# Affective Benefits in Communication: The development and field-testing of a new questionnaire measure

J. v. Baren[1], W. IJsselsteijn[1], N. Romero[1], P. Markopoulos[1], B. de Ruyter[2]
[1] Eindhoven University of Technology, Eindhoven, The Netherlands
[2] Philips Research, Eindhoven, The Netherlands
Email: w.a.ijsselsteijn@tue.nl

## Introduction

A recent focus of research in HCI and CSCW, influenced by previous work in Media Spaces[1] and Portholes[2], as well as current trends in ambient intelligence, are awareness systems for use in personal settings – either home or mobile. Here, lightweight, emotional, informal forms of communication are being facilitated by systems that help people to effortlessly maintain awareness of each other's whereabouts and activities. Examples include the work by Hindus et al.[3] and Markopoulos et al.[4]. In line with Marc Weiser's notion of calm computing[5], such systems can typically be always-on, yet be very gentle or calm in terms of attentional demands.

The aim of awareness systems is often simply to stay in touch, i.e. to be reassured about the well-being of others, to let others share your experiences, to let someone know you're thinking of him/her, or to create opportunities for synchronous communication. In other words, for this type of communication, the informational content of the message is of secondary importance to the emotional, relational content that is being transmitted.

Most existing communication means have been developed to support the transmission of information rather than emotion, i.e., communication is content-oriented rather than connectedness-oriented[6]. Awareness systems are specifically aimed at enriching the communication for emotional purposes, thus strengthening existing social bonds and enabling new kinds of interactions. To assess the value of such systems, new evaluation methodologies sensitive to affective characteristics of communication are needed. Traditional assessments of communication media have often included social presence measurements[7]. Although highly relevant for assessing synchronous communication, specifically systems aimed at providing transparent immediacy, it is less appropriate for evaluating asynchronous awareness systems.

An important affective benefit of awareness systems will be a sense of connectedness. Connectedness is a positive emotional experience which is characterised by a feeling of staying in touch within ongoing social relationships. This is quite similar to the concept of "affective awareness" described by Liechti & Ichikawa[8]: "a general sense of being close to one's family and friends. It seems that affective awareness is best achieved when people are engaged in shared experiences, especially when these experiences affect their emotional state".

## The ASTRA project

The goal of the ASTRA project is to develop and evaluate a prototype that helps distributed family members to stay in touch with each other. We want to show that although CMC tools cannot replace face-to-face communication, they can help people to maintain and even strengthen their social relationships.

Building on the user requirements gathered through both a user study and a literature study, we developed a system that supports the sharing of pictures, drawings and/or short handwritten messages. Messages can be recorded by a simple and easy-to-use mobile device including a digital camera and writing pad. These messages will be shown on displays in the homes of both the sender and the receiver(s). These home

displays will also show awareness information about the status and availability of family members who do not live in the same household.

The following short scenario illustrates this idea:

*Laura, a 20-year-old student, comes home from a day at the university. On her home display, she sees that she has received two messages from her father. The first one is a picture showing a horse, with a small handwritten message saying "my new horse has finally arrived!". The second message is a funny drawing. After dinner, Laura sees that her father is available for communication, She decides to call him; she wants to hear all about his horse. She presses on his picture. The display shows all the messages that she sent to or received from him since their last contact.*

To assess the effectiveness with which the ASTRA prototype system serves the social and emotional home communication needs, and successfully supports and enhances a sense of connectedness, we developed a questionnaire measure designed to be sensitive to this dimension of human communication, the *Affective Benefits in Communication (ABC) Questionnaire*. With this questionnaire we focus specifically on the affective benefits that awareness systems may foster.

## Development of the Affective Benefits in Communication (ABC) Questionnaire

An extensive literature review revealed that at present there does not appear to exist a suitable questionnaire to assess the affective benefits of communication means. This prompted us to develop such a questionnaire ourselves. A main difficulty was a lack of theories to base it on. We held a brainstorm with 5 people working in the area of awareness and communication research. Each person generated a number of aspects that s/he thought were relevant. Input for this brainstorm was existing literature, a requirements study performed earlier within ASTRA on communication needs in the home[9] and the results from an e-mail questionnaire about connectedness[10].

Items, which were generated in the brainstorm, were grouped in an affinity diagram to identify main concepts. These main concepts could be grouped into three categories: Control (privacy, obligations, and expectations), Staying in Touch (thinking about others, situational awareness, connectedness, sharing experiences, recognition, and group attraction), and Effort. For each concept except group attraction, a scale consisting of 6 questions was generated based on the brainstorm results. For group attraction, we found an existing questionnaire (the Group Attitude Scale by Evans & Jarvis[11]) which contained 6 items which were appropriate to our situation. We added these to the ABC questionnaire.

The first version of the ABC was reviewed by 2 experts. They were asked to check whether items were understandable and measured the intended concept. On their advice, 2 items were removed from the questionnaire because they were unsuitable, and the wording of 5 items was slightly changed to make them clearer.

A pilot test was then conducted to gather data for the item selection. Twenty participants (Philips employees, students and employees of the TU/e) filled out the questionnaire, which now contained 58 items. The goal was to reduce the number of items to approximately 40, i.e. 4 per scale.
Criteria to remove items were:
- The item did not contribute sufficiently to the scale (low/negative item-total correlation)
- Alpha would improve when the item was removed
- An item did not discriminate (low variance and/or extreme mean).

Reliability of the Effort scale turned out to be very low. A closer look at the inter-item correlations suggested that this scale was multidimensional. A short interview with several respondents confirmed this. Effort is a complex concept; it can be positive in one situation and negative in another; also there are many different kinds of effort. Therefore we decided to remove the effort scale from the questionnaire and to assess this concept instead using interview. After removing the Effort scale, internal consistency, as

measured by Cronbach's alpha, of the ABC as a whole was .86, which indicates that the questionnaire is very reliable. Values for Cronbach's alpha for the scales of the ABC can be found in Table 1.

| Scales | α |
|---|---|
| **ABC** | **.86** |
| **Control** | **.64** |
| - Obligations | .41 |
| - Expectations | .73 |
| - Privacy | .76 |
| | |
| **Staying in Touch** | **.88** |
| - Thinking about each other | .70 |
| - Situational Awareness | .84 |
| - Connectedness | .58 |
| - Sharing experiences | .81 |
| - Recognition | .72 |
| - Group Attraction | .84 |

**Table 1.** Internal Consistency of the ABC

# The ASTRA Field Test

The field test aimed to gather data about how people use the ASTRA system in their normal lives, over a longer time period, and how they experience this. We investigated what communication patterns emerge and how the availability of ASTRA influences the usage of other communication media. Importantly, this field test offered us an opportunity to investigate whether the newly developed ABC questionnaire would yield sensible and stable results.

## Participants

Two families, both distributed over two households, participated in the field test. The first household was a family in Amsterdam consisting of a woman (42), a man (41), their daughter (7) and their son (4). The complementary household was a family in Bilthoven consisting of a man (43), a woman (41), their daughters (18 and 15) and their son (13). The woman from Amsterdam and the man from Bilthoven are brother and sister; there is a close relationship between the two households.

In the second field test participants were a family in Oldenzaal consisting of a woman (53), a man (54), and their son (16), and another son (24) who lives in Rotterdam. Participants took part in the study because they were interested in trying out a new communication system. All households received an incentive of €100 for their participation.

## Method

We used a within-subjects design consisting of two phases that lasted a week each. In the first week we observed the normal communication between two related households by means of a diary and two questionnaires (IPO_SPQ measuring social presence, and ABC). We also conducted a group interview about the family situation, relations, and attitude towards communication. In the second week we introduced the ASTRA communication system in both households and let them use it for one week. In this week we used the same observation measures as in the first week, plus logging of the usage of ASTRA. At the end of the week we conducted a focus group about their experiences with the system.

## Results

Reporting of the result is limited to the ABC questionnaire and some relevant quotes from the focus group interview afterwards. Full results will be available in the final deliverable of the ASTRA project, to be published around the end of the year 2003.

The mean scores for all scales of the ABC Questionnaire are shown in Figure 1. The Wilcoxon test was used to test for significant differences between scores. The results show that the three scales of the ABC

relating to Control do not differ significantly in the first and in the second week. In both weeks, subjects experienced substantial feelings of obligations and expectations, and a very high level of privacy. The Staying in Touch scales show some marked differences. Participants thought about each other more often in the second week, when they were using ASTRA ($Z = -2.67$, $p = .008$). Also, their awareness of the situation of their family members was much higher ($Z = -.2.31$, $p = .021$). Participants indicated they felt more connected to each other in the second week ($Z = -2.02$, $p = .043$). They also felt they were sharing more experiences with each other ($Z = -2.38$, $p = .011$). The level of group attraction was higher in the second week ($Z = -2.23$, $p = .026$). The recognition, finally, was slightly higher in the second week but this difference was not significant.
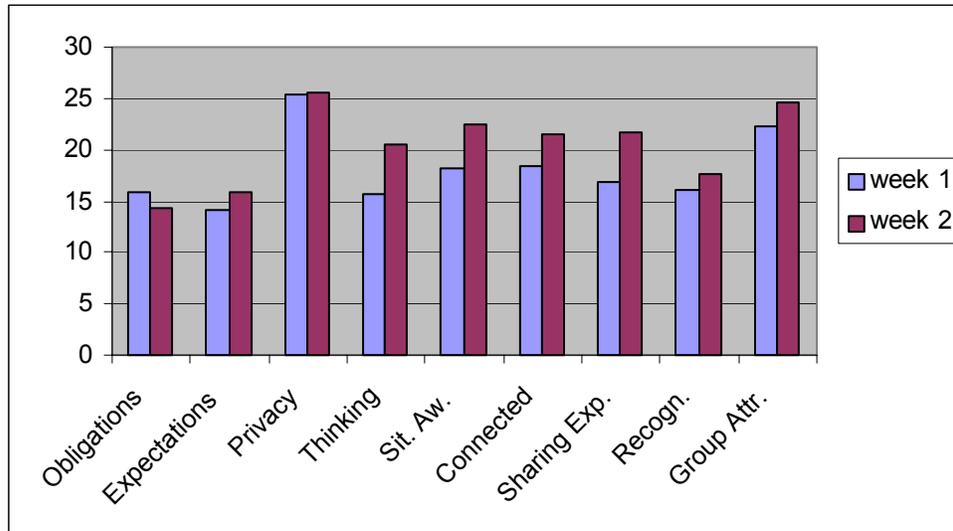


**Figure 1.** Mean scores on the ABC in the first and the second week of the field test. N.B. All scales have a minimum value of 4 and a maximum value of 28.

A focus group / interview was conducted with each of the four participating households after they used ASTRA. These confirmed the results of the ABC; participants reported that they felt more in touch with each other in the second week. They thought about each other more often, were more aware of what their family members were doing and could share more of their own experiences. There were many remarks made that support this. Some illustrative user quotes:

*'There was more involvement, more curiosity. I was thinking about them much more than usual.'*
*'You become more conscious of what your family members are doing, and you also become curious.*
*'It is so good to see what they are doing. I always want to stay in touch but I normally don't have the time. Now it is easier.*
*'It was fantastic to keep them up-to-date.''*

## Conclusions

The results from this study imply that the ABC is a promising measure. The initial pilot testing during the development phase has shown that it is a reliable measure. In the field test, the ABC proved to be sensitive to changes in condition (in our case, the introduction of the ASTRA system). Although validity has not yet been formally established, the correspondence between ABC scores and the interview results is striking and encouraging. Therefore, we believe that the ABC will be a useful addition to the currently limited spectrum of relevant measurement tools in the field of communication, particularly aimed at measuring affective benefits of communication media.

Paper presented at PRESENCE 2003, 6-8 October 2003, Aalborg, Denmark.

## Acknowledgements

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