

# Expected information needs of parents for pervasive awareness systems

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**Abstract.** This paper examines the communication needs of busy parents that can be served by awareness systems: systems supporting a continuous and semi-automated flow of information about the activities of communicating individuals. We report an online survey involving 69 participants. This survey focused on whether the types of information offered by awareness systems as these are introduced in current research literature are appreciated by busy parents. The results show a) that information items that allow personalization and expressing intentionality are more desired than those than low granularity and automatically sensed information that is easy to collect automatically b) the attitudes regarding the information that people wish to share about themselves is almost identical to what they wish to know of their partners and c) survey methods focusing on information do not need to differentiate between the direction of information flow or whether this is symmetric, since people report almost identical preferences.

**Keywords:** Awareness systems, Communication needs, Pervasive computing.

## 1 Introduction

Among the pervasive computing community there is a growing interest for using pervasive computing to support informal, social communication. The target group of such efforts is usually family members, close intimates, friends. For example, contact lists currently available on mobile phones can be augmented with presence information or other contextual information that provides a context and a trigger for communication or coordination of the activities of individuals, e.g., [11]. Our research focuses especially on the communication needs of busy parents; our earlier work on intra-family communication needs focused originally on cross generational communication and on supporting elderly. However, during the field trials of our prototype for intra-family awareness [10] we found out that busy parents were a very

promising user group who had pronounced needs for frequent communication over and above mobile phones and text messaging.

The communication between couples has attracted the interest of researchers in this field, who have focused mostly on poetic and playful forms of communicating affect through physical artifacts connected over distance. Examples include Strong and Gaver's conveyance of presence by a feather in a plastic cone that floats when the distant partner picks up a picture frame of the couple [13]; Tollmar and Joakim's light 'orb' that glows when a remote family member walks into their apartment [15]; Brave and Dahley's two sets of cylinders that roll and rotate in unison as they are manipulated by separated partners [1]; Vetere's virtual hug realized through an inflatable vest that can be triggered to inflate from a remote partner. These works have inspired a lot of the developments in research on awareness systems for intra-family communication, but there has been little empirical research to understand the needs regarding what communication is needed between couples (and especially busy parents). Some fundamental questions that arise are:

- A. Is a sustained flow or trickle of information between parents wanted at all?
- B. Are there any other communication needs to be exchanged except intimacy?
- C. Should the information exchange be symmetric?

In an earlier interview study [8] we examined questions A and B. The results of that study indicated that parents do not really want to communicate during the day. For example, we found out that parents, while separated during the day, refrain from initiating communications with each other for fear of interrupting their work, unless for an emergency or a change of plans. Contrary to our initial expectations, parents did not report as much a need for directly communicating affective communication, e.g., to indicate that they think of each other, or to display affection over the phone. Moreover, in most cases parents use a practical reason to communicate as a pretext for a richer, more affective communication, something also found before in the case of cross-generational communication, see [10] for example. With the present study we set out to validate this result, by triangulating the interview study with a different research method focusing on exactly this issue. The survey was designed to uncover what types of information sharing busy parents wish to achieve, considering the range of information sharing that is typically addressed by awareness systems.

Question C above, has been examined at a theoretical level. For example, the concept of social translucence [3] has been put forward as a way to describe the symmetric needs for transparency and accountability between users of communication systems. The concept of minimum information asymmetry has been also proposed by Landay and Hong [4], as a way to ensure privacy protection between connected individuals. Apart from these theoretical analyses, many systems that are presented for intra-family awareness are essentially asymmetric, as for example the well known Family Portrait [12], which supports one way information flow from a lonely elderly to their close family. Such assertions have a strong logical and theoretical basis but as yet, there is little or no support from empirical research. The survey described aims to address this point.

## 2 Method

We reviewed related literature on Awareness systems. We included in this review papers published in conferences such as Mobile HCI, CHI, CSCW and Ubicomp. We included only papers describing systems rather than theoretical and empirical works in this domain. In each case, we examined the essence of the information that the awareness system helped communicate abstracting away from context capture mechanisms and the presentation medium. For example, Cadiz, et. al. describe in their paper [2] Sideshow, an awareness system that displays among other information traffic conditions at a particular location in the city. This is displayed on a PC based application. For our survey we retained only the fact that traffic conditions are communicated. Thus the statement we formed is presented in Table 1.

The review included 16 papers. Our overall impression is that the information exchange through the described systems varies in detail, but overall it seems to cluster around the repeating themes of location, availability, presence and activity descriptions.

In addition to the literature review, we added statements regarding information needs of busy parents that we obtained from the transcriptions of the interview study we had conducted earlier with 20 Dutch working parents [8]. In total we had 41 seed statements describing awareness information that can be exchanged between busy parents by using an awareness system. This list is of course not exhaustive, as one might be able to dream up an infinite range of information types, at different levels of details and referring to different aspects of people's lives. Rather, this list was meant to capture the range of concerns of researchers in awareness systems and to put this set of concerns to the test but also to base our own designs of awareness systems on stated communication needs and preferences of parents.

An essential tenet of awareness systems is that people will not explicitly engage in direct communication of some information, (as one would with a notification or a messaging system), but that information about one's context or activities is made continuously available and others can choose to inspect it or not. Put in another way, this suggests that there is a difference between actively wanting to share information to not minding if others view it. To implement this distinction in our survey, we asked participants to rate each statement using the following scales: I want, I don't want but I don't mind, I don't want. For our analyses, we rate these answers as 1, 0 and -1. The I don't want but I don't mind scale might initially sound bizarre. However there might be cases that someone would not mind sharing information and at the same time someone would want to receive this information, or the other way round.

Exchanging information implies both sharing and receiving. For our purposes we wanted to find out what information couples find useful to share and what to receive. Therefore for each of the types of information identified as above, we asked a question regarding the willingness to share and a question regarding the willingness to receive this information. For example, for information regarding traffic at the location of the partner the two questions were those shown in Table 1.

**Table 1.** Example of the two statements we formed.

share	receive
My spouse is informed about the traffic conditions near the location I am	I am informed about the traffic conditions nearby the location my spouse is

At this point a methodological issue arose. Since we wanted to ask two questions we could think two ways of asking; disjoint or conjoint. For example, when asked about the traffic conditions in the location a person is, we could first ask the question: “How willing are you to share this information?” (about the statement: “My spouse is informed about the traffic conditions near the location I am”) and then “How willing are you to receive this information?” (about the statement: “I am informed about the traffic conditions nearby the location my spouse is”). Or we could ask the question at the same time: “How willing are you to share/receive this information?” (about the statement: “I am informed about the traffic conditions near the location my spouse is and my spouse is informed about the traffic conditions near the location I am”).

This methodological issue reflects upon the nature of an awareness system as well. Asking disjointed questions suggests a system that is asymmetric whereas the conjoined question on sharing and receiving suggests a system that is symmetric. To examine whether attitudes of partners are influenced by an assumed symmetry or not, we split participants asking half of them two questions (separately about sharing/receiving: disjoint) and the other half one question (conjoint).

We created an online application which assigned in counter balance the participants to the two ways of asking them the questions. The application presented the statements to the participants in randomized order and recorded their ratings.

## 2.1 Participants

69 people were recruited through advertisements placed at an online forum for parents as well as by sending email adverts to secondary schools. 34 of them saw the statements in two steps (for receiving and for sharing) as explained previously. 35 of them saw the statements in one step as explained previously. The order, in this case, both within a statement and overall was randomized.

## 2.2 Hypotheses and analysis

The study had two hypotheses.

H1: When couples are asked in a way representing an asymmetrical exchange of information they would be willing to exchange more information than when asked in a way representing a symmetrical one.

H2: Spouses are willing to receive more information than they are willing to send.

For testing H1 we had to compare the two ways participants rated the statements. In one case participants answered two questions (about sharing and then about receiving) and in the other case they answered one question (about sharing and receiving). To compare the two we had to merge the two ratings participants gave when answering two questions. By merging, we had one rate to compare it against the rate participants gave when answering a single question. We merged the rates as following. We first converted the 1 and 0 scale items to logical True and the -1 scale item to logical False. We then took the logical conjunction of the rating of each participant who answered the two questions. For example, if a participant rated the question: My spouse is informed about the traffic conditions near the location I am with I don't want (-1, thus logical False) and for the question: I am informed about the traffic conditions nearby the location my spouse is (1, thus logical True) then the result of the logical conjunction would be False (since True AND False = False).

We calculated the proportion of participants choosing a statement. For that we added up the I want, I don't want but I don't mind scales and divided by the number of the participants answering that particular method (34 and 35 respectively).

We wanted to find out whether the difference between the two ways of asking was significant. For that reason we calculated the significance interval at 95% for each and every statement as well as for the overall mean of percentages of the first way of asking. We then checked whether the proportion of the second way was inside the interval. If so this meant that it the difference of proportions is not significant [7]. To illustrate an example we will examine one statement. The statement about being "a few minutes idle behind my computer" after the re-rating had 10 participants (out of the 34, i.e. 29%) who wanted to either share or receive it. To calculate the confidence interval we need to calculate the margin of error. The margin of error is then calculated by the following formula:

$$1.96\sqrt{\frac{\hat{p} \times (1 - \hat{p})}{N}}$$

Where  $\hat{p} = 0.29$  and  $N=34$ , error = 0.15 and therefore the confidence interval is {0.14 to 0.44} or {14% to 44%}.

The same statement had 13 participants (out of the 35, i.e. 37%) who wanted to either share or receive it when asked in the second way. The 37% is included in the confidence interval {14% to 44%}. We can therefore conclude that the difference between the two ways of asking is not significant for this particular statement.

For testing the second hypothesis we plotted a table with the frequency ratings for the I want, I don't want but I don't mind scales and divided by the number of the participants answering that particular method (34). We then again calculated the significance at 95% for each and every statement as well as for the overall mean of percentages.

### 3 Results

For the first hypothesis we repeated the analysis described for one statement in the previous section for each of the 41 statements. For all 41 statements there was no

significant difference. Hence we can conclude that generally there is no significant difference between the two ways of surveying preferences by users.

The same holds for the second hypothesis for each and every statement except the statement: My spouse is informed that I am away from my office, I am informed that my spouse is away from his/her office where it a significant difference appears between the two. It seems that couples would like to receive this information than send it to their spouses.

### 3.1 Content of information exchange

We were interested in the statements that emerge to be most and least wanted to be shared and received.

Least wanted statements to be shared are presented in Table 2. They appear in both ways of asking. All of these statements represent very detailed information. It seems that parents are not interested in that. If we also view the statements that do not want to be shared but parents do not mind to share them anyway (Table 3) they also seem to be detailed and two of them are related to computer activity. On the other hand (and this is what we would expect) parents seem to be interested in sharing broader information like how they are feeling and if they do not want to be disturbed (Table 4).

**Table 2.** Least wanted statements to be shared.

My spouse is informed about the general noise level of the room I am in  
My spouse is informed that I am a few minutes idle behind my computer  
My spouse is informed about what the title of my next meeting is

**Table 3.** Statements that do not want to be shared but parents do not mind to share them anyway.

My spouse is informed that I am logged out from my computer  
My spouse is informed that I am having a break  
My spouse is informed about my Instant Messenger status

**Table 4.** Most wanted statements to be shared.

My spouse is informed that I am wishing him/her a good day  
My spouse is informed about how I am feeling today  
My spouse is informed that I do not want to be disturbed now

Least wanted statements to be received are presented in Table 5. One of them is also found in Table 2(does not want to be shared as well). As was the case with sharing information that parents do not want to also receive very detailed information. The same idea is also reflected with the statements that do not want to be received but parents do not mind to receive them anyway (Table 6). They all represent information which is very detailed. It is naturally not surprising that the statements that are most

wanted to be received are exactly the same with the ones that want to be shared with the exact same order (Table 7). This again reflects the wish of having symmetric exchange of information.

**Table 5.** Least wanted statements to be received.

I am informed that my spouse is a few minutes idle behind his/her computer  
I am informed about how many times my spouse spoke with other people today  
I am being informed about what is going on in the room my spouse currently is

**Table 6.** Statements that do not want to be received but parents do not mind to receive them anyway.

I am informed that my spouse is engaged in an Instant Messaging conversation with another user  
I am informed about when my spouse is close to the supermarket  
I am informed about the medication my spouse has taken during the day

**Table 7.** Most wanted statements to be received.

I am informed that my spouse is wishing me a good day  
I am informed about how my spouse is feeling today  
I am informed that my spouse does not want to be disturbed now

In conclusion, it is clear from the data that very detailed information is not really wanted by parents and it is high-level information that would make more sense for them to be exchanged.

## 4 Conclusions & Discussion

We presented an online survey of 69 busy parents regarding their communication needs. According to the data we got we can draw the conclusion that parents are willing to exchange information between them. Design implications for our results are that more expressive means of conveying emotions and intentions are needed; emotional communication is valued more than communicating trivia enabled by technology.

Furthermore, since no significant difference was found between the two ways of asking participants, we can draw the conclusion that there is no difference in the way researchers of awareness systems would ask their participants. For simplicity and efficiency, in future surveys we recommend only surveying the need to 'share information'.

The found balance on willingness to share or receive information supports the "Principle of Minimum Asymmetry in Information Flow" proposed by Jiang, et. al. for designing ubiquitous information systems [5] and the concept "Social translucence" by Erickson and Kellogg [3].

There are limitations to the method of online surveys, such as not having control of the participants who are answering (self-selection bias) and the often discrepant

expressions of attitudes to the actual behavior of people as users. However, our results have interesting implications for both design and research methodology aspects of awareness systems. To address these limitations an experience sampling study [9] is currently under way to examine the preferences and attitudes of people as they move in different contexts and engage in their daily activities

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