

3E – EXPRESSING EMOTIONS AND EXPERIENCES

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ABSTRACT

Ambient Intelligence or ubiquitous computing is the technology vision of the future. Ambient Intelligence will provide applications and services to users anywhere and anytime. To ensure acceptability and pleasurability, Ambient Intelligence systems should also be socially intelligent. This requires research and design sensitive to the user's emotions. 3E is an emotion assessment method for collecting rich data of users' emotions and related context whilst using an application or service. 3E is a self report method allowing both pictorial and verbal reporting. In this paper, 3E is preliminary validated by comparing it to two other emotion assessment methods, SAM and Emocards. Also, the reliability of the analysis of 3E results is evaluated. It appears that 3E is a promising method for obtaining profound information from complex user experience and thus complementing more formal methods.

Keywords

Emotions, non-verbal methods, self-report, user experience

1. INTRODUCTION

In short future - if visions are to become true - we will live in a world of Ambient Intelligence (AmI). Computers will be everywhere but invisible, supporting human action, interaction, and communication in various ways whenever needed, regardless of time and place (e.g., [7][8][16][20]). Interaction between user and technology will radically change. A new kind of interaction design, that takes the holistic nature of the human user into account, is needed.

To serve people well, AmI systems need to adapt to users' emotions not to ever be disturbing or inconvenient. One interesting aspect of AmI is the system feature of social intelligence. In visions, Ambient Intelligence becomes an essential part of our social life. AmI technology should support the social processes of humans and even be a competent social agent in group interactions [11][13][14]. This requires high social intelligence from a technological system. A system designed with socially intelligent features invokes positive feelings in the user [11]. On the other hand, "socially clumsy" technology has a high potential for evoking negative feelings in users, leading to possible rejection of the technology in question. One example mentioned by Nijholt [13] is the paperclip help agent in Microsoft® Office products.

Thus, to gain user acceptance for AmI, it is not sufficient for applications to function properly, be usable, efficient, and aesthetically nice. Applications need to be emotionally appealing [5]. We want to design Ambient Intelligence environments that elicit positive emotions and pleasant user experiences.

Current research on AmI is active in terms of technologies, applications, and infrastructures, but less on suitable evaluation methods, in particular, methods for evaluating emotions. AmI is a complex thing, and should be evaluated as such. This is difficult because real-use AmI systems are still immature. Much research concentrates on designing and building new applications or proof-of-concepts, and does not strive for coherent knowledge and understanding of AmI [15].

Sharp and Rehman [15] point out the need for evaluating AmI applications in realistic environments. This is the only way to assess the complex AmI (or ubiquitous computing in their terms) interaction, three-fold as it includes applications, users, and environment. Moreover, the changeable context of use sets new challenges for research of user experience and emotion, especially because many current methods are developed for laboratory conditions.

In field settings, in real-life environment, it is difficult to observe users and gauge their emotions without affecting the user and user experience. Video cameras and other equipment may make users feel uncomfortable and restrict their natural movements and actions. The equipment may draw the attention of other people, and so alter the situation. Elimination of environmental factors is of course not desirable in real-use evaluation, as real-use environment is a valid parameter that needs to be taken into account when designing products. However, rendering the usage situation with equipment, setup and methods of evaluation should be as insignificant as possible.

Considering the complexity of interaction between a user and an AmI system, an emotion assessment method should be able to capture both the emotion and its context to explain what aspect of interaction affected the feelings of the user. The method should be applicable for field tests and easy to use. Furthermore, the method should minimize the influence of the researcher on the evaluation and possibly enable long-term studying. Taking these points into account, a novel method for evaluating emotions has been developed. Expressing Emotions and Experience, or 3E for short, is a projective method combining verbal and non-verbal user

feedback of feelings and experience in a usage situation. The development of the method has been described in detail in [17]. In this paper, the results of preliminary validation of 3E, a comparison with two other emotion assessment methods in a field study, are presented.

2. EVALUATING EMOTIONS

Today the instruments measuring emotions range from simple pen-and-paper rating scales to high-tech equipments [5]. The instruments relying on self-report utilise rating scales, verbal protocols (verbal methods) or pictograms (non-verbal methods) that are used by the user to describe his/her emotions. The most often used methods for collecting subjective feelings verbally are interviews, traditional surveys, diaries and experience sampling method (ESM) [4].

Two examples of self-report instruments using pictograms for non-verbal assessment of emotions are Self-Assessment Manikin (SAM) [10] and Emocards [6]. SAM represents visually three dimensions of emotion by using three axes: 1) pleasure-displeasure 2) degree of arousal and 3) dominance submissiveness (Figure 1).

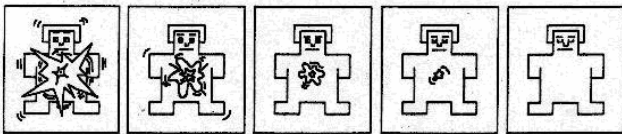


Figure 1. Example figures of SAM: the arousal dimension [5]

Emocards consists of 16 cartoon faces (eight male faces and eight female faces) that depict eight distinct emotional responses (Figure 2).



Figure 2. Example figures of Emocards: happy and sad female and male faces [6]

We have applied the Emocards and SAM methods in mobile device field tests [18][19]. The methods were easy to use and analyze. However, the predefined pictures caused some difficulties for users in matching their emotions to the test figures. In addition, users found some of the depicted emotions difficult to interpret.

Furthermore, a drawback of SAM and Emocards is that they capture only users' emotions, but not the context or cause of them. These methods thus require an additional assessment to the causes, for example the researcher asking clarifying questions.

The 3E method enables to gauge users' emotions with a different approach. Users are allowed to depict their emotions by drawing as well as writing, so giving information of their feelings and reasons behind them in a way of their preference, and without the simultaneous intervention of the researcher.

3. 3E METHOD

3.1 3E method

3E is a self report method, in which the user is provided with a simple pictorial template for expressing emotions and experience, in the form of a sketched human body (Figure 3). The user is able to draw a face to the human figure so

projecting her/his emotional state to the figure. In a later version of the method, the human figure was added with two cartoon-like speech bubbles as in the Figure 3. The bubbles can be interpreted so that the cloud-like one is used to depict inner thoughts (whether they are pictorial or verbal) and the square-like bubble is for oral expression.

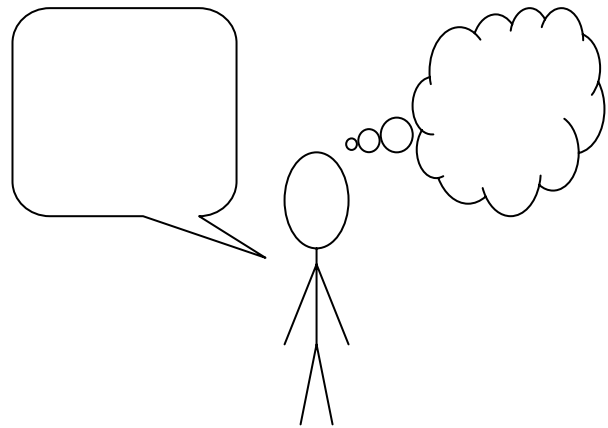


Figure 3. The 3E template

The 3E method offers a way to express emotions and experiences by both writing and drawing. We hypothesise that this helps different individuals to communicate their feelings as they can choose the way of their preference.

Moreover, as a projective test, 3E may help users to express negative feelings. The basic idea behind projective tests is to provide neutral stimuli to users and let them to respond in an individualistic way, for instance, interpret the stimuli, fill in the blanks, or make associations [2]. This approach may help the user to safely express negative emotions, which might be difficult in other kind of evaluation situations, for example in an interview.

3.2 Evaluating 3E

Validity refers to the extent to which the method is capable to collect such data as desired [9]. One way to examine the validity of a method is to compare obtained results to results acquired by using another already validated method [3]. This is called concurrent validity. To preliminary analyse the concurrent validity of 3E, the results collected by it have been grossly compared to the results of SAM and Emocards.

In short, 3E, SAM and Emocards were used in two different studies, of which the other study was replicated four times in different places. In both studies, all 72 users wielded all three methods. In the first study, the users' task was to send a text message with an unfamiliar mobile phone. In the second study, the task was to use the SmartLibrary application (introduced by Aittola et al. [1]) in a mobile phone to find a book from a library. In both studies, the subjects were first shown all three methods and asked the first impression of them. Then the users performed the given task (sending text message or finding a book with a mobile application). After the task, the users were asked to express their emotions by using all of the three emotion assessment methods (Emocards, SAM and 3E). Finally, the users were asked which method they preferred of the three, and why.

In addition, the reliability of the analysis of 3E has been evaluated with triangulation [3]. In this method, more than one researcher separately analyse the material and compare their interpretations.

3E has been also used as a part of a long-term study of SmartLibrary. The application was used for five days and the users daily filled out a diary and 3E figures.

In these studies two different versions of 3E have been used, figures with and without speech bubbles. The results of the studies are not reported as such, only as they relate to the validation of the 3E method.

3.3 3E drawings

In the evaluation filling 3E took somewhat more time than SAM and Emocards from the users, but still only a few minutes. Some users commented that they are not good at drawing and thus do not prefer 3E. However, the pictures drawn by these users were as “good” and expressive as the other users’.

In general, the users produced very communicative drawings and explanations with the 3E method. The example drawings presented here are examples either from the comparison studies or the diary study.

Figure 4 shows a simple drawing, in which the human figure is chained up. In an interview, the user told that the application was too chaining (restrictive).

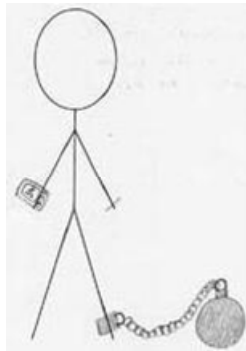


Figure 4. Feeling chained.

Figure 5 shows a more complex drawing, depicting contradictory emotions. It is pretty clear that the user is feeling happy about some aspects of the product whilst raging about some other features.



Figure 5. Several emotions in one picture. First speech bubble on the left: “I just want to write a message, why so many things to select?” Second bubble (drawn): “Nice colours!” Third bubble: “this buttons are so small! where is it?” Last bubble on the right: “I like my phone better but it also has small keys.”

This picture depicts the feelings of the user, but it also clarifies the reasons behind them, and so helps to understand the mental context of the user. In Figure 6, the user has

included physical context in the drawing in addition to expressing an emotion.



Figure 6. An emotion presented with its physical context.

Social context was not presented in the drawings. This may be because the tested applications were not multi- but one-user in nature. Considering the richness in which users utilize the 3E method, we expect that social context, if explaining some emotion, would be included in drawings as well.

3.4 3E evaluation results

Before use of the method, the majority (48%) of the participants preferred SAM. Emocards was preferred by 31% of the users and only 21% preferred 3E. After the studies, the distribution among methods was different. Most test users (43%) still conceived SAM as the best method. However, the endorsement of 3E increased from 21% to 35% of the participants. Now only 22 % of the participants preferred Emocards. The 3E method was the only method that increased its endorsement.

In the users’ comments, 3E was acknowledged for its power and freedom of expression and possibility to give personalised answers. On the negative side, 3E was seen as too abstract and open, requiring imagination, and taking too much time and effort. SAM and Emocards were both thought to be fast and easy to use, and their visuality and fun aspect (e.g., funny faces) were liked. On the other hand, the emotions depicted by the faces or drawings were not always understood or did not match to the users’ feelings.

The results from the three methods were cross-evaluated with simply categorising the single responses as emotionally neutral, positive, or negative. The correlation between the results of different methods was calculated. The correlation (Cohen’s Kappa) between 3E and SAM is 0.61 (substantial), and between 3E and Emocards, 0.51 (moderate). The smaller Kappa value with Emocards and 3E may be due to the difficulty for users to understand one of the Emocards pictures.

The same gross categorization was used when comparing the 3E analyses of three independent researchers to check the reliability of the analysis. The pair wise correlations varied between 0.58 and 0.75, which indicates that the 3E drawings were somewhat easy to interpret in a reliable manner.

Summarizing users’ comments from the studies it can be said that users liked SAM and Emocards because they are fast and simple to use. 3E requires somewhat more time but it gives a freedom to depict exactly the emotions users are experiencing, and thus offers a possibility to obtain more in-depth knowledge of the use situation.

In 3E the ideal case is to have both kind of information, pictorial and verbal, to tell about the user's feelings. The different formats support each other. If the user produces only one of them, we are still able to collect information of emotions and experiences elicited by the use of the application.

4. DISCUSSION

The 3E emotion assessment method is a way to collect rich data on the user's feelings and their context – mental, physical, and possibly social – without too much burden on the user. The method does not require any extra equipment but pen and paper. In testing the method, some users worried of their competence on drawing. It is thus important to point out to users that special drawing skills are not required in the 3E method. Simple, non-detailed pictures are held as valid as those of skilled drawers. 3E allows the user to respond in verbal (written) means as well.

3E offers a lot of colourful material, which is the richness and the weakness of the method. The analysis of the material is time consuming and laborious for the researcher. Furthermore, it is totally up to the researcher how to interpret the drawings. In our study, the independent analyses of three researchers were moderately similar. Still if 3E is used to complement other methods, such as diary or form-filling, the 3E material should be interpreted against information obtained from these. Also, it is possible to go through the 3E pictures with each participant in subsequent interviews to specify the meanings of the material. In our studies, the user-drawn 3E figures facilitated recalling the emotions which the users experienced at the time of the evaluation. However, it would be useful if a scoring method could be developed to facilitate the analysis.

The 3E method has been tested in evaluating two different mobile applications, but the method also applies well to Ambient Intelligence (AmI) use situations that take place in real environments and does not necessarily require the researcher's presence. For instance, in the MIMOSA project [12], a mobile-based solution for context-aware everyday applications will be evaluated with the 3E method. The application is based on RFID tags, which are read with a mobile phone to get context-based information from the environment. Test users will fill the 3E template after using the system a few times for different purposes in a real-life environment.

The 3E method does not apply well to evaluations, in which the purpose is to get very precise information or evaluate some detailed properties of a product in a "quick-and-dirty" manner. Fast, lightweight evaluation is often preferred in technology and interaction design to get the product quickly to the market. However, we argue that it can be useful to study the user in addition to the usability of a product. Especially to understand the multifaceted interaction situation with complex AmI systems, we need more profound information than just the user's feeling at the moment of interaction. In particular, we need to understand the context, in which the feeling is evoked in the mind of the user. The 3E method provides a way for that. In addition, as a projective method and with no researcher present, 3E may facilitate expression of negative feelings towards the evaluated application or system.

Naturally, to best evaluate users' emotions invoked by different AmI applications and their usage, a whole set of alternative evaluation methods needs to be invented, suitable for different interaction contexts. The work is worth doing. If AmI is to be anywhere, anytime, we do need to take care of that we will be feeling just happy with it.

REFERENCES

- [1] Aittola, M., Parhi, P., Vieruaho, M. & Ojala, T. (2004)- Comparison of mobile and fixed use of SmartLibrary. *MobieHCI2004*, 383-387.
- [2] Atkinson, R.L., Atkinson, R.C., Smith, E.E. & Bem, D.J. (1993). *Introduction to psychology* (11th ed.). Harcourt Brace & Company, USA.
- [3] Coolican, H. (1990). *Research Methods and Statistics in Psychology*. Hodder & Stoughton, U.K.
- [4] Csikszentmihalyi, M. and Larson R. (1987). Validity and Reliability of the Experience-Sampling Method. *The Journal of Nervous and Mental Disease*, 175(9), 526-536.
- [5] Desmet, P. (2002). *Designing Emotions*. Doctoral dissertation. Delft University of Technology.
- [6] Desmet, P.M.A., Overbeeke, C.J. & Tax, S. J. E. T. (2001). Designing Products with Added Emotional Value; Development and Application of an Approach for Research through Design. *The Design Journal*, 4(1), 32-47.
- [7] ISTAG (2001). *Scenarios for Ambient Intelligence in 2010*. Available online at <ftp://ftp.cordis.lu/pub/ist/docs/istagscenarios2010.pdf> (31/10/2005)
- [8] ISTAG (2003). *Ambient Intelligence: from vision to reality*. Available online at <http://ica.cordis.lu/documents/documentlibrary/ADS0000806EN.pdf> (31/10/2005)
- [9] Järvinen, P. (1999). *On research methods*. Tampereen Yliopistopaino, Finland.
- [10] Lang, P.J. (1980). Behavioral Treatment and Bio-behavioral Assessment: Computer Applications. In Sidowski, J.B., Johnson, J.H. and Williams, T.A. (Eds.) *Technology in Mental Health Care Delivery Systems*. Norwood, NJ: Albex, 119-139.
- [11] Markopoulos, P., de Ruyter, B., Privender, S. & van Breemen, A. (2005). Case study: bringing social intelligence into home dialogue systems. *ACM Interactions*, 12(4), 37- 43.
- [12] MIMOSA (2005). <http://www.mimosa-fp6.com/> (project website, 15/11/2005)
- [13] Nijholt, A., Rist, T. & Tuijnbreijer, K (2004). Lost in Ambient Intelligence?. *CHI 2004*, 1725-1726.
- [14] Sampson, F. (2005). Why Do I Want Ambient Intelligence? *ACM interactions*, 12(2), 9-10.
- [15] Sharp, R. & Rehman, K. (2005). The 2005 UbiApp Workshop: What makes good application-led research? *IEEE Pervasive Computing*, 4(3), 80-82.
- [16] Streitz, N. & Nixon, P. (2005). The disappearing computer. *Communications of the ACM*, 48(3), 33-35.
- [17] Tähti, M. & Arhippainen, L. (2004). A Proposal of Collecting Emotions and Experiences. Volume 2 in *Interactive Experiences in HCI*, 195-198.
- [18] Tähti, M., Rautio, V.-M. & Arhippainen, L. (2004). Utilizing Context-Awareness in Office-Type Working Life. *MUM2004*, 79-84.
- [19] Tähti, M., Väinämö, S., Vanninen, V. & Isomursu, M. (2004). Catching Emotions Elicited by Mobile Services. *OZCHI2004*.

[20] Weiser, M. (1991). The computer for the 21st century.
Scientific American, 265(3), 66–75.