

“HOW DO YOU FEEL?”

AN ASSESSMENT OF EXISTING TOOLS FOR THE MEASUREMENT OF EMOTIONS AND THEIR APPLICATION IN CONSUMER PRODUCTS RESEARCH

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ABSTRACT

This paper introduces the subject of emotions in consumer products research; what are they, how to define them and most importantly, how to quantify and qualify them. A brief background research is made to clarify the concepts involved and to identify existing tools to measure emotions. Furthermore, a small field research was performed to test the validity that two of the most promising tools have on the field of consumer products research.

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1. INTRODUCTION

After being a subject of psychological, social and even anthropological studies for many years, the nature of emotions and their measurement has become a popular target for research in recent times, in fields such as advertising and design. Conferences and similar events that have been held around the world (e.g. Desmet & Hekkert, 2002, and Overbeeke & Hekkert, 1999), and the growing number of studies being conducted by experts from fields other than the social sciences, in search for better and more reliable ways to measure emotions, are just but a mere reflection of the fact that emotions are gaining an important spot in other fields as well.

The consumer world is starting to realize that the human is by nature an emotional being, and that it is important to start addressing this in many different levels in order to for example improve sales, develop better and more personal products and in general to evaluate the effect that all these products and services may have in our life.

In the specific case of industrial design, it would be interesting to see if different products affect our emotions, how they do it, and furthermore which specific features might trigger emotional responses in the user. In order to take a first step towards these goals, it is important to understand how to define emotions, how they work and how it is possible to quantify and qualify them. With this research we hope to approach these issues, to identify existing tools for the measurement of emotions, and to evaluate their validity and possible usage within an industrial design context.

2. DEFINING EMOTIONS

Emotion is a word widely used in our everyday language, but when it comes down to defining what an emotion actually is, it becomes difficult to reach consensus on the matter. Words like 'emotion', 'mood' or 'feeling' are all used by laypersons to define a single concept, and it is precisely this ambiguity of the definition which makes it all the more difficult to measure it.

Psychologists define the concept of emotion as a process of changes in different components rather than a homogeneous state (Scherer 2001). According to this view, the different states can be categorized into emotions (like anger, disgust or happiness) as a combination of different levels of these main components.

2.1 Emotional episodes

In everyday life it is common to talk about emotional *states*, but it is important to remember that an emotional episode is not a state but a process in time, during which a response is triggered by a certain stimulus. According to appraisal theories of emotion, once a stimulating event occurs, the individual evaluates what the consequences of this event may be and how they may affect his well-being and goals. Immediately after, a response is triggered to adjust to the new situation or to take action to modify it into a more suiting one.

2.2 Emotional response components

Emotions have been traditionally divided into three main components (the so called 'emotional response triad' - Scherer 2001): physiological arousal, motor expression, and subjective feeling. These components can be defined as follows:

- **Physiological arousal:**
The physiological changes the body goes through as a response to an emotional event. These changes include alterations of heartbeat and breathing rates, body temperature and skin conductivity, among others.
- **Motor expression:**
These are changes in facial and vocal expression as well as gestures and posture. They are thought to be a way of communicating an individual's state and its corresponding behavior intentions to the other members of the group (Scherer 2001). These responses can be both conscious and unconscious.
- **Subjective feeling:**
Refers to the fact that the individual is aware of the emotional episode and can describe it through the use of a rich emotional lexicon to easily communicate his response to certain stimuli.

2.3 Differentiating emotions

How many emotions are there and what are they? There is no general consensus on this issue and so it has been approached through the use of different models. Some of the most important models are:

- **Dimensional Models:**
The first dimensional model was proposed by Wundt (1905), where feelings varied by their position on three independent dimensions: Pleasantness-unpleasantness, rest-activation, and relaxation-attention. In recent time, most work has been done with a two-dimensional approach: Pleasant-unpleasant and rest-activation since these seem to suffice for the description of emotions.
- **Discrete Emotion Models:**
These models suggest a limited set of basic emotions such as fear, anger, joy, sadness and disgust. According to these models, the basic emotions can be mixed which would explain the large number of descriptions an individual can give for a certain emotional episode. The set of emotions varies depending on the model.
- **Componential Models:**
These models suggest that emotions can be differentiated according to the dimensions used by the individual to evaluate a certain event and how it can affect him. It is related to the appraisal process mentioned before.

3. ASSESSING EMOTIONAL RESPONSES

Many different researches and studies have been conducted throughout the years looking to develop a reliable method of assessing emotional episodes. These methods can be divided according to the component of the emotional response they address. Following, is a brief description of the different approaches along with some of their general advantages and disadvantages. Some of the methods developed under these approaches and their relevancy to the measurement of emotions for consumer products are also included.

3.1.1 Physiological Arousal

Through the use of specialized apparatus (i.e. diodes, thermometers, etc) it is

possible to quantify the physiological changes the body experiences as a result of an emotion triggering event. Changes in blood pressure, heartbeat rate, skin conductivity and brain waves can all be easily and accurately monitored.

General Advantages:

One of the main advantages of physiological measurements is the fact that these are not consciously controlled by the individual, but are triggered by the body on an unconscious level, and so they can be considered objective measurements. They are also independent of any cultural or social variables and so they can be used on every target group possible.

General Disadvantages:

The main disadvantage of this approach is the fact that although measurements of the physiological changes themselves are very accurate, there is still discussion on how exactly certain physiological reactions can be linked to a specific emotion. The effect other external variables may have on these physiological measures, are not taken into consideration either. For example, issues like physical activity prior to testing can affect the subject's heartbeat rate or his body temperature, independent of his emotional state.

The use of external measuring instrumentation can become an intrusive factor that affects the user's reaction since he is not being tested in a neutral environment. The measurements demand a qualified workforce of experts on physiology and high technical instrumentation requirements and it is cumbersome to integrate into consumer product research.

3.1.2 Motor Expression

Through the measurement of gestures, facial expressions and changes in voice tones for example, it is also possible to assess the emotional responses of subjects. Studies on the intrinsic working of facial muscles and their importance in facial behavior, as well as experiments on recognition of emotions from the acoustic speech signal are among some of the current research being conducted in this field.

General Advantages:

Many specialists agree on the existence of a few universal facial expressions of basic emotion. Taking this into account, the main advantage of this approach is the certain level of cultural independency of its nature (at least concerning basic emotions), meaning that it can be used for cross-cultural assessments.

The observation and assessment of these expressions can be done in a non-intrusive manner as the instrumentation used (video cameras and microphones) can be set up in a manner that does not disturb the individual, making it less likely to affect or interfere with his reaction towards the stimuli.

General Disadvantages:

This approach is generally focused on the measurement of basic emotions, since different studies have not proven it to be reliable to measure mixed emotions yet, due to the difficulty to link certain motor responses to secondary emotions. Mild emotions with little motor response can also be difficult to assess.

There is also a possibility that motor expressions can be controlled to a certain degree by the individual, which means that it is not guaranteed that the emotion read is in fact the emotion experienced.

Another major disadvantage is the high technical requirements for instrumentation and expertise that this approach demands.

3.1.2.1 Description of Emotion Facial Action Coding System – EMFACS (Ekman and Friesen)

FACS is a system to measure and describe facial behavior based on the muscles that produce them. It was developed in the 1970's by Paul Ekman and W.V. Friesen by determining how the contraction of each facial muscle affects the facial expression of the subject. But FACS is only a descriptive tool. It provides no information about the meaning or the origin of facial behavior. In order to 'translate' the results obtained through FACS, into more meaningful concepts in the field of emotion assessment, a tool called EMFACS (Emotion FACS) can be used. This is a version of FACS with data limited to that which has been identified as having connotations in facial emotional expressions. Basic emotions can be identified to a certain degree.

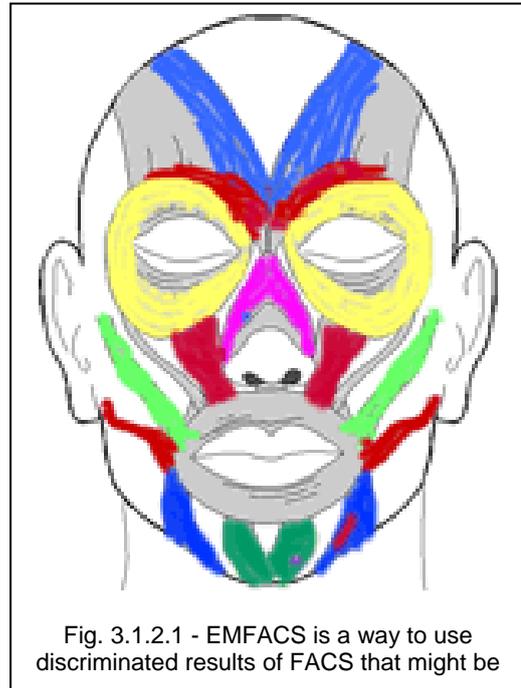


Fig. 3.1.2.1 - EMFACS is a way to use discriminated results of FACS that might be

Relevancy:

The level of expertise and technical support needed is high, so this could be a drawback. But most importantly, the authors themselves

recommend that this tool should not be used if the study is primarily interested in blends of emotions, if the emotional expressions are likely to be disguised or highly controlled, or very subtle. Since we are expecting a blend of subtle emotions being elicited by consumer products, this rules out the use of EMFACS in our field.

3.1.2.2 Recognizing Emotion in Speech (Dellaert, Polzin & Waibel, 1996)

Through a complex analysis of voice patterns, rhythm and pitch (among other features), studies are being done on the possibility of recognizing emotions in speech. In this particular case, over a 1000 utterances from several different speakers were recorded on the basis of 4 emotion labels: happiness, sadness, anger and fear. Different analysis were performed in order to recognize the different patterns linked to each emotion with varied success rates.

Relevancy:

This particular study can only detect differences and patterns for the four emotions mentioned above so far. Although the tool shows incredible potential as a non intrusive method of measuring emotions, it is still far from being reliable and accurate enough, and the emotions it can recognize are very limited. The subtle and blended emotional experiences we are expecting in our field might not be possible to assess.

3.1.3 Subjective Feeling

Through the use of self-report methods an assessment of the individual's subjective feelings can be done. These methods are in essence questionnaires in which the individual can rate his emotion(s) by using a given scale, or by describing it verbally. Pictorial versions of these methods have also been developed to alleviate, to a certain degree, the cultural and linguistic specificity of verbal material.

General Advantages:

A main advantage is the possibility to assess mixed emotions, as the individual has often the possibility to rate what he experiences as a combination of a varied set of emotions. It demands little technical support and a few sheets of paper and a pencil can often suffice to conduct a test, making it extremely easy to collect data from a significant amount of people with very little technical expertise needed for it.

General Disadvantages:

It is often difficult for the individual to clearly express his emotions the way they are being experienced, and the fact that he is conscious of the assessment can distort what he reports (either consciously or unconsciously).

Since emotional episodes are a process in time, it is crucial that it is assessed as fast as possible. An assessment taken too long after the stimulus event is over can cause a distorted measurement, and concentrating on a list of given emotions for too long can be misleading for an individual's reliable evaluation of his experience.

3.1.3.1 The PAD Emotion Scales (Mehrabian 1980, 1995, 1997)

PAD is an acronym for Pleasure, Arousal and Dominance, the 3 dimensions used by this method to describe and measure a certain emotional response. 'Pleasure-displeasure' assesses the affective quality of the experience; 'arousal-non-arousal' addresses the issue of physical activity and mental alertness, and 'dominance-submissiveness' defines the individuals feeling of control, or lack thereof, on the given situation.

Within the PAD model, there are eight basic emotion varieties to be distinguished and grouped according to their position in the 3-dimensional model. They are defined by all possible combinations of the levels of pleasure, arousal and dominance. So for example 'hostile', described by low pleasure, high arousal and high dominance (or -P+A+D for short), can include feelings of anger, insolence, or defiance.

Relevancy:

As we've said before, emotional episodes are time-related and often not very extreme in our field, so a quick assessment is needed in order not to compromise the validity of our results. Thinking too much about how to break down what he feels into 3 abstract dimensions might take too long for the individual and the results could be distorted. It might also be difficult for the individual to assess himself on this basis without a proper understanding of the dimensions. For instance, the dominance dimension is a difficult one to explain and self assess.

3.1.3.2 Self-Assessment Manikin – SAM (Lang, 1985)

SAM is a graphical depiction of the PAD dimensions (see 3.1.3.1) developed by Lang as an alternative to the verbal self report measures. It represents each dimension with a graphic character and a nine-point scale from which the user can choose what he feels.

The tool has been used extensively in the field of advertising and due to its graphical nature it can be used in a

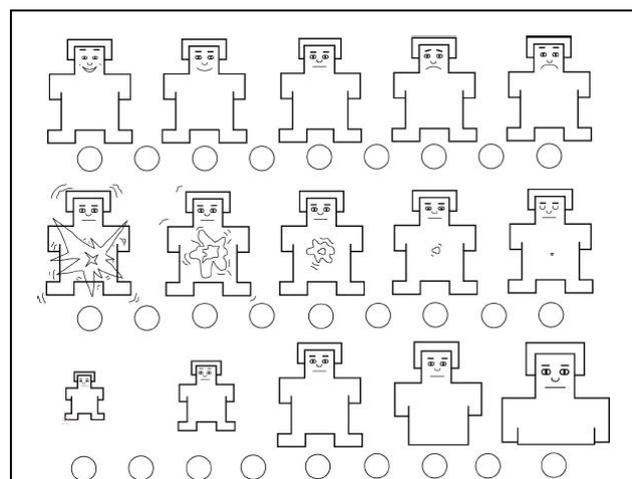


Fig. 3.1.3.2 – Self-Assessment Manikin

cross-cultural environment. Specific emotions are not measured or differentiated with this approach, but rather the intensity of the different underlying dimensions.

Relevancy:

The pictorial approach of this tool makes it ideal to be used in a cross-cultural environment, and with illiterate subjects (such as children), and as it can easily be distributed as printed material to be filled up by hand, it has very low technical requirements for its implementation.

Nonetheless, the inability to measure differentiated emotions is a very important weak point that makes it unsuitable for measuring emotions elicited by consumer products.

3.1.3.3 Geneva Emotions Wheel (Scherer 2005)

The respondent is asked to indicate the emotion he/she experienced by choosing intensities for a single emotion or a blend of several emotions out of 20 distinct emotion families. The emotion families are arranged in a wheel shape with the axes being defined by two major appraisal dimensions (Control and Pleasantness).

Five degrees of intensity are being proposed, represented by circles of different sizes. In addition, "No emotion felt" and "Other emotion felt" options are provided (Scherer 2005).

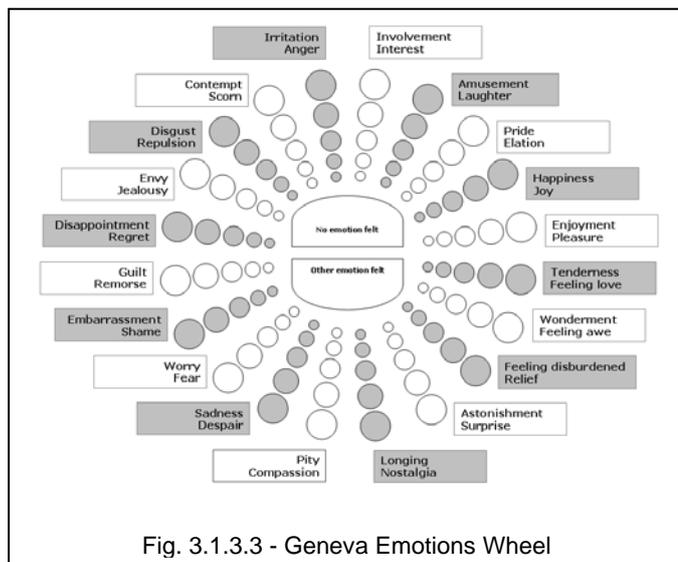


Fig. 3.1.3.3 - Geneva Emotions Wheel

Relevancy:

The tool was designed to measure emotional reactions to objects, events, and situations, which makes it easy to be applied to various scenarios, including the measurement of emotions elicited by consumer products.

It has very low technical requirements for the collection of data as the wheel can be easily printed out and filled in with a pen.

3.1.3.4 Product Emotion Measuring Instrument v7.0 - PrEmo (Desmet, 2003)

Through the use of ten animated characters with sounds, each representing a specific emotion, subjects are asked to evaluate what they feel and describe it by giving each animation a rating on a three-point intensity scale: 'did not feel the emotion', 'felt it lightly', 'felt it intensely'.

It is possible for the user to give ratings for more than one emotion felt at a time giving the possibility to describe more complex emotional responses.

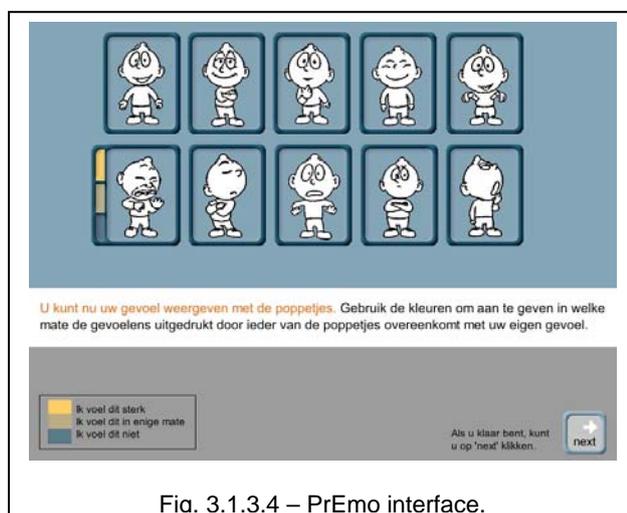


Fig. 3.1.3.4 – PrEmo interface.

Relevancy:

The tool was originally designed to measure emotions elicited only by the appearance of consumer products, and has been evolving through its different versions by taking away any emotions that were rated non-relevant to this field. This makes it a good starting point for the measurement of emotions elicited by products and their use.

It is non-intrusive, and the user can give a self-assessment on what he felt. As a software application with low system requirements, it can be run easily in standard PC environments. As with the SAM manikin, the pictorial approach makes it ideal for cross-cultural environments and assessment of illiterate subjects.

4. FIELDWORK

Based on our findings, we decided to test two tools which show the biggest potential for the measurement of emotions elicited by consumer products: PrEmo and the Geneva Emotions Wheel. These tools were chosen due to their ease of use, their ability to discriminate an emotional episode into several specific emotions and the low technical requirements for data collection that they impose.

Our goal was to find the strong and weak points of each tool, to find out which is more suitable to our field of interest and based on our results to propose eventual improvements that can be made to enhance their performance.

The two tools were assessed on scores given by the subjects to each of them in four dimensions:

1. ABILITY:

Whether the subject was able to express what he felt with the tool.

2. MEMORY:

Whether the subject could still remember what he felt while describing his emotions.

3. CLARITY:

Whether the tool is clear enough to be understood and used by the subject.

4. INFLUENCE OF THE TOOL:

Whether the tool could be considered as influencing the subject's judgment about what he felt.

4.1 METHOD

A small field test was set up to use both tools at the same time on actual consumer products so that we could see them in action on our field of studies. Two products were chosen, a designer's coffee machine which we hoped would elicit positive emotions on the subject as coffee is often associated with soothing feelings and enjoyment, and an old alarm clock with very complex user cues which we hoped would get negative responses from the subjects such as irritation, as it can be very frustrating to manipulate. These specific products were chosen because the reactions to them could be predicted to some extent, and so the results delivered by the tools at the end of the experiment, could provide us with an idea of whether or not the tools were performing their task reliably.

A questionnaire comprising 12 questions regarding each tool plus a final one

regarding both of them (adding up to 25 questions) was compiled in the following manner: In a first set of questions for the first tool, two questions were formulated per dimension and randomly placed in the set. Four more factual questions were included to get some more extra information, like whether the user had any previous experience with the tools or if he had any comments or suggestions regarding the specific tool. These 12 questions were then repeated on a second set for the second tool. Finally, the subjects were asked which tool they would prefer and the reason why. The questions were formulated as statement to which the subject had to give a score from a 7-point scale ranging from “I completely disagree” to “I completely agree”.

To keep the test as homogeneous as possible, and due to the multimedia nature of PrEmo (making it very difficult to translate to other media such as printed material), we decided to make a digital version of the Geneva Emotions Wheel and compiled a single software application bearing both tools (including the instructions) and the questionnaire.

The emotion families present in the Emotions Wheel were translated into Dutch and can be found as an attachment to this report.

4.1.1 SUBJECTS

We decided to use 40 native Dutch speaking industrial design students as our test subjects, since by the nature of their studies they have a high sensitivity towards consumer products and user experience. The group was comprised entirely of Dutch native speakers not only to maintain a homogeneous sample, but due to the linguistic nature of the Geneva Emotions Wheel which requires the subject to have a thorough understanding of the terms used by the tool to describe different emotional families.

4.1.2 APPARATUS

- Desktop computer with speakers
- Philips/Alessi Coffee Machine
- Grundig Sonoclock380
- Software application bearing PrEmo v7.0, a digital version of the Geneva Emotions Wheel translated into Dutch and the final questionnaire comprising 25 inquiries.



4.1.3 PROCEDURE

In an experiment room, each of the products was placed in a separate table and kept out of sight while the experiment began. A small task was written on a piece of paper

and placed next to each product. The desktop computer was set aside on a separate table.

The following steps were carried out:

- 1) While in front of the computer, the subject was first presented with an introduction of each tool (built into the software application). Here they were able to become acquainted with the tools and had the opportunity to ask any questions they might have regarding their use.
- 2) The subject was asked to approach the first table, where he was presented with the first product (according to the order shown in table 4.1.3) and he was asked to carry out the small product related task (“make two cups of coffee” for the coffee machine, and “set the alarm to go off two minutes from now” for the alarm clock”).
- 3) He was then asked to return to the computer and use the tools (in the order given by table 4.1.3) to describe what he felt towards the given product.
- 4) Steps 2 and 3 were repeated for the second product
- 5) Finally, the subject was presented with the final questionnaire. The order in which the questions were presented, was determined by the order in which the subject had used the tools during the experiment, as can be seen in table 4.1.3.

To minimize the effect it would have on our results the order in which the tools were introduced to the subjects and the order in which they would carry out the tasks with each product, it was decided to use the scheme shown by table 4.1.3

Subject 1-10	Subject 11-20	Subject 21-30	Subject 31-40
Coffee machine as first product	Alarm clock as first product	Coffee machine as first product	Alarm clock as first product
PrEmo as first tool used		Emotions Wheel as first tool used	
12 questions to score PrEmo as first in the questionnaire		12 questions to score Emotions Wheel as first in the questionnaire	

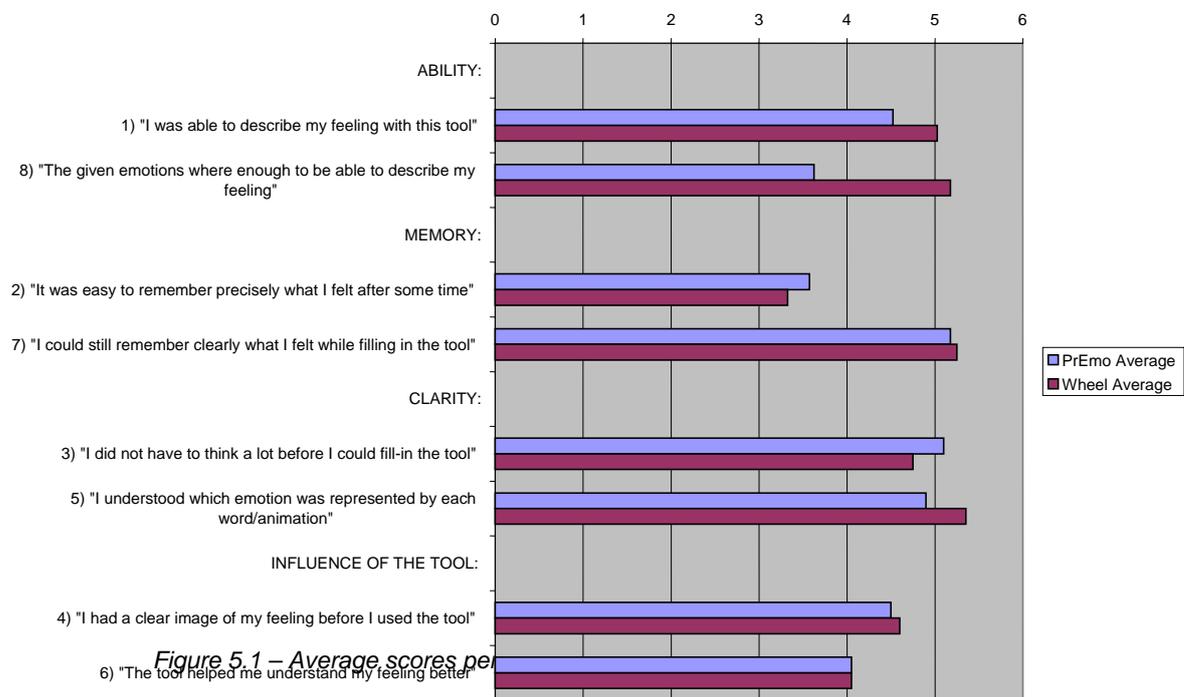
Table 4.1.3

5. RESULTS

The elicited emotions as measured by the tools were within the boundaries of what was expected without major surprises, and most importantly both tools seemed to provide us with the same range of emotions for every product tested. Graphics for these results can be found as attachments to this report. Knowing that both tools were actually performing at an acceptable level meant that we were now able to proceed to analyze the scores of our questionnaire.

At a first glance, the results seemed to be quite similar for both tools in all the given dimensions, as can be seen from the average scores given to each question (fig 5.1). It should be noted that question 2 had to be re-coded by inverting the score values, as it was originally formulated as a ‘negative’ statement (“It was difficult to remember

precisely what I felt after some time”) while all the other questions were formulated as ‘positive’ ones.



As can be seen from the averages in figure 5.1, the results from the “Ability” dimension seem to show the biggest difference between the tools. But the correlation between the questions had to be tested in order to check if in fact they were measuring a single dimension. To achieve this, we performed a Pearson Correlation test. The correlation coefficient is a commonly used measure of the size of an effect; values of $\pm 0,1$ represent a small effect, $\pm 0,3$ a medium effect and $\pm 0,5$ a large effect.

As the results to this test show on tables 5.2 and 5.3, we found out that the questions on two dimensions were actually not correlated: “Clarity” and “Influence of the tool”. This means that the questions within these dimensions must be analyzed separately and not as a single dimension.

		WHEEL3	WHEEL5
WHEEL3	Pearson Correlation	1	-,061
	Sig. (2-tailed)	.	,707
	N	40	40
WHEEL5	Pearson Correlation	-,061	1
	Sig. (2-tailed)	,707	.
	N	40	40

Table 5.2 – “Clarity” correlations

		PREMO4	PREMO6
PREMO	Pearson	1	-,012

4	Correlation		
	Sig. (2-tailed)	.	,942
	N	40	40
PREMO 6	Pearson Correlation	-,012	1
	Sig. (2-tailed)	,942	.
	N	40	40

Table 5.3 – “Influence of the tool” correlations

Furthermore, to test the validity of the initial averages, we performed a Paired-T test. This test is generally used to see if there is a significant difference between two normally distributed variables for a within-group design. In our case it compares the score averages for each question (dependent variable) and for each tool (independent variable).

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PrEmo Q1	4,53	40	1,339	,212
	Wheel Q1	5,03	40	1,459	,231
Pair 2	PrEmo Q8	3,63	40	1,644	,260
	Wheel Q8	5,18	40	1,500	,237
Pair 3	PrEmo Q2	3,55	40	1,108	,175
	Wheel Q2	3,48	40	1,132	,179
Pair 4	PrEmo Q7	5,18	40	1,357	,214
	Wheel Q7	5,25	40	1,127	,178
Pair 5	PrEmo Q3	5,10	40	1,464	,231
	Wheel Q3	4,75	40	1,481	,234
Pair 6	PrEmo Q5	4,90	40	1,630	,258
	Wheel Q5	5,35	40	1,272	,201
Pair 7	PrEmo Q4	4,50	40	1,450	,229
	Wheel Q4	4,60	40	1,236	,195
Pair 8	PrEmo Q6	4,05	40	1,484	,235
	Wheel Q6	4,05	40	1,484	,235
Pair 9	PrEmo Q9	2,98	40	,974	,154
	Wheel Q9	4,28	40	,816	,129
Pair 10	PrEmo Q10	5,78	40	1,209	,191
	Wheel Q10	5,15	40	1,494	,236

Fig. 5.2 – Paired Sample statistics

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Dev.	Std. Error Mean	99,5% Confidence Interval of the Difference				
				Lower	Upper			
PrEmo1 - Wheel1	-,500	2,051	,324	-1,465	,465	-1,542	39	,131
PrEmo8 - Wheel8	-1,550	2,207	,349	-2,588	-,512	-4,443	39	,000
PrEmo2 - Wheel2	,075	1,421	,225	-,594	,744	,334	39	,740
PrEmo7 - Wheel7	-,075	1,366	,216	-,718	,568	-,347	39	,730
PrEmo3 - Wheel3	,350	2,237	,354	-,702	1,402	,990	39	,328
PrEmo5 - Wheel5	-,450	2,218	,351	-1,494	,594	-1,283	39	,207
PrEmo4 - Wheel4	-,100	1,317	,208	-,719	,519	-,480	39	,634
PrEmo6 - Wheel6	,000	1,840	,291	-,866	,866	,000	39	1,000
PrEmo9 - Wheel9	-1,300	1,203	,190	-1,866	-,734	-6,837	39	,000
PrEmo10 - Wheel10	,625	2,084	,330	-,355	1,605	1,897	39	,065

Fig 5.3 – Paired samples test

As we can see, there was a significant difference between PrEmo and the Emotions Wheel for questions 8 (“The given emotions where enough to be able to describe my feeling”) and 9 (“The scale used for the emotions is: [too Short - too Long]”).

On average, participants experienced a significantly greater ability to describe their feelings with the available emotions, while using the Geneva Wheel ($M = 5,18$, $SE = 0.24$) in comparison to the ability experienced during the use of PrEmo ($M = 3,63$, $SE = 0.26$, $t(40) = -4.44$, p (two-tailed) < 0.005 , $r = 0.58$)

In question 9, the subjects were given the possibility to score the scale used for each tool on a 7-point scale ranging from “Too short” to “Too long”). For these scores, PrEmo had an average that was 1 scale-point lower than the middle point of the answering scale ($M = 2.98$, $SE = 1.54$). Geneva Wheel had an average that was a fraction higher than the middle point of 4 ($M = 4.28$, $SE = 1.29$, $t(40) = -6.84$, p (two-tailed) < 0.005 , $r = 0.74$)

It is important to mention that one of our factual questions asked whether the subject had seen or used the given tool before. It was interesting to see that if we were to remove the scores from people with earlier experience, the outcome of these tests would still be the same (The tables of the paired t-test for only people with no experience is included as attachment). The previous experience did not have any effect for the differences between PrEmo and Emotions Wheel.

Finally, an interesting point arose with the answers given to the last question (“Which tool do you prefer and why?”). 60% of the respondents had a preference for the Emotions Wheel with comments regarding the substantial amount of emotions to choose from and the scale used to score each emotion. The other 40% preferred PrEmo with comments about how it was more intuitive, the use of sounds as a supporting feature to the animations and how the animations give a clear example of the emotion intended.

6. CONCLUSIONS

As we expected, both tools have shown excellent potential for the measurement of emotions for consumer products. Nonetheless, there are of course some weak points and some strong points for each tool which should be addressed in order to enhance their performance.

PrEmo

Weak Points:

- The limited amount of emotions may constrain the subject from fully expressing what he feels.
- The 3-point scale is a bit insufficient for the differentiation of experienced emotional intensities, specially for a field like ours where we expect subtle reactions.
- Some of the animations are not completely clear to the user (the one representing “desire” for example was mentioned various times by the users as being incomprehensible).

Strong Points:

- In general, the use of animations and sounds works as a good support for the representation of emotions.
- Its graphical nature makes it ideal for cross-cultural environments. This was proven by the fact that for our fieldwork, only the instructions had to be translated into Dutch before the tool could be used.

Geneva Emotions Wheel

Weak Points:

- Its semantic nature makes it more difficult to use in cross-cultural environments. For our fieldwork, the list of emotions used had to be fully translated into Dutch.

Strong Points:

- A big range of emotions to choose from.
- The 5 point scale (6 if we count 0 as representing no emotion felt) seems to suffice for a clear differentiation of intensities.
- The arrangement of the scales in a circular pattern, giving the user an overview of all the emotions felt and their intensities as the tool has been already filled in.

Because of the fairly similar scores obtained for the different dimensions for each tool, it is difficult to conclude which one might be better to apply into consumer product research. Nonetheless, the score given to the “Ability” of the tools, show that the Emotions Wheel has an advantage over PrEmo.

Some of the improvements that could be implemented to PrEmo to bridge this gap include adding extra emotions to the available ones and the use of a more discriminating scale of measurement.

7. DISCUSSION

Many improvements can be made to the field research. For instance, the questions could be re-formulated in hopes of scoring the single dimensions they were originally intended for, and a broader sample could be used to improve the reliability of the results. Issues like the translation of the emotions list for the Geneva Wheel, are bonded to the translators understanding of the foreign terms which can always bring

inconsistencies to the results if applied to cross-cultural studies in different languages.

On the other hand, the experiment also had some strong points, like the fact that the subjects were not aware that our goal was to assess the tools themselves, and not the emotions elicited by the products, until the end of the test.

An interesting issue regarding the temporary nature of emotions was to be seen in the emotions resulting from the alarm clock and the informal comments regarding it that the subjects gave after the experiment was over. Our test subjects were initially irritated by the difficulty of the clock's user cues, but they felt proud and amused once they finally managed to set the alarm, and both of these readings are reflected in the results.

Some interesting issues that can be pointed out from the comments given by the users include the fact that some people would choose PrEmo as their preferred tool on the count of it being "fun to use", or it would be neglected because it seemed too 'childish', without mentioning whether they could express what they felt correctly or not by using it. Other people pointed the fact that the Emotions Wheel had a broader selection of emotions to choose from, but these were not being used to their full extent when reporting their own emotions. Of course, this can always change depending on the stimulus used, but from the background information we gathered (specially from PrEmo) we know that there are some emotions that seldom appear in the measurement of emotions with consumer products, and thus some could eventually be filtered off the tool to improve its compactness and performance in our field.

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9. ATTACHMENTS

9.1 Questionnaire

Question categories:

- **ABILITY:** Whether the user was able to express what he felt with the tool.
- **MEMORY:** Whether the user could still remember what he felt while assessing his emotions.
- **CLARITY:** Whether the tool is clear enough to be understood.
- **INFLUENCE OF THE TOOL:** Whether the tool could be considered as influencing the user's perception or just as a tool.
- **FACTUAL QUESTIONS:** question for a bit of extra info.

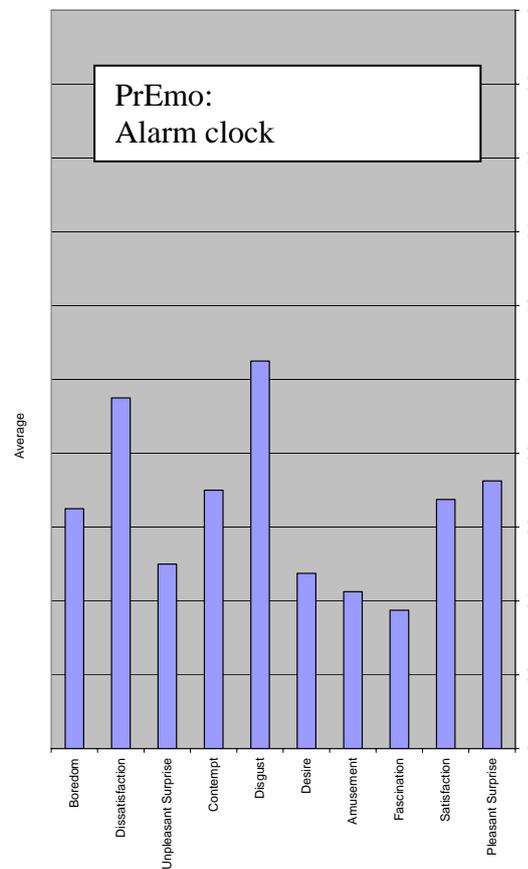
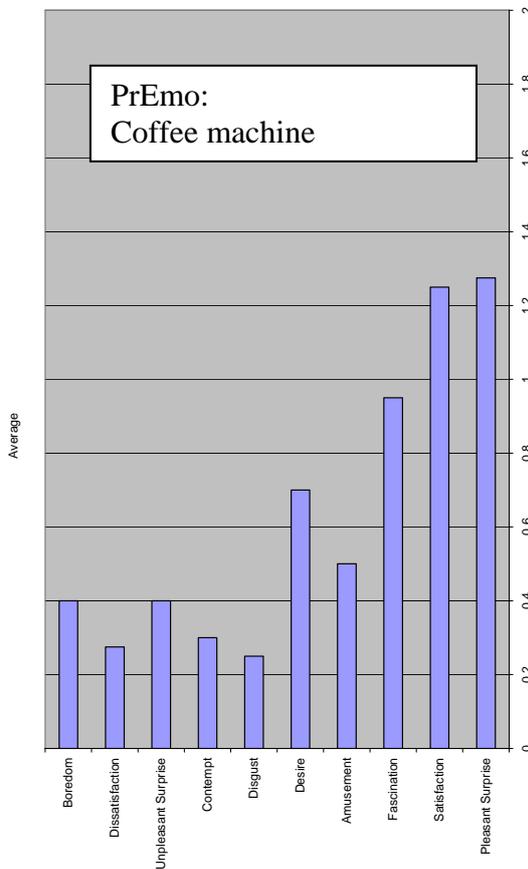
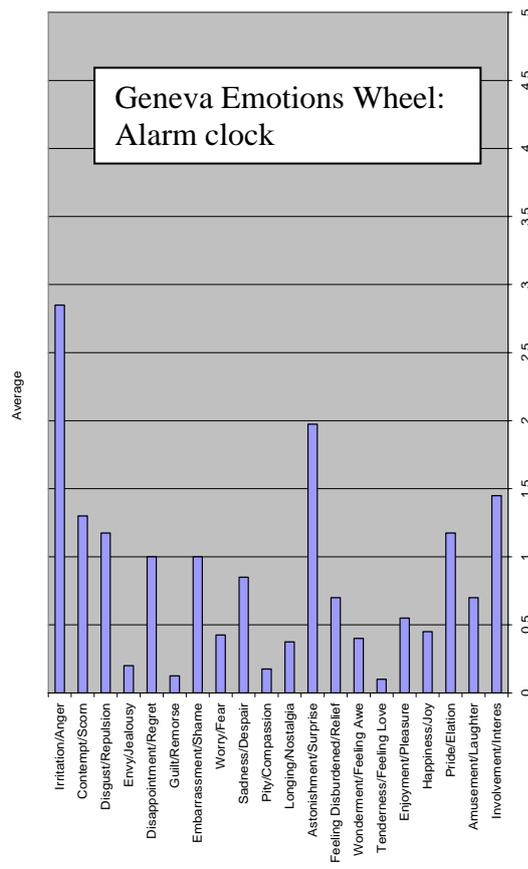
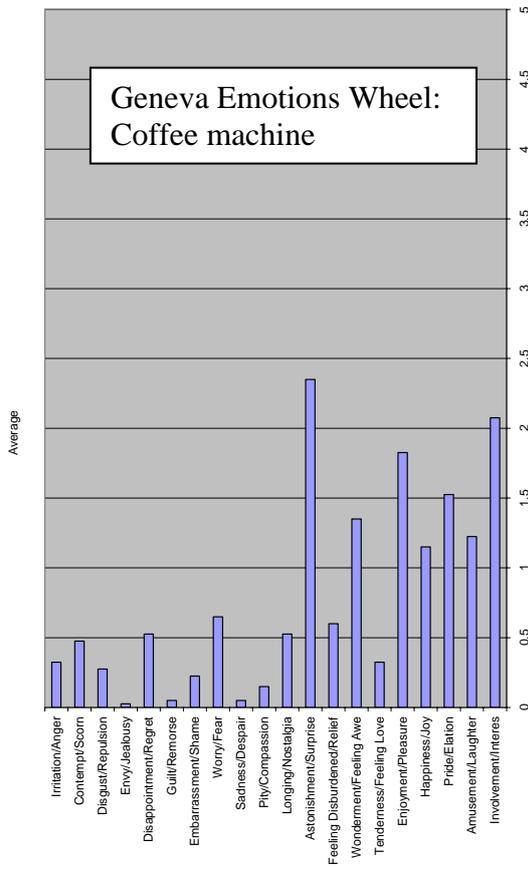
Questions:

- 1) Ik kon mijn gevoel goed beschrijven met deze tool.
(I was able to describe my feeling with this tool)- *ABILITY*
- 2) Het was moeilijk om mijn gevoel goed te herinneren na een tijdje.
(It was difficult to remember precisely what I felt after some time.) – *MEMORY*
- 3) Ik hoefde niet lang na te denken voordat ik de tool in kon vullen.
(I did not have to think a lot before I could fill-in the tool) – *CLARITY*
- 4) Ik had een duidelijk beeld van mijn gevoel vòòr het gebruiken van de tool.
(I had a clear image of my feeling before I used the tool) – *INFLUENCE OF THE TOOL*
- 5) Ik begreep welke emotie werd bedoeld met elk woord/animatie.
(I understood which emotion was represented by each word/animation) - *CLARITY*
- 6) De tool hielp mij om mijn gevoel beter te begrijpen.
(The tool helped me understand my feeling better) – *INFLUENCE OF THE TOOL*
- 7) Ik kon nog goed herinneren wat ik voelde, tijdens het invullen van de tool.
(I could still remember clearly what I felt while filling in the tool) - *MEMORY*
- 8) De gegeven emoties waren genoeg om mijn gevoel te kunnen beschrijven.
(The given emotions where enough to be able to describe my feeling) - *ABILITY*
- 9) De schaal die gebruikt wordt voor de emoties is: [te Kort - te Lang]
(The scale used for the emotions is: [too Short - too Long]) – *FACTUAL QUESTION*
- 10) Wat vond je van de tijd die het invullen in beslag nam? [Langzaam - Snel]
(What did you think of the time it took you to fill in the tool? [Slow - Quick]) –

FACTUAL QUESTION

- 11) Heb je deze tool eerder gezien? [Ja-Nee]
(Have you seen this tool before? [Yes-No]) – *FACTUAL QUESTION*
- 12) Heb je nog verdere opmerkingen, suggesties of vragen over deze tool?
(Do you have any extra comments, suggestions or questions regarding this tool?) – *FACTUAL QUESTION*
- 13) Aan welke tool geef je de voorkeur en waarom?
(Which tool do you prefer and why?) – *FACTUAL QUESTION*

9.2 Emotion measurement results



9.3 User comments

Heb je nog verdere opmerkingen, suggesties of vragen over deze tool? (Do you have any extra comments, suggestions or questions regarding this tool?) – FACTUAL QUESTION

PrEmo

Bij de commentaren die gegeven zijn bij PrEmo is vijf keer gemeld dat de emotie rechtsboven in de hoek niet is begrepen. Twee proefpersonen vonden het geluid ondersteunend voor het begrip. Twee anderen hadden gemeld dat ze het snel en gemakkelijk te gebruiken vonden. Verder hebben twee proefpersonen gezegd dat ze PrEmo minder compleet dan de Geneva-tool vonden. Tot slot heeft iemand vermeld dat hij het instrument “grappig” vond om te gebruiken. Een ander had gemeld dat hij het een goede manier van weergave van emoties vond.

Als suggesties voor verbeteringen zijn twee mogelijkheden genoemd; Namelijk om de geluidjes optioneel te maken (omdat de desbetreffende gebruiker het op een gegeven moment irritant vond worden) en om ook andere emoties toe te voegen.

In the comments for PrEmo, two testing persons thought the sound was supporting for reporting their emotions. Two other people found the use of PrEmo very quick and easy. There was one person who commented he thought the way of presenting of the emotions was good.

There were some critics too; two people experienced PrEmo as less complete than the Geneva measurement tool. Five people commented that they did not understand the animation in the right upper corner.

One of our testing persons commented PrEmo was a funny instrument to use.

As a suggestion to improve PrEmo, somebody thought it would be a good idea to make the sounds optional, because he experienced it as annoying after a while. An other person suggested increasing the number of emotions.

Geneva Emotions Wheel

De positieve opmerkingen over de Geneva Wheel hebben voornamelijk betrekking op het grote aantal mogelijkheden. Drie gebruikers hebben aangegeven dat ze de manier van rapporteren van emoties beter vinden dan bij PrEmo, aangezien ze het gedetailleerder vinden. Het instrument heeft een grotere schaal per emotie en meer emoties. Eén proefpersoon heeft vermeld dat hij het een goede manier van emoties aangeven vindt aangezien het de mogelijkheid geeft tot eigen interpretatie. Verder denkt een van de proefpersonen dat het een behoorlijk gebruiksvriendelijk instrument is, ook voor niet io-ers. Drie proefpersonen gissen naar de betekenis en volgorde van de kleuren bij de emoties, in de ruimte voor de opmerkingen.

Naast de positieve opmerkingen zijn er ook kritieken geplaatst. Een van de gebruikers heeft de schaal ietwat verwarrend ervaren aangezien hij in eerste instantie dacht dat de kleinste cirkel van elke emotie aangevinkt moest worden wanneer deze emotie niet gevoeld was. (Tijdens de test is gebleken dat meerdere proefpersonen deze handeling hadden gevolgd, nadat ze hadden gewerkt met PrEmo) Een ander vond de grijze letters van de emoties lastig leesbaar. Het emotiegebied van verdriet of medelijden vond een van de proefpersonen niet vaak voorkomen bij productgebruik, een ander had de leuke geluidjes gemist.

Als suggesties zijn gemeld om een combinatie te maken van de twee verschillende meetinstrumenten. De ronde oriëntatie vond een gebruiker niet een meerwaarde, dus deze vroeg zich af of er een mogelijkheid was het anders te presenteren.

The positive remarks that are given about the Geneva Wheel were mostly about the huge opportunities to report emotions. Three people said in the comments that they thought it was really detailed; there are more emotions to choose from and the scale is bigger than PrEmo. One of the testing persons thought the way of reporting emotions in Geneva Wheel was good because there was some space to interpret it for yourself. Somebody else thought it was a user-friendly instrument, and it would be usable for non-industrial designers, too.

There are three testing persons who are guessing what the meaning of the colours and the arrangement of it would be.

There were also some negative points said. One of the users had experienced the scale as being a bit confusing. In first place he thought he had to fill in every smallest circle, when he did not feel that specific emotion. There was also somebody who said that he found the grey letters of the emotions hard to read. Somebody thought emotions like sadness and compassion were not relevant for using the Geneva Wheel for user-product interaction. One person had said that he missed the nice sounds that were representing emotions in PrEmo.

As a suggestion to improve the measurement tool, somebody said it could be possible to combine the two methods. There was somebody else who did not think that this presentation of the Wheel was the best, so he wondered if there was a better way of presenting the emotions.

Voorkeur / Preference PrEmo

In totaal hadden zestien van de veertig proefpersonen vermeld dat ze voorkeur gaven aan PrEmo. Vier gebruikers vonden het makkelijker, drie vonden het sneller, en ze hebben als commentaar gegeven dat ze dit instrument intuïtiever vonden. Verder is vier keer genoemd dat ze het geluid ondersteunend voor het begrip hebben ervaren, en een keer is opgemerkt dat dit instrument universeel en visueel sterk is. Er zijn echter ook kritiekpuntjes gemeld; Drie keer is gegeven dat het aantal emoties en de grootte van de schaal te weinig mogelijkheid gaf voor de gebruiker zijn precies ervaren emoties weer te geven. Verder hebben twee mensen genoemd dat niet alle emoties duidelijk voor hen waren. Een enkeling heeft gemeld dat er voor diegene onbegrip was, wat betreft de link tussen kleur en emotie. Ten slotte is het opvallend dat iemand heeft vermeld dat hij vond dat het meetinstrument de ervaren emotie beïnvloed.

In total, sixteen out of forty people said that they preferred the PrEmo tool. In the space for some comments four people said that they experienced PrEmo as an easier, three as a faster tool, and they said that it was more intuitive. Four times has been said that the sound was supporting for understanding the emotion. One of the testing persons said that it was universal and visually strong.

There were given some negative points, too. Three times people said the number of emotions was too less and the scale was too small. Two people had said again that there were some emotions they did not understand. There was one testing person who did not understand the relationship between colour and emotion, too. One of our testing persons had said that he thought that the measurement method had influence on his emotion.

Voorkeur / Preference Emotions Wheel

Van de veertig proefpersonen hadden 24 mensen voor de Geneva Emotion Wheel gekozen. Maar liefst zeventien personen hebben genoemd dat ze de voorkeur gaven aan de Geneva Wheel, doordat de schaal en het aantal emoties groter is. Over de interface hebben proefpersonen opgemerkt het handig in het gebruik, visueel aantrekkelijk (drie proefpersonen) en intuïtief is.

In vergelijking tot de PrEmo hebben proefpersonen vermeld dat ze de Geneva Wheel kleurrijker, overzichtelijker (twee proefpersonen), duidelijker (drie proefpersonen), sneller (drie proefpersonen), minder kinderlijk en serieuzer (twee proefpersonen) vonden. Een van de gebruikers vond dat hij een vrijer gevoel had bij het invullen, en dat het geen invloed had op de ervaren emoties.

Out of forty people, twenty-four testing persons had chosen the Geneva Emotion Wheel above PrEmo. Seventeen testing persons had said that they preferred Geneva because it was much more detailed; the number of emotions was bigger and the scale was wider. About the interface, three testing persons thought it was visually attractive, one said it was user-friendly and intuitive.

In comparison to PrEmo, one of the users thought it was more colourful, two of them said it gave a better overview, three of them thought it was clearer, two of them found it less childish and more serious. One of the users said it gave him a feeling more free to fill in his experienced emotions, and he thought the method did not have any influence on his emotions.

9.4 Test of normality

A condition for the Pearson correlation test and the Paired t-test is that all variables have to be normally distributed. We checked this with help of the Kolmogorov-Smirnov test, From the output of this test we can conclude that all of our variables, so every question in our questionnaire is normally distributed, because for all variables the significance is beneath 0,05.

Tests of Normality

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PrEmo1	,264	40	,000	,890	40	,001
PrEmo2	,333	40	,000	,796	40	,000
PrEmo3	,306	40	,000	,845	40	,000
PrEmo4	,185	40	,001	,946	40	,056
PrEmo5	,200	40	,000	,886	40	,001
PrEmo6	,164	40	,008	,949	40	,068
PrEmo7	,228	40	,000	,905	40	,003
PrEmo8	,173	40	,004	,932	40	,019
PrEmo9	,204	40	,000	,887	40	,001
PrEmo10	,324	40	,000	,791	40	,000
Wheel1	,268	40	,000	,867	40	,000
Wheel2	,304	40	,000	,863	40	,000
Wheel3	,176	40	,003	,922	40	,009
Wheel4	,227	40	,000	,917	40	,006
Wheel5	,270	40	,000	,852	40	,000
Wheel6	,214	40	,000	,898	40	,002
Wheel7	,272	40	,000	,872	40	,000
Wheel8	,184	40	,002	,884	40	,001
Wheel9	,382	40	,000	,756	40	,000
Wheel10	,240	40	,000	,869	40	,000

a Lilliefors Significance Correction

9.5 Pearson correlation test results

Pearson correlation

Ability

Correlations

		PREMO1	PREMO8
PREMO 1	Pearson Correlation	1	,325(*)
	Sig. (2-tailed)	.	,041
	N	40	40
PREMO 8	Pearson Correlation	,325(*)	1
	Sig. (2-tailed)	,041	.
	N	40	40

* Correlation is significant at the 0.05 level (2-tailed).

Correlations

		WHEEL1	WHEEL8
WHEEL1	Pearson Correlation	1	,514(**)
	Sig. (2-tailed)	.	,001
	N	40	40
WHEEL8	Pearson Correlation	,514(**)	1
	Sig. (2-tailed)	,001	.
	N	40	40

** Correlation is significant at the 0.01 level (2-tailed).

Memory

Correlations

		PrEmo2	PrEmo7
PrEmo2	Pearson Correlation	1	,634(**)
	Sig. (2-tailed)	.	,000
	N	40	40
PrEmo7	Pearson Correlation	,634(**)	1
	Sig. (2-tailed)	,000	.
	N	40	40

** Correlation is significant at the 0.01 level (2-tailed).

Correlations

		Wheel2	Wheel7
Wheel2	Pearson Correlation	1	,427(**)
	Sig. (2-tailed)		,006
	N	40	40
Wheel7	Pearson Correlation	,427(**)	1
	Sig. (2-tailed)	,006	
	N	40	40

** Correlation is significant at the 0.01 level (2-tailed).

Clarity

Correlations

		PREMO3	PREMO5
PREMO3	Pearson Correlation	1	,445(**)
	Sig. (2-tailed)	.	,004
	N	40	40
PREMO5	Pearson Correlation	,445(**)	1
	Sig. (2-tailed)	,004	.
	N	40	40

** Correlation is significant at the 0.01 level (2-tailed).

Correlations

		WHEEL3	WHEEL5
WHEEL3	Pearson Correlation	1	-,061
	Sig. (2-tailed)	.	,707
	N	40	40
WHEEL5	Pearson Correlation	-,061	1
	Sig. (2-tailed)	,707	.
	N	40	40

Influence of the tool

Correlations

		PREMO4	PREMO6
PREMO 4	Pearson Correlation	1	-,012
	Sig. (2-tailed)	.	,942
	N	40	40
PREMO 6	Pearson Correlation	-,012	1
	Sig. (2-tailed)	,942	.
	N	40	40

Correlations

		WHEEL4	WHEEL6
WHEEL4	Pearson Correlation	1	,109
	Sig. (2-tailed)	.	,503
	N	40	40
WHEEL6	Pearson Correlation	,109	1
	Sig. (2-tailed)	,503	.
	N	40	40

9.6 Paired T-tests

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PrEmo1	4,50	32	1,344	,238
	Wheel1	4,97	32	1,555	,275
Pair 2	PrEmo8	3,66	32	1,753	,310
	Wheel8	5,00	32	1,545	,273
Pair 3	PrEmo2	3,44	32	1,162	,205
	Wheel2	3,38	32	1,185	,209
Pair 4	PrEmo7	5,06	32	1,435	,254
	Wheel7	4,97	32	1,062	,188
Pair 5	PrEmo3	4,94	32	1,523	,269
	Wheel3	4,91	32	1,510	,267
Pair 6	PrEmo5	4,88	32	1,621	,287
	Wheel5	5,44	32	1,243	,220
Pair 7	PrEmo4	4,31	32	1,512	,267
	Wheel4	4,53	32	1,295	,229
Pair 8	PrEmo6	3,91	32	1,467	,259
	Wheel6	3,91	32	1,489	,263
Pair 9	PrEmo9	3,13	32	,942	,166
	Wheel9	4,25	32	,803	,142
Pair 10	PrEmo10	5,72	32	1,198	,212
	Wheel10	5,25	32	1,320	,233

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	99,5% Confidence Interval of the Difference				
				Lower	Upper			
PrEmo1 - Wheel1	-,469	2,048	,362	-1,563	,625	-1,295	31	,205
PrEmo8 - Wheel8	-1,344	2,252	,398	-2,547	-,141	-3,375	31	,002
PrEmo2 - Wheel2	,063	1,564	,277	-,773	,898	,226	31	,823
PrEmo7 - Wheel7	,094	1,422	,251	-,666	,854	,373	31	,712
PrEmo3 - Wheel3	,031	2,265	,400	-1,179	1,241	,078	31	,938
PrEmo5 - Wheel5	-,563	2,139	,378	-1,705	,580	-1,487	31	,147
PrEmo4 - Wheel4	-,219	1,431	,253	-,983	,546	-,865	31	,394
PrEmo6 - Wheel6	,000	1,849	,327	-,988	,988	,000	31	1,000
PrEmo9 - Wheel9	-1,125	1,185	,209	-1,758	-,492	-5,372	31	,000
PrEmo10 - Wheel10	,469	1,814	,321	-,500	1,438	1,462	31	,154

9.7 Translated Emotion Families for Geneva Emotions Wheel

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May 16, 2006

English	Dutch
Involvement	Betrokkenheid
Interest	Interesse
Amusement	Amusement
Laughter	Lachen
Pride	Trots
Elation	Opgetogen
Happiness	Geluk
Joy	Blijheid
Enjoyment	Genieten
Pleasure	Plezier
Tenderness	Tederheid
Feeling love	Liefde voelen
Wonderment	Verwondering
Feeling awe	Ontzag voelen
Feeling disburdened	Bevrijd voelen
Relief	Opluchting
Astonishment	Verbazing
Surprise	Verrassing
Longing	Verlangen
Nostalgia	Nostalgie
Pity	Medelijden
Compassion	Medeogen
Sadness	Verdriet
Despair	Wanhoop
Worry	Bezorgdheid
Fear	Angst
Embarrassment	Gegeneerdheid
Shame	Schaamte
Guilt	Schuldig
Remorse	Berouw
Disappointment	Teleurstelling
Regret	Spijt
Envy	Afgunst
Jealousy	Jalousie
Disgust	Walging
Repulsion	Weerzin
Contempt	Minachting
Scorn	Verachting
Irritation	Irritatie
anger	Boosheid