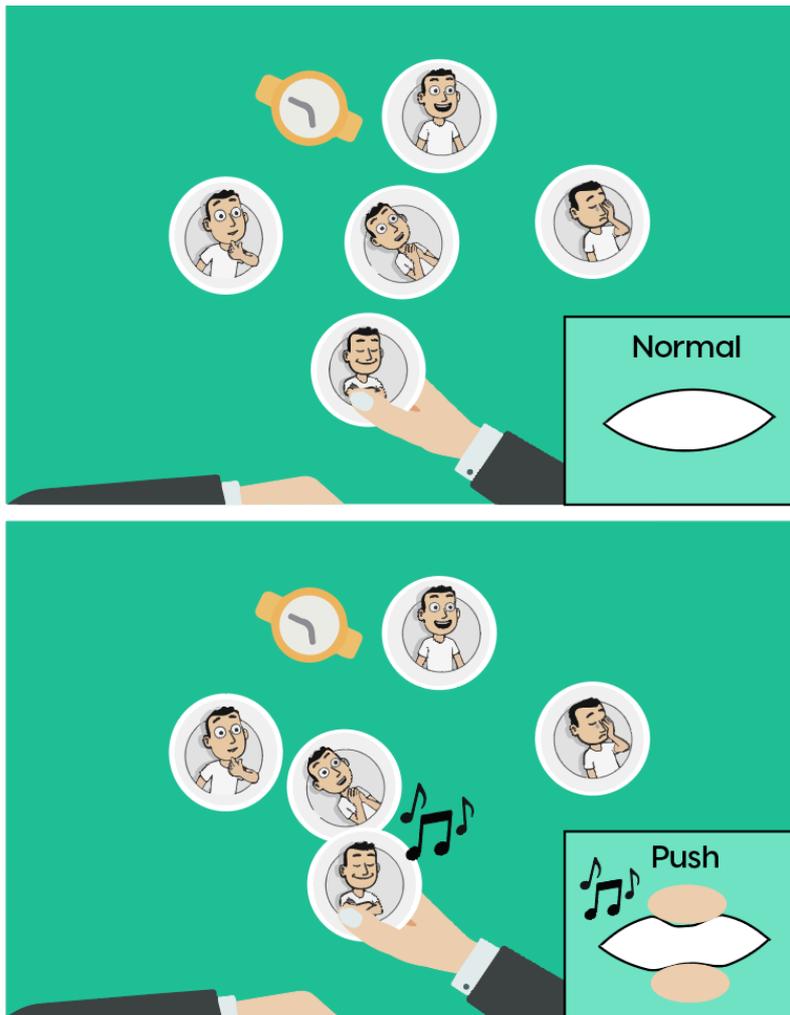3. For animations, RFID techniques could be applied here.

Figure 28 Design direction 5

Figure 29 Design 5 prototype

2.5 Interview

2.5.1 Research aim

After making the design directions, an interview was organized. The study has two main aims.

First aim:

> The first is to get an overview of how designer researchers have used PrEmo, to get insights about their experiences of using PrEmo, their measurement needs, and their ideas on how PrEmo can be improved. This will help us to formulate requirements for the design.

Second aim:

> The second aim is to get some feedback on initial design ideas from the session.

2.5.2 Research questions

First research aim

> 1. What are the experience of PrEmo users?
> 2. What strength & weakness do PrEmo users perceive?
> 3. What ideas do PrEmo users have for making a useful interface?

Second research aim

> 4. Which of the generated design ideas are preferred and why?
> 5. What additional ideas to PrEmo users have for the new PrEmo design?

2.5.3 Participants

Nine design researchers from various countries who have used PrEmo in a design project were recruited. Half of them are students and the others are designers or researchers. The gender is also mixed. Because PrEmo aims to communicate the emotions beyond the language, it is necessary to get insights from designers all around world and with different background.

2.5.4 Procedure

The interview consists of two parts: In the first part, participants were asked some open questions regarding their PrEmo experience. In the second part, researchers focused on ideas about the new version and invited participants to respond to ideas generated from the session. To help participants understand directions better, drawings and regarding descriptions were offered. Interviews were done either in person or by skype (or telephone call). When done in person, the interview will take place in a neutral room. Three of the interviews were conducted in Chinese and the rest six were in English. Since it would be more com-

Figure 30 Participants

fortable for the three Chinese participants to talk in their mouther tongue and it would be helpful to get more insights.

2.5.5 Analysis
All the interviews were recorded and then translated into documents by the researcher. Participants' quotes about their experiences of using PrEmo and their reasons of making choices among five design directions to some extent reflect their requirements for the new product. Sentences of difficulties of using previous version as well as their expectations for the new version are picked out. And then they were clustered into four categorizes by the different steps through the whole using process and the irrelevant comments were filtered. The similar insights were combined and their insights are very useful in formulating the below requirements of the design.
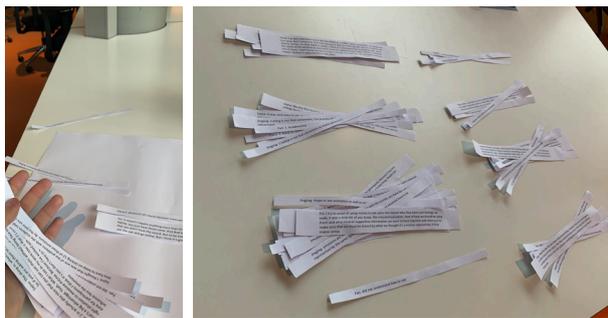
2.5.6 Results

Figure 31 Quotes

Requirements and quotes:
Prepare phase
1. There is not that much preparing cut working as the printed version.
   Evi: I would like to have both online and offline, prefer a version to be quickly-insert in a survey without copying, cutting and things like that.
2. Required devices are convenient to carry.
3. Researchers know how and where to use the PrEmo.
   Fan: *did not understand how to use*
   Sajna: *it was very easy to set up and use, it was fast. It was simple note this, the participants did not have any problems in using it.*

Using phase
4. The coverage of emotions is full and the categorization is clear between different emotions.
5. The emotion can be shown accurately in good

details and steadily.
Evi: just an image could be a little bit ambiguous
Evi: animation can give a little bit of a more clarity to what emotion that is.
6. The emotions should be presented in a good structure that their relations are clear they could be recognized fast.
   Dana: *I've also used other tools, like the wheel of emotion, I don't remember. But I remember that that tool was it was more like specific, like the emotions are clearly written. So that makes it easier, I think as a as a researcher to, to know, like, what the name of the emotion is, and which ones are related to each other. I think it would be nice if there. I don't know, maybe it's there already, but that you can see which ones are maybe related or opposite from each other.*
   Fan: *without a certain structured order like pick up mood.*
   Rachel: use some time figuring out what the emotions are
   Sajna: *want to add relation with people daily used emoji, because they have to first understand what the emotion is. if you are to give something like that, then it becomes easy for them to relate. if you give the emoji side by side with it, which it closely represents, okay, then it could be easier for students to kind of understand the emotion faster.*
   Sajna: *You have to click each of the different ones to figure out what it is and sometimes with the facial expression or not, people may not understand what kind of emotional. Sometimes it is not easy for the person who's using it, to immediately understand what kind of emotional. I thought that was one of the problems with the students told me at the time that they have to keep on clicking 12 of those emotions. By the time you click 12, you're like lost.*
7. The interaction applied here should be easy and learnt very fast.
8. There are no things influencing the emotions participants choose. (interaction and names)
   Sajna: The thing is, when an emotion is being Elicited, it has to be free from all other things, so if you are asking them to look at a product, the medium of your asking should be very seamless. if you have five of them on the thing, and then you just pick it up and put it and immediately you feel it on the laptop, the direction one is the only option which can elicit that, because all the

other one kind of, has other actions in between, which could hamper your reporting of the emotion. So, my suggestion is, let's not try to bring other technology into the peace. Because the more technology you try to bring in, it's very difficult for the person to accurately report the emotion because emotions are very, very sensitive to any kind of external stuff.

Evi: *I try to avoid of using names to ask users the reason why they have such feelings, so yeah, it was a little bit of you know, like miscommunication, how of how we should be using them and what kind of supportive information we want to have together with them just to make sure that we must be biased by what we thought it's a motion represented, if that makes sense.*

9. Participants could easily pick up their feelings.

tool design
10. The character should be without sexism.
    Evi: *one of the versions of Primo was a male. And that was taking a little bit. Let's say that it wasn't like the lot by the feminist.*
11. The material used should be durable, eco-friendly and cheap.
    David: *1. not eco-friendly, like the second one,*
12. The size of cards had better fit a A4 paper where used to have customer journey.
    David: *concern the size of the emotion, usually used in a sheet of A4 (prefer small)*

Future development
13. The results and participants' explanations could be recorded.
    Fan: *2. Smartphone convenient, accessible, can afford many functions in data collection*
    David: *want to store results, so in one folder, I have all the replies for each participant + want to share storage between web and mobile.*
14. The situations could be explored more beyond current interview and workshop, such as mass data collection, the remote interview. And there could be a platform for users to communicate their own usage and projects.
    Dana: *2 is actually also nice that you can use them without being face to face. Yeah, I think that's a big advantage. Yeah. What I see in my work now is that it's really hard to get the right situation to measure PrEmo. Because I've worked with pregnant women. this tool is so easy for participants I think it's you don't have*

to be there as a researcher so you influence less the emotions.
Evi: *it's been so far workshops and surveys that we've used it. I wonder explore if it would work in a diary.*
Evi: *actually, I haven't heard about but the idea of combining the Primo tool with the purpose of a survey that you want to target a bit of a more a larger group of people. And you get you want to get information fairly quickly from them. So, it doesn't require a lot of time for them interacting with the survey or whatever you're sending. And something that is quick and easy to set up from our side. And also, to is quick and easy to aggregate the data and start drawing conclusions from the summary of the findings.*
Evi: *it doesn't require anything more than that. So doesn't require phone does require laptop, you just have those cards. And that's, that's all you need. I do understand, though, that you don't have the sound. But to be honest, I mean, from my experience, I guess we use the sun and go online. But I think it's good enough to just see the animation.*
Evi: *test if animations are need and then explore other situations to use them.*
Yasir: *There's like a little kitchen there, you know. And there's a quite a large table, something like this, but more squared, where nurses can just sit and talk to each other. So I help my users that's there. And that was a clinical lesson with like 810 people there. And then then all working together at this usage this, and I only had like one screen, I couldn't like afford to give every individual a different screen. And I think I'm not sure, but I think focus groups that companies hire might be like that, too.*
Yasir: *you really benefit from having something on paper, because you can just hand it out to each individually, instead of having to hand out like a computer with a tablet, to all eight people, it's going to be difficult and the other people or you use.*
15. The medium could be evolved and new functions could be added conveniently.
    David: *Want to know more situations can use PrEmo from how the others use it. (know how to use them and get inspiration from other people, get continuous inputs and improvement)*
    David: *2 can give you much more like a bigger chance to evolve with the same mobile application. So, you can provide new approaches or*

new uses with the mobile application

David: what's really important to have an extra, an extra piece of paper, so they can give further explanation and terms of why they used and they felt the emotion

Yasir: *Primo tool is it relies on the senses. And there are more senses than just one right hearing. And that's what we usually use for user stats. But this is like seeing with your eyes and photos. Just one thing, and you see more. Now you're earning sound. Why don't you add textures for feel?*

2.6 Qualities

To determine the qualities of the offline version PrEmo, the requirements were then categorized furtherly. And then four qualities were gotten: convenient, easy, accurate and sustainable.

Convenient   Convenient means the required materials is easy to carry and prepared.

Easy   Easy means how to use PrEmo is easy to get for participants and the instruments involved are also easy to use. What's more, the time of recognizing emotions is also easy for participants.

Accurate   Accurate means the whole emotions details could be conveyed to participants steadily with little influence on their choices.
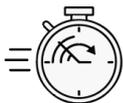
Sustainable   Sustainable not only means the materials used in producing the cards is friendly to society as well as the nature. There could also be more opportunities for the technologies applied in connecting its users to evolve itself. The results of tests can also be recorded and utilized better.

2.7 Conclusion

Concerning all the requirements, Direction 2 is the most suitable one for further studying. The medium of it is easy and convenient to be used in various situations like interview, workshops and surveys.

The others like the direction 1 and 3 are not that convenient to carry. The application of AR technique can also increase clarity of emotions as well as benefit further development of PrEmo. While the direction 3,4 and 5 may lose animation to show all the information and all the others do not have potential of combining the web end in future. The report then would continue to develop the concept based on the direction 4.

Conclusion

From previous research, we found that there are different instruments measuring emotions but the format of displaying the characters is explored less. This inspired us to work on the medium that could conveys information and meet design researchers' requirements. Some technologies that could improve the experience of using PrEmo were explored and five concepts came up. Then from the interview, four qualities were ensured and the AR technology was finally selected to develop the PrEmo.

CHAPTER 3
DESIGN

Requirements and insights were gotten from the research above. What is more, costs of technologies used in different directions were also explored. Base on them, initial decision was made. It is card set with AR technology who is convenient, easy, accurate and sustainable that outstands from five directions. To develop the concept better, exploration was completed and different forms combing all the information at this point was proposed and then evaluated among an expert group.

3.1 Design inspiration

To get more insights about the card set, a desk research was paid to the board game shop. More than ten kinds of board games were gathered and their boxes, broachers as well as the cards analyzed. Some useful ideas were gotten and were applied on the concepts.

Figure 32 Board games

3.2 Design exploration

Logo

Based on the insights gotten from the other board games and other design research toolkit cards, different styles of logos were produced to express the PrEmo. Some of them are technique style and some of them are lively. While some are in between to keep the balance between scientific and lively as an emotional measurement instrument.

Figure 33 Logo exploration

Card

Card set which is a portable tool and widely-used in daily life can easily meet requirement 1.9 and 11. To attempt all the possibilities of the new version, different formats were explored in materials and sizes. The materials are cardboard, acrylic and wood. Different sizes are also attempted. Real cards were also produced. Based on the requirement of categorizing the positive and the negative, there are also two methods to solve the problem: the first method is to paint different colours on the back of the cards, with the positive cards red and the negative emotions blue. The second method is to add the tags on the different sides of two kinds of emotions: positive emotions have the tags on the left side and the negative emotions have them on the right side.

Figure 34 card exploration

Manual

Manual is adopted here because it can play as a resource of information guiding users how to use the product and it can meet requirement 3. To decrease the reading load of users and simply the usage process, the manual is designed to a card that connect the physical cards and the application. How to use the card set is also explained on it, with some sketches to make the procedure clearer.

Figure 35 Instruction card

Package

To explain more information regarding the card set to users clearly, the package is also used to introduce the PrEmo card set. Different patterns are also used for the cover of the box. The style should be simple and scientific.
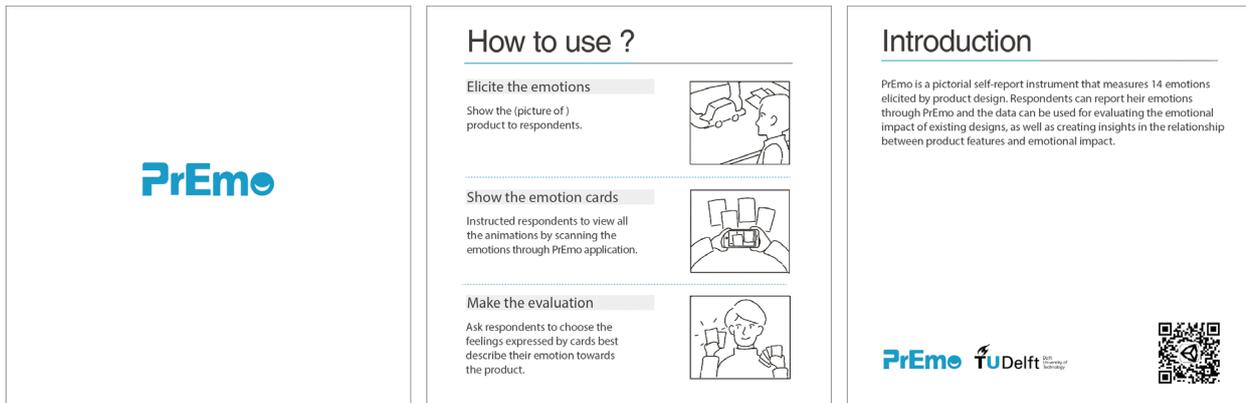
Figure 36 Package design concept
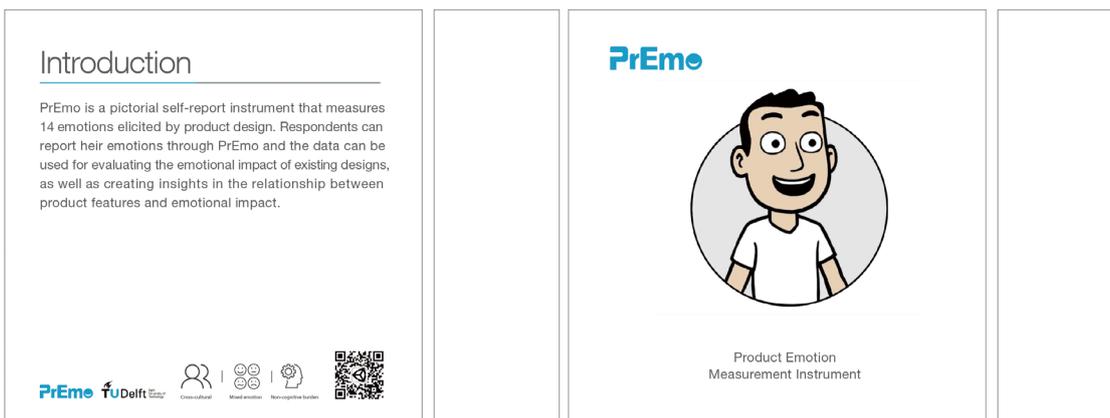
Figure 37 Package design concept

Figure 38 Package design concept

Figure 39 Package cover design

Application

As the most suitable medium connecting the animations and the physical interfaces, the application performs well in both convenience and further development. There are also some requirements on its accuracy of displaying animations. An application was developed to assistant the process. The AR technology was introduced. When the participants scan the characterises of the cards, the animation expressing the emotions will be displayed and here are the main screens as well as the storyboard. A video introducing the PrEmo is also attached. Except showing the animations of emotions, the application aims to guide the users to use the card set fluently without the manual.

Introduction

PrEmo is a pictorial self-report instrument that measures 14 emotions elicited by product design. Respondents can report their emotions through PrEmo and the data can be used for evaluating the emotional impact of existing designs, as well as creating insights in the relationship between product features and emotional impact.

How to use

1 Elicite the emotions

Show the (picture of) product to respondents.

2 Show the emotion cards

Instructed respondents to view all the animations by scanning the emotions through PrEmo application.

3 Make the evaluation

Ask respondents to choose the feelings expressed by cards best describe their emotion towards the product.

Figure 40 Application user interface

3.3 Iteration: expert evaluation

To iterate the card set better, a group consisting of three card experts evaluated the three concepts through group discussion based on their experiences. They were asked to propose their suggestions and reasons as they use the card set. Some nice insights were also proposed to improve the final concept.

Results (problems)

Logo

The PrEmo is a kind of research toolkit, so it should avoid being too childish. While using cartoon characters makes it also lively. Then the logo should adapt to this scenario.

Card

The color printed on wooden cards doesn't perform well because it may become different compared to the original color. And the paper cards are too normal.

Manual

Current instruction cannot explain the usage scenario as well as the emotions on cards clearly. What is more, as a scientific research tool, users may also wonder more information regarding colophon. A more detailed manual need to be developed.

Package

Users may have no idea what kind of cards is in the box. There should be some information describing clearly the function and the content of PrEmo on the package.

Application

The sensitivity of the scanning interaction is not that high. The speed of exhibiting animations also need to be improved. To let users can still use PrEmo without the manual, more information should be added into application. What is more, following the insights from the interview, more possibilities should also be added on this platform.

CHAPTER 4
FINAL DESIGN

This chapter elaborated on the final PrEmo product. All components were described and a scenario was also developed.

Description
The final PrEmo is one set of products to measure participants' emotions in design research. It consists of one set of cards, a manual, a sheet and an application.

Style
Rigorous but not serious, interesting but not childish. Simple and clear. It is easy to use and communicated well globally.

Logo
The logo is selected to perform the meaning of PrEmo best. It is clear for users to see all of the letters. And the "O" is like a smiling emoji which express the topic cleverly.

Figure 41 Logo design

Card
The round acrylic cards are chosen as it feels good to hold them on hands, which fits the scenario very well. It is playful compared to normal paper card.

Figure 42 Cards design

Manual
A folding booklet is applied for the manual to fit the size of box. No other material is required. The manual consists of five parts: introduction, PrEmo emotions, PrEmo dynamics, using PrEmo and colophon. Introduction part introduce the background and the aim of PrEmo. The content of the whole manual is also briefly introduced. PrEmo emotion part describes each emotion on card textually to help users understand each emotion better. PrEmo dynamics teach users how to download and use PrEmo application and Using PrEmo part describes some situations and the procedure that PrEmo can be used. Colophon page is added for researchers who would use the PrEmo, which is helpful.

Figure 43 Manual design

Sheet

To show the relations among the 14 PrEmo emotions, a sheet exhibiting 14 emotions in one circle is produced. Positive and negative emotions are placed on different sides of the circle: the positive emotions are on the upper side and the negative ones are below. To decrease the influence of the words, the PrEmo circle on the front side contains no names of the emotion. And the names are listed on the back side of it. Synonyms are also shown on the back side of the sheet.
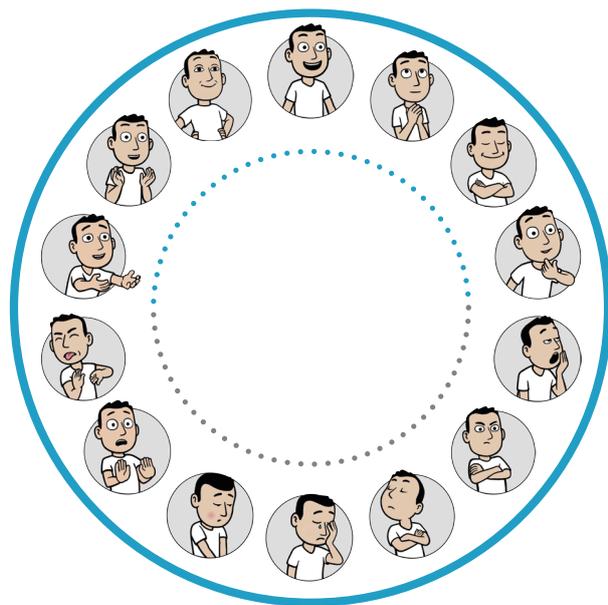
Figure 44 Sheet design (front)
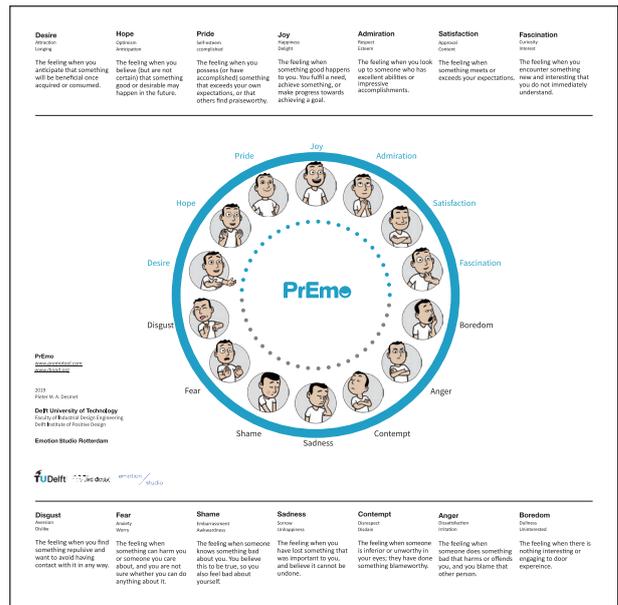
Figure 45 Sheet design (back)

Package

Some improvements on the text are completed. There are also some words describing the content of the box. One emotion is also printed on the cover of the box to add clarity as well as beauty of the box.
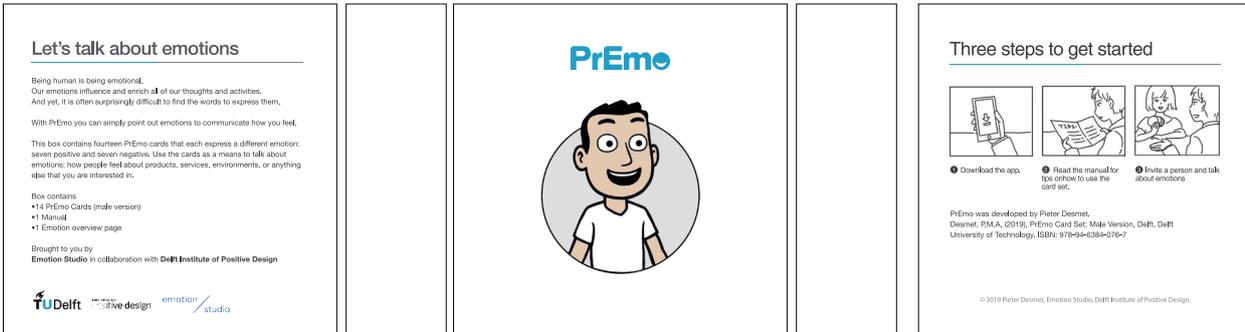
Figure 46 Package design

Figure 47 Package design
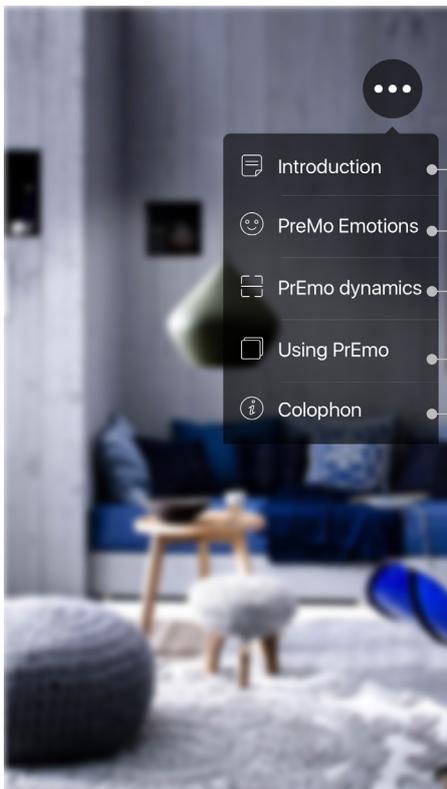
Figure 48 Application User Interface

Application

There are two functions of the application: the first one is to display the animation of emotions through APP by scanning emotion cards and the second one is to show all information about PrEmo aiming to let users can still use it without the manual. Users could download the application by scanning the QR code in the manual. And when they open the application, they could see the animation by scanning the images on cards with the help of AR technique. There is also one icon on the right top corner of the screen. When you tap on that, the menu appears, showing items of the topics included in the manual. People could see the content by tapping them. There is also an introduction movie in the introduction page. More functions could be added in the future.

Introduction

Even though we experience many emotions every day, it is often difficult to find the right words to communicate them. What if we could simply point out emotional expressions to show how we feel?
This idea inspired PrEmo: A pictorial emotion self-report instrument.
The heart of PrEmo is a cartoon character that uses his face, body and voice to express fourteen different emotions. The fourteen cards can be used for measuring emotions and to support people in talking about their feelings.
With the free PrEmo app, you can bring the characters to life.
Because the cards do not rely on words, they support cross-cultural research. The characters have been validated in The Netherlands, UK, China, and the USA.

Please watch the introduction video:
PrEmo introduction.

PreMo Emotions

For more information about the emotions, see: www.emotiontypology.com

Pride
The feeling when you possess (or have accomplished) something that exceeds your own expectations, or that others find praiseworthy.

Admiration
The feeling when you look up to someone who has excellent abilities or impressive accomplishments.

Joy
The feeling when something good happens to you. You fulfil a need, achieve something, or make progress towards achieving a goal.

Shame
The feeling when someone knows something bad about you. You believe this to be true, so you also feel bad about yourself.

Contempt
The feeling when someone is inferior or unworthy in your eyes; they have done something blameworthy.

Sadness
The feeling when you have lost something that was important to you, and believe it cannot be undone.

Hope
The feeling when you believe (but are not certain) that something good or desirable may happen in the future.

Satisfaction
The feeling when something meets or exceeds your expectations.

Desire
The feeling when you anticipate that something will be beneficial once acquired or consumed.

Fascination
The feeling when you encounter something new and interesting that you do not immediately understand.

Fear
The feeling when something can harm you or someone you care about, and you are not sure whether you can do anything about it.

Anger
The feeling when someone does something bad that harms or offends you, and you blame that other person.

Disgust
The feeling when you find something repulsive and want to avoid having contact with it in any way.

Boredom
The feeling when there is nothing interesting or engaging to door experience.

PrEmo dynamics

The PrEmo character expresses emotions with movement and sound. You can use the PrEmo application to see the dynamic animations. With the app you can use the camera on your phone to bring the PrEmo cards to life by aimming your camera at a PrEmo card. The animation will automatically be projected over the image.
Note that you can use the card set with or without the application. The advantage of using the app is that the movement and sound add clarity to the expressions. The disadvantage is that it will take some more time for your respondents to look at all the characters.

Using PrEmo

The emotion cards can be used in interviews, focus groups, or any other conversation in which you want to address or talk about feelings. You can ask your respondent(s) or conversation partner(s) to pick one or more expressions to express their feelings.
You can ask them how they feel about a particular stimulus, such as a product design, an image, a fragrance, an interior, a service encounter, and etcetera. Likewise, you can also ask them what they would like to feel, what they are not feeling, what they felt in previous events, or what they expect to feel in future events.
Examples of questions/tasks you can use in interviews or focus groups:
- Select one or more cards that best express how you feel.
- Place order the cards to express how strong your feelings are.
- Explain in your own words what the card expresses.
- Explain why you feel this way.

The design has been kept simple to support usage versatility. The characters are basically self-explanatory, but if you want you can introduce and discuss them at the start of your conversation. Depending on your conversation needs, you can decide to use the application to include the dynamics, either when introducing the cards, or during the course of the conversation.

Colophon

Production
PrEmo concept and development by Pieter Desmet. Cartoons created by Peter Wassink. Card set production by Yancheng Du in collaboration with Pieter Desmet and Haian Xue.
Reference
In communication, please refer to this card-set as follows:
Desmet, P.M.A. (2019). PrEmo card set: Male version. Delft, Delft University of Technology. ISBN: xxx-xx-xxxxx-xx-x
Publications
Desmet, P.M.A. (2018). Measuring emotion: Development and application of an instrument to measure emotional responses to products. In: M.A. Blythe & A.F. Monk (Eds.), Funology 2: from usability to enjoyment (pp. 391–404). Springer Publishing.
Laurans, G., & Desmet, P.M.A. (2017). Developing 14 animated characters for non-verbal self-report of categorical emotions. Journal of Design Research, 15(3/4), 214–233.
Terms of use
The PrEmo card set is published under an Attribution-NonCommercial-NoDerivatives 4.0 International Creative Commons licence (CC BY-NC-ND 4.0). This means that you are free to share the card set for non-commercial purposes as long as you give appropriate credit, provide a link to the license, and do not modify the original material. For licence details, see: https://creativecommons.org/licenses/by-nc-nd/4.0/

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PrEmo Manual
www.premotool.com
www.diopd.org.

2019
Pieter M.A Desmet

Delft University of Technology
Faculty of Industrial Design Engineering
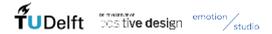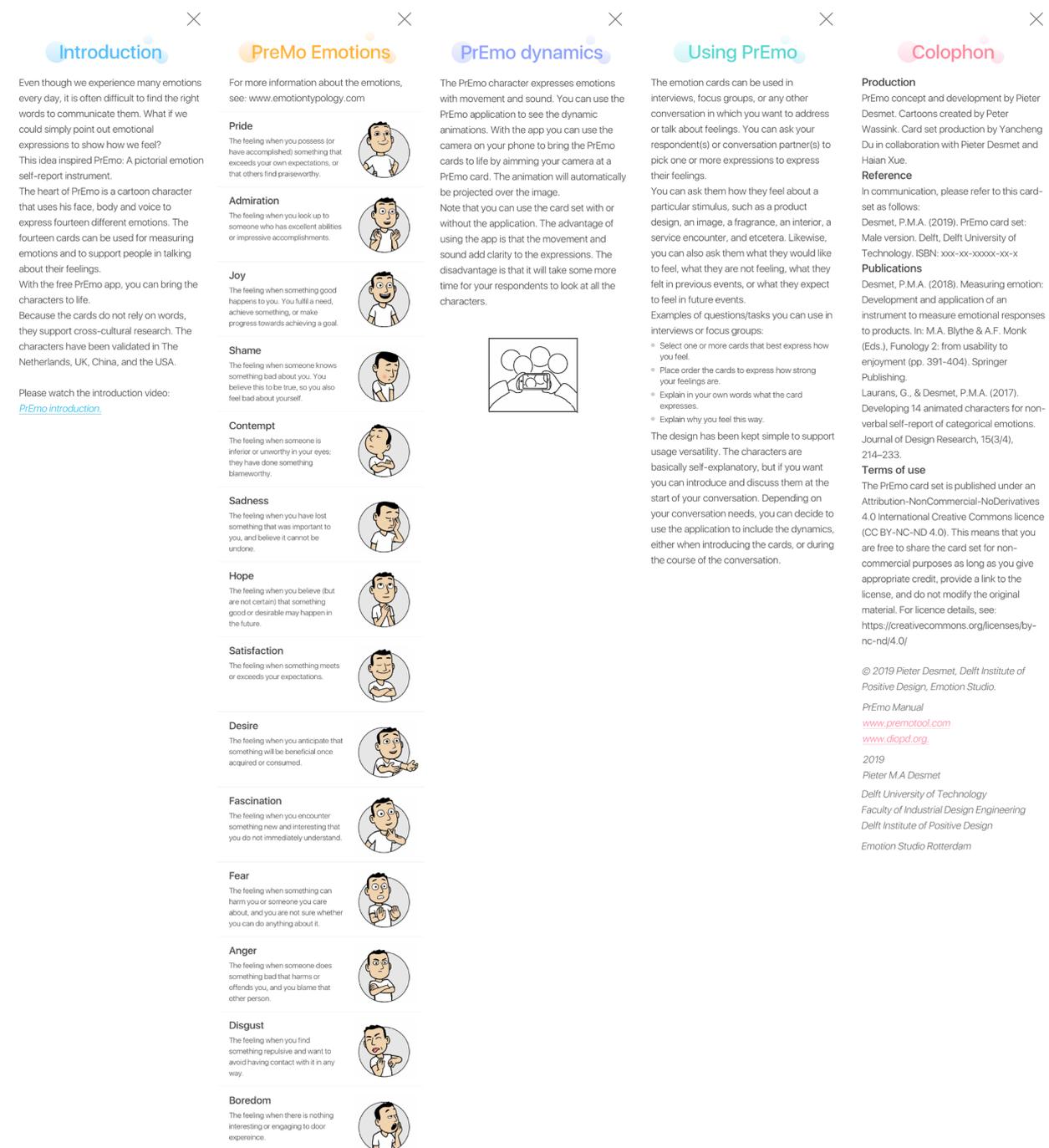*Delft Institute of Positive Design*

Emotion Studio Rotterdam

Figure 49 Application categories

Movie

To let the users understand PrEmo better, a movie was developed. And it is at the bottom of the intro-
duction page of the application. In the video, its aim, principles, usage scenarios and advantages were all
described vividly. People could get rid of reading tons of text and get familiar with the PrEmo fast and con-
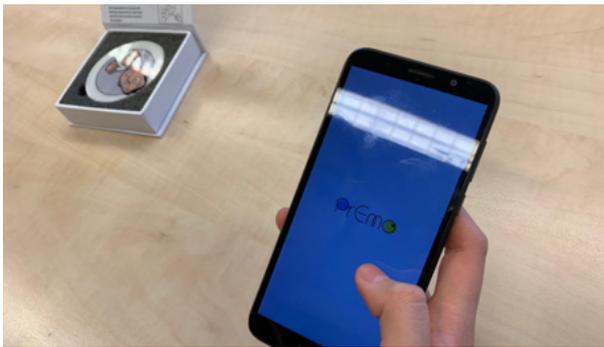veniently. A colopohon page is also included.
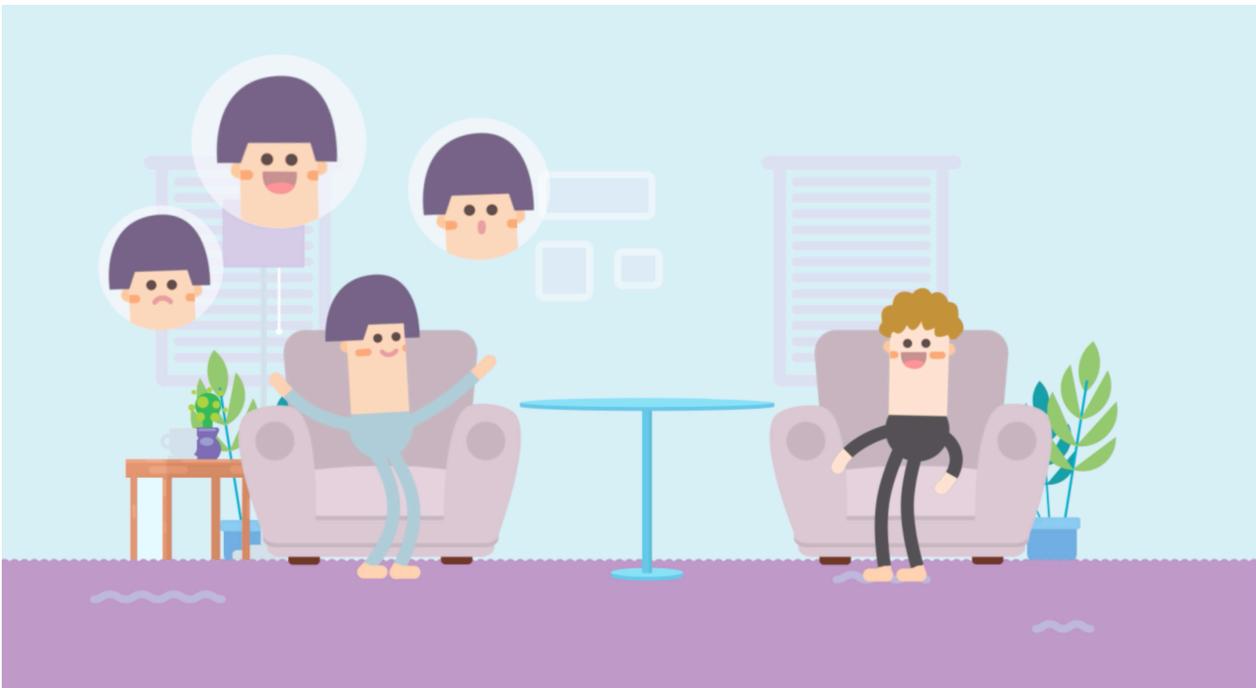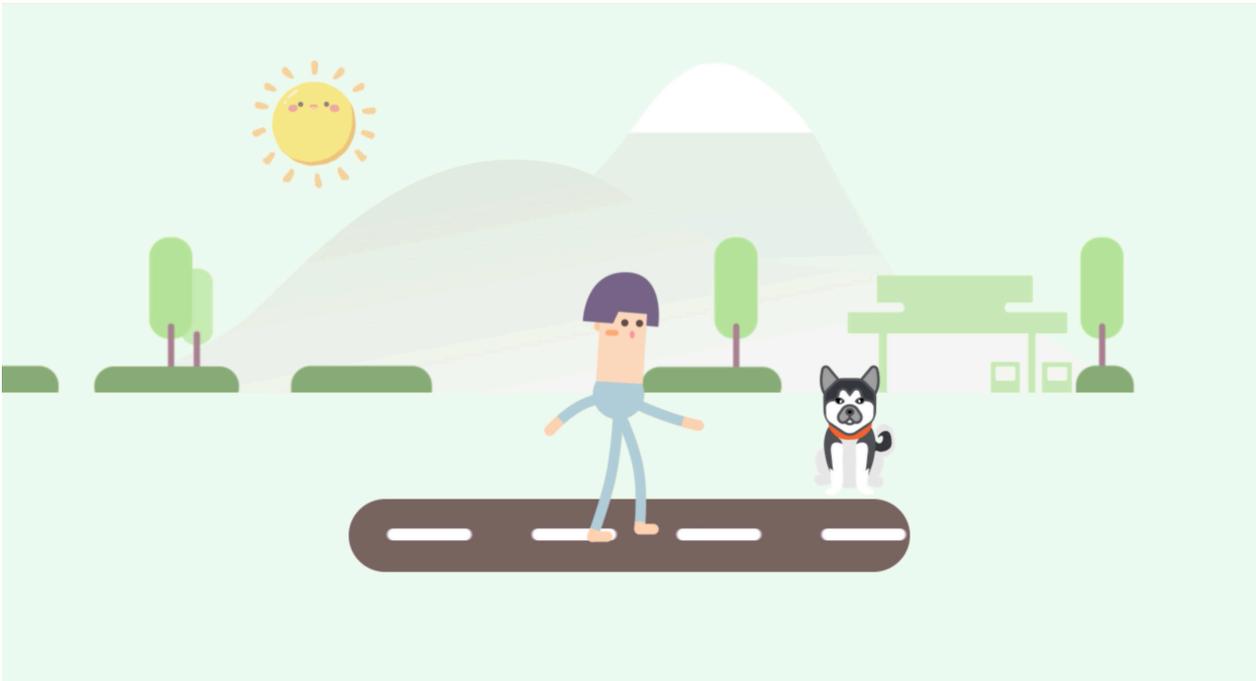
Figure 50 Movie

Scenario

Based on the insights gotten from the evaluation, some improvements are completed. A usage scenario
was also developed.

1. Open the box and read the manual.

2. Scan the QR code (or using the link) in the manual to download the application.

3. Recruit participants and organize the interviews.
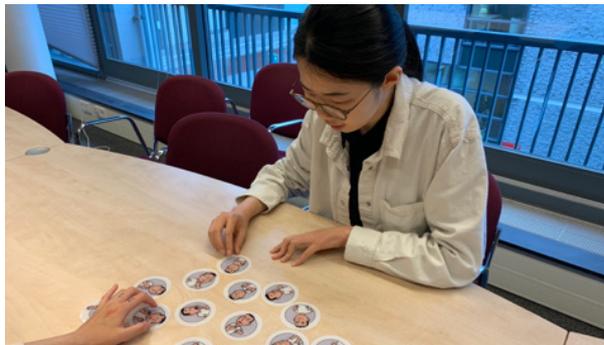
4. At the beginning, show the PrEmo card to the participants and let them first go through all emotions. A sheet explaining all 14 emotions and their relations would also be offered to participants to assist them better understand different emotions.

5. They can also open the application and watch the animations of different emotions by aiming the camera at the cards.
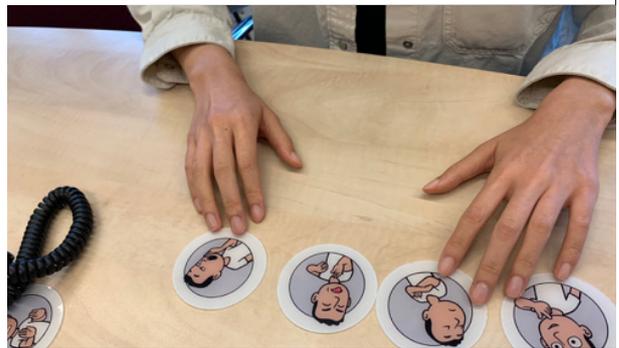
6. During the test, let participants experience the design and pick up emotions they feel through the process regarding the design/ experience.

7. Ask for the reasons about their chosen emotion experience and record the results.

7. Thank them for participating.

Cost
The cost of producing one set of sample (including the box, sheet, manual and the cards) is about 100 euros and it would decrease to around 5 euros each set if it was produced massively in a factory.

PrEmo

CHAPTER 5
EVALUATION

A user test was operated with the final product to assess the design. This chapter exhibits how the test was set up and conducted. What is more the results of the user test were also analysed afterwards.

5.1 Research aim

The study aims to assess how well the PrEmo cards help participants to express their emotions in a face-to-face interview. And also, to explore its strenghts and weaknesses as well as opportunities to further develop it in the future.

5.2 Research questions

1. What are the participants' impressions of new PrEmo?
- Is it easy or difficult for them to know how to use PrEmo through the manual and the application? How do they feel about that? what difficulties do they encounter?
- What do they think about the content of the PrEmo (manual and the application)? Which part is not clear and what else do they need to know?

2. How do they experience PrEmo through the process of using it?
- What do they think about the usage process? Are there any difficulties of using PrEmo?
- Can the participants operate the procedure of using PrEmo correctly and fast?

3. What ideas do PrEmo users have for its further development?
- What else functions do they want from the PrEmo to make it convenient for participants to use it and improve their experience? What functions or information is missing?

5.3 Participants

To have a better overview of how different background researchers think about the new PrEmo, design researchers from various countries with different background of PrEmo experience were recruited to test. The recruitment of respondents was completed through social media to look for participants who are interested in emotion measurement and willing to use it in the interview of their projects. The number was finally 5.

5.4 Procedure

There were test appointments. To prepare for the test, respondents received an email with a short explanation about the aim and setup of the study at the beginning (explaining that they will be asked to test the new PrEmo), and also a consent form. At the start of the test, the participant were welcomed by the moderator. Moderator introduced the aim of the study and the procedure. Then the

test took place. The PrEmo card set with all accessories like manual and sheet were distributed to them to let them get familiar with the product as well as try to use it for a period of time. After they getting familiar with the PrEmo, there was a usability test for them, following face-to-face interviews that ask about their experience and suggestions on the PrEmo. All the interviews audios were recorded. The interview script is in the appendix 2. Besides the interview, also observations were done during the PrEmo usage.

5.5 Results

All the tests went well and they could operate the test in a good order after reading the manual of the PrEmo. Participants' emotions regarding the products were talked about with the help of PrEmo. The same as the previous test, interviews were recorded and then translated into script. Quotes reflecting their opinions regarding the PrEmo product were picked out and then clustered.

They all think the cards with AR animation is an amazing method to exhibit all emotions. People would fall in love with this interesting method.
Yue: *The images are vivid, and the AR is also attractive.*
Xueyao*: It is really a cross-culture toolkit to do the research.*

Though all participants could complete their own interview with PrEmo, they also had some problems regarding the content of PrEmo. They found there was little introduction about the sheet and they did not know how to use it correctly.
Haoxin*: I had no idea how to use the sheet because there are no sentences describing it.*

As for the emotions, participants would worry that people would have different explanations to the same emotions. And they also did not know if the definitions would lead to bias.
Xueyao*: I wonder if it is necessary to put the definition at the back of cards, but I have a different understanding to emotions that are defined.*

What is more, some Chinese students who did not speak English frequently said there was too much text in the manual which would ruin their experience of reading it and they usually miss it because the important information such as using method and usage situations are separate and not

obvious. They prefer to have them highlighted and expressed in visualization.

Fan: I tend to ignore to read the manual cause there is too much text and I have to come back to read the manual again after reading Using PrEmo part because PrEmo dynamics is not sufficient to solve my questions about the test.

Conclusion

Through the user test with the final prototype, the usability of the new PrEmo was evaluated. All the participants liked the concept with AR animation and the format of acrylic cards. Though they had some confusion about the manual, they all completed their test in a good order. There are also some insightful comments and suggestions to improve the PrEmo card set. The recommended solutions will be offered in next chapter.

CHAPTER 6
CONCLUSION

The product generated in this project aims to develop offline version of an emotion measure instrument and the objective of the project is to combining the convenience of physical product and the clarity of animations.
By analysing some other emotion measurement instrument as well as previous work, some opportunities that could help to improve the offline product. Through a group discussion, some inspiring ideas were generated and five design directions formed. Eight interviews were conducted to get users' requirements of PrEmo and also assess the five design concepts. Four qualities were summarized and the ideal solution was selected.

After some exploration and several iterations, the final prototype was made. It is a set of acrylic cards with manual guiding people to use it. An application was also developed for users to watch the animations of emotions. There is also an introduction movie inserted in the APP. An evaluation test was taken place at the end of study and all the tests went well, proving that the usability of the PrEmo is fine, though the clarity still haves some room to be improved.

Figure 51 Using the PrEmo

Reflection

The first problem is the number of participants is limited and majority of them are young Chinese who don't speak English as a mother tongue. Then their feedbacks about the manual would be similar and their limited designing experience may also be not sufficient to find all usability problems.

The second one is that due to the limited time, researchers did not have plenty of time to organize their own tests. And the problems could only be found by their participants are ignored.

Recommendations

Though the time is limited, we still got some very useful ideas about the new PrEmo. In reaction to the previous feedback, there are two aspects that could be improved in further research:

First, participants from different background should be recruited and they should also be offered with more time and freedom on test design. There would be more productive feedback and suggestions in a further developed user test.

Second, the feedback indicates that the information about how to use PrEmo can be expressed in a better form and the text could also be better organized. The important text could be highlighted and there could also be some cartoon paintings explaining the scenario of using PrEmo. The usage of sheet should also be added in.

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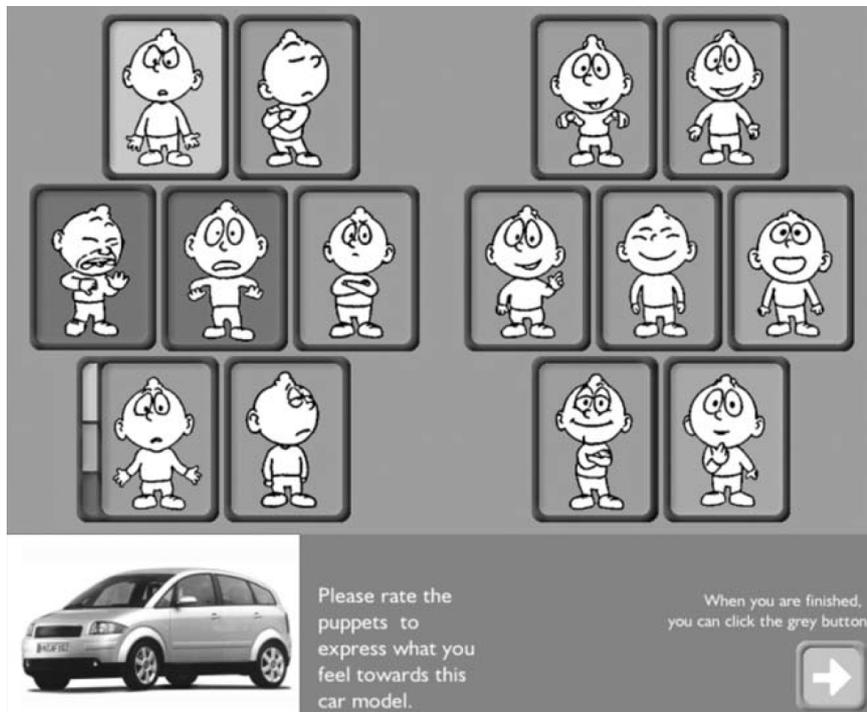
APPENDIX 1.

Introduction Booklet

14 emotions

animations and sounds

online version

Please rate the puppets to express what you feel towards this car model.

When you are finished, you can click the grey button

requirements and senario

The platform is too complicated, not ==sufficiently flexible,== and does not ==support quick in-context== measurements. Researchers are in need of an offline (non-screen based) version of PrEmo that can be used in a wide variety of contexts. As a consequence, it has been decided to terminate the online platform.

The assignment is to develop a modern, effective and efficient offline (non-screen based) emotion measurement with the use of the original PrEmo animations. This will result in a new aesthetically appealing, inspiring, and effective PrEmo toolkit. The toolkit consists of a tangible measurement instrument (e.g., set of PrEmo cards) and a supporting website with example studies and other inspirational material. The ==target group== is design students, design researchers, and other researchers interested in measuring emotions.
The toolkit should be usable for both qualitative and quantitative research questions, and it should be ==affordable== (i.e. it should be made available for max 10 euro) and usable for design researchers across the globe.

Some design challenges for developing the PrEmo toolkit:

· How can we make use of the animated quality (movement & sound) of the PrEmo characters in an offline environment?

· How can the toolkit be ==self-explaining?== (usability research and develop manual and online inspiration resource page).

· How can the toolkit be designed to support ==efficient dissemination== (packaging that supports international shipment).

current ideas and inspiration
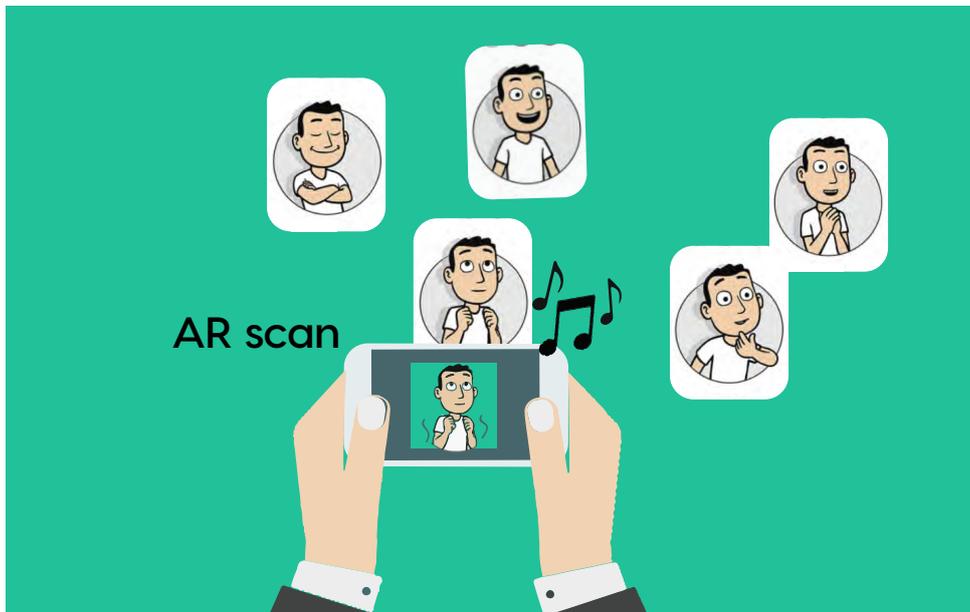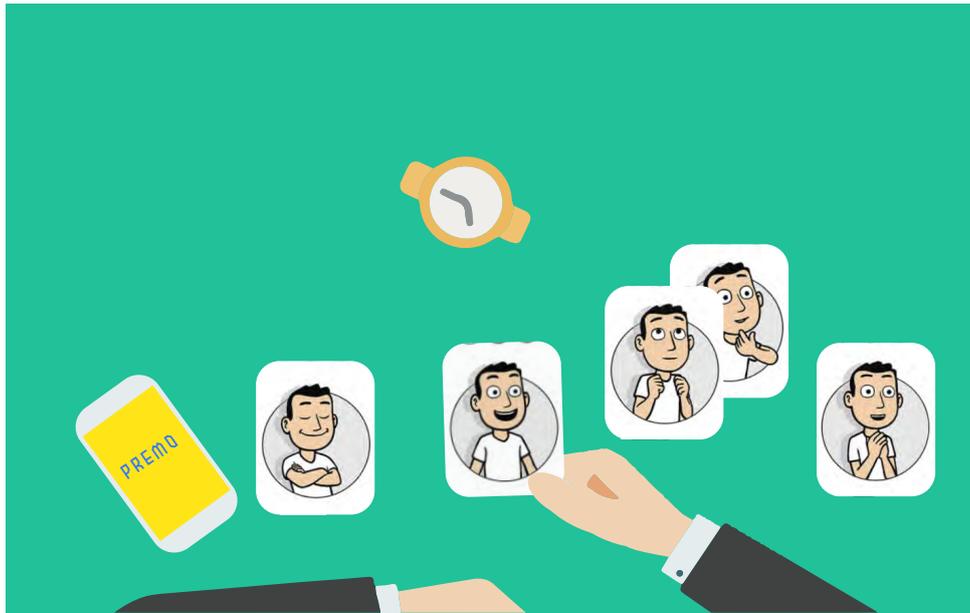
Prototype 1: RFID technique card set

Prototype 2: AR technique card set

Prototype 3: Sound box + AR tech

AR scan

Prototype 4: Page flip animation

Fold

Fast flip
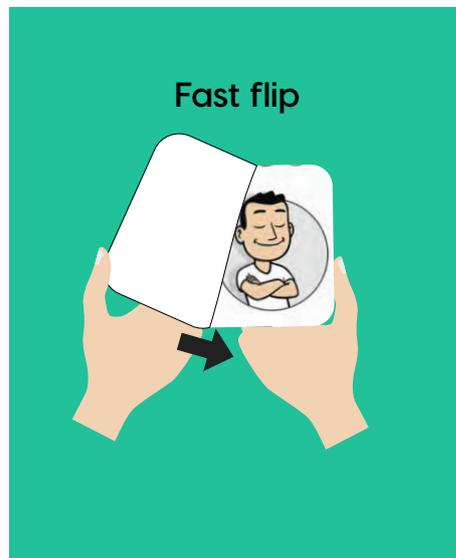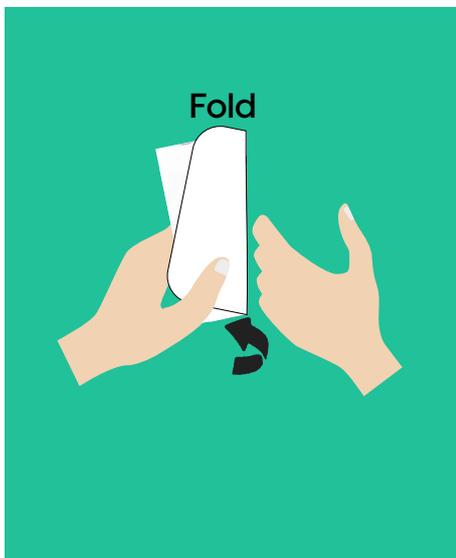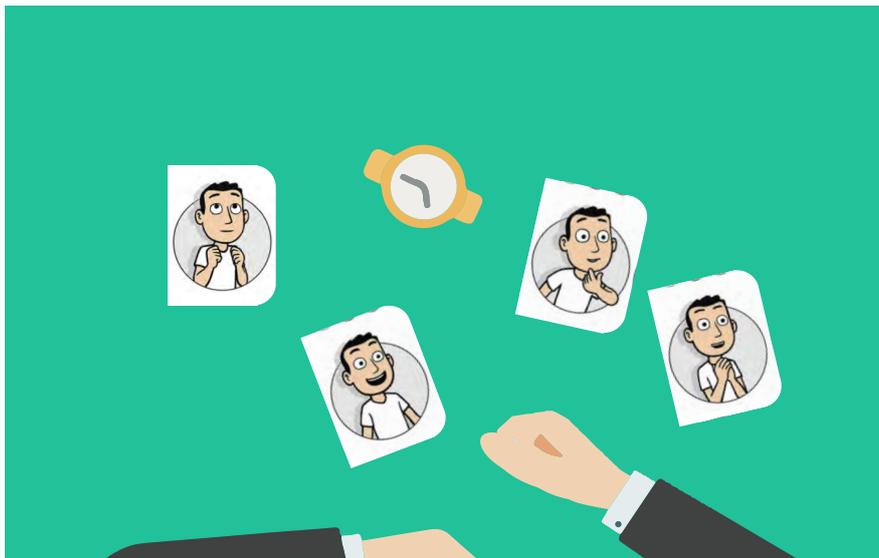
Please write down your story...

Please write down your story...

PrEmo

APPENDIX 2.

Interview Script of Evaluation

Part 0 - introduction
- Welcome to this study, and thank you for your participation.
- The study aims to get you desi gner researchers' experiences with using new PrEmo. We will use the results to improve the PrEmo design.
- This study consists of two parts and each will take you roughly 30 minutes.
- During the test, you are welcoming if you can explain everything you did and thought. There is no right or wrong. you would really help us in our research.
- In the invitation email, we had attached a consent form and a document with design concepts. Did you receive these files?
- In the consent form, we explained what we will do with the audio gathered during the test. We won't use the recordings outside of academicals settings. Did you have a chance to read the document? If not, you can take a moment to read it. Do you have questions about the form? If you agree, please sign the form (or confirm by email that you agree) and we will start the test. (Make sure that they understand it and feel free to ask any question they have about it.)
- Also feel free to ask questions if something is unclear.
- Are you ready to start?

Part 1 - questionaires with PrEmo experience
- In the first part, you will be asked some questions regarding your background.
1. What is your nationality and your age? How long have you been a designer and what is your occupation?
2. For what purpose did you use the tool? Can you describe more about the context and process how did you use it?

Part 2 – new product evaluation
- In the second part, we will focus on your PrEmo experience and invite you to respond to our product.
1. How do you like this idea? Why? – what do you like, and what do you not like?
2. What are your experiences with using PrEmo? In your opinion: What are the strength & weakness of PrEmo?
3. What are your impression of new PrEmo?
- Is it easy for you to know how to use PrEmo through the manual and the application? How do you feel about that
- What do you think about the content of the PrEmo (manual and the application)? Which part is not clear and what else do you need to know?
4. How do you experience PrEmo through the process of using it?
- What do you think about the usage process? Are there any difficulties of using PrEmo?
- Can the participants operate the procedure of using PrEmo correctly and fast?
5. What ideas do PrEmo users have for its further development?
- What else functions do you want from the PrEmo to make it convenient for participants to use it and improve their experience? What functions or information is missing?
6. Do you have any suggestions or expectations for improving the PrEmo?
7. Is there anything else you would like to mention about PrEmo?

Part 3 – round up
<Check if the recording is still stopped.>
- Thank you for your contribution, we will send you an e-mail to ask you for your address, so that we can send you a little gift to thank you for your help.

- We also want to know if you want to be informed about the project and if you would be willing to also give feedback once the design is developed.
- Have a nice day!

PrEmo