An Experience Sampling Study into Awareness Needs of Busy Families

Abstract — **We report an investigation into the communication needs of working parents pertaining to awareness of each other's whereabouts and activities. Twenty working parents took part in an experience sampling study for a period of one week and in follow up interviews. Analysis of participant responses shows that working parents can benefit from automatically updated information relating to availability of each other through the day, support for micro-coordination especially surrounding dinner time and children's activities and getting reassurance regarding the well being of the family. Analyzing the situational variations of information needs we find that parents seek their partner's communication availability during the day, require information to coordinate evening tasks and are prone to exchange information at home than at work.**

Keywords — **Awareness systems, pervasive computing, user requirements elicitation, family communication, busy parents.**

I. Introduction

TECHNOLOGIES that support automated context sensing and interpretation, e.g., positioning technologies, sensors embedded in mobile devices or even instrumented physical environments, can be used to inform one's social network (or parts thereof) regarding this person's whereabouts and activities. Examples include a contact list featured on mobile phones as shown by Nokia [9], or plazes.com [11] where users can share their location with their contacts through their mobile phone. Field trials of such technologies have shown how people appropriate such information to derive the inferences that are useful for them in the course of their daily activities [10, 3, 13].

A large body of design works concerns intra-family communication or communication between couples. They range from media for poetic and expressive communication acts, e.g., [5]; to more functional media for sharing moments through capturing stills [12] or even video [4]. Where available, evaluations of such systems confirm core motivations of their designers, but leave open more fundamental questions regarding the acceptance of such technologies: Is continuously available awareness information desirable? What are the needs for awareness people actually have? How is awareness of one's social and family relations used and appreciated once it is available?

Financial support acknowledgments removed for anonymity.

Here we examine whether such automatically acquired awareness information is needed by busy parents, by which we refer to parents who both work more than half time and are raising young children. More specifically, we try to find out what kinds of information they wish to share with each other through the day and through the week.

Brown et al. [1] deployed and evaluated their Whereabouts clock; the 'clock' was an information appliance that hung on a kitchen wall; it concealed a computer display through which awareness information of the whereabouts of family members was presented. The information this appliance provided was very coarse, distinguishing between 'home', 'work', 'school' and an unlabelled region (meaning 'elsewhere'). The clocks were installed in five family homes (26 people in total) for a period of at least one month for each family. Qualitative interviews revealed a range of usage patterns for the Whereabouts clock, and concluded that despite the low resolution of location awareness provided the system was valued for:

- Coordinating activities; e.g., knowing that mom is about to return home dad makes sure the kettle is on when she gets home.
- Giving reassurance; confirming known or assumed location of another party, reassured family members that things are as normal and as they should be.
- Expressing identity; some participants used their reported location as a way of identifying and expressing activities to others.
- Expressing affection; several messages were sent to the device expressing affection.

Field studies of these kinds are very valuable because of their contextual nature and because they refer to actual experiences with the technologies under investigation. However, their results can be criticized on two accounts. Mostly, they attempt to generalize from experiences gained with one specific system to draw conclusions about communication needs. Derived uses of the system are bound by the nature of this one system, and which may fail to reveal actual communication needs not related to the specific design. Second, deploying such systems creates a context in which participants can be expected a priori to use the system as part of their participation in the study. This may create a bias, as participants will find a use for a system because that is expected from them. In this sense, while one of the most valuable research methods in our field, field trials do not then provide convincing evidence

that proclaimed awareness needs are actual and that they are not already well served by current communication media.

A recent study acknowledges this limitation and has addressed it but with a generic user group of mobile individuals [15]. By means of a diary study they surveyed the information needs of 20 people while they were mobile. Their analysis concludes in 16 broad categories of needs with the top five being: trivia, directions, point of interest, friend info and shopping. Moreover, the research concluded that when an information need arose, participants addressed it at the time, later, or not at all by "calculating a complex cost function" pertaining to the context sensitivity of information needs.

Taking a user perspective, it is important to test some of the assumptions underlying design works such as those discussed above. An interview study [6] found that parents do not really want to communicate during the day, refrain from initiating communications with each other for fear of interrupting the other's work, unless for an emergency or a change of plans. Further, their participants did not express as much a need for directly communicating affect, e.g., to indicate implicitly that they think of each other, or to communicate affect more explicitly over the phone or mail. On the contrary, another interview study concluded that family members need awareness of other family members to coordinate, to feel connected and to enjoy a feeling of comfort [8].

The aforementioned interview studies illustrate that interviews and questionnaire based surveys suffer from the limitation that respondents' opinions are solicited out of a specific context and removed from the time where related awareness needs arise. Field research is a way to compensate for this limitation. Sellen et al. [14] present an ethnographic study of the everyday problems of working parents and identify several problems those people face which can be facilitated through communication technology. Among them are: planning for meals, remembering activities other family members need to do during the day and change of plans during a working day. However, [14] did not focus specifically on communication needs that this group has and did not attempt to answer the question whether awareness of each other covers an actual communication need or a technology push for this field.

In order to survey awareness needs between busy parents in a manner sensitive to context but without priming them with a particular system prototype, we conducted an Experience Sampling study. The method and the findings of the study are detailed in the sections that follow. While focusing on busy families, the findings of this research are of more general interest as they confirm the relevance of social awareness systems triangulating partial evidence found by the research works reviewed in this section.

II. METHOD

The method used is an adaptation of the Experience Sampling Method [7]. Participants were asked to carry a smart phone on which they could record answers to an experience sampling protocol referring to their needs for sharing awareness information. To address a well known limitation of Experience Sampling, namely that respondents do not answer on several occasions (e.g., because they are occupied by some other activity), our sampling protocol allowed them to review logs of their answers over the past day and fill in omitted details. The Experience Sampling logs (answers but also records of unanswered questions), are presented to users over a website and provide a context and a prompt to facilitate recollection at the end of each day of the sampling period (or at least at regular intervals of about a day). The details of the tool and the validation of the method as such are outside the scope of this paper.

A. Participants

Twenty people (ten men and ten women), with a mean age of 39 took part in the study. Ten of the participants were couples. At the time of the study, they had between 1 and 4 children (mean 2.25), they both worked at least part-time and the mean age of their children was 7.

Participants were recruited through advertisement in a scouts association and by use of a participants' database of our university. Their level of education and their occupation varied widely, though all possessed a home computer and had internet access at home. All were fluent in English but this was not their native language. After the study participants received a gift voucher of small value.

B. Procedure

On accepting to take part in the study, participants were directed to a website where they could describe contexts of a typical, working day of theirs. By "contexts" we mean locations participants visit and activities they perform during a usual working day of theirs. In the third and final step of this 'bootstrapping' phase we asked participants to enter on the website what kinds of information they would like to communicate while being in a specific place doing a certain activity (Figure 1); they could choose from a list of possible options we provided to them or enter their own descriptions of information they would wish to know regarding the activities of their partner.

The ready-made list of statements was constructed based on a survey of related system concepts discussed in proceedings of the following mainstream conferences in this field (mobile HCI, CSCW, CHI and Ubicomp). Conferences were preferred over journals given that they are relatively more up to date and provide a broader cross section of the research field. In each case, we examined the essence of the information that the system communicates abstracting away from specific context capture mechanisms and the presentation medium. For example, Cadiz, et al. [2] describe a system that displays among other information traffic conditions at a particular location. For our purposes we retained only the fact that traffic conditions are communicated.

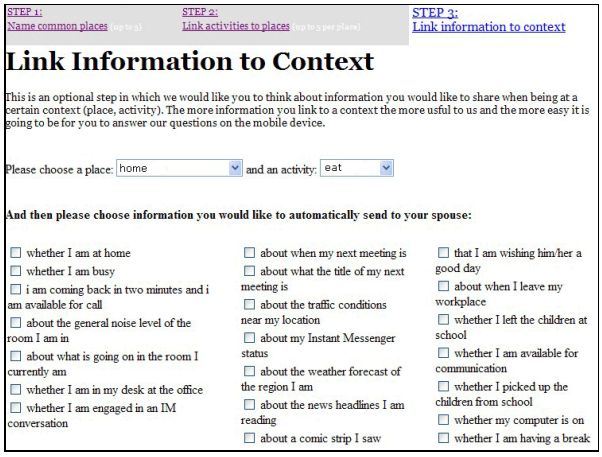

Figure 1: Link information to places and activities

In total we included in this survey 16 papers and derived in this manner 41 statements describing awareness information that busy parents might wish to know of each other.

All the collected information (i.e. places, activities and selected awareness information for different combinations thereof) provided on the website was used to initialize the experience sampling application running on a mobile device given to the participants. This information was synchronized to the mobile device to make the mobile part of the study easier for participants. With synchronizing the information participants had to either choose an answer they had inserted on the website or choose "Other". For example, when asked on the mobile device to name the place the participant is, he can choose from a drop-down menu comprising of the places named at the website. If a participant is in a place she did not name at the website he can always choose "Other". We requested participants to keep the device in close proximity constantly. During the sampling period, the application was always in the foreground of the mobile device and participants could not access any other application. The sampling period lasted one week for each participant. Though they could lower the volume participants were asked not to shut down the device and to recharge it every evening. Within three days after the sampling period we had a debriefing interview with each participant.

C. *Experience Sampling Application*

Our experience sampling application interface is structured using four tabs (Figure 2). The first tab, titled "Start" is the default screen that includes contact details for the experimenter. The tab titled "Questions" is activated only when it is time to for the participant to answer a question. The application decides when to prompt a question. A participant cannot trigger questions or fill in any information in any other way. The third tab, titled "Settings" enables the participant to set the weekdays and the time span which he would like to receive the questions. We instructed participants to set those according to the days and times that they are separated from their spouse. This was important in order to limit the nuisance from

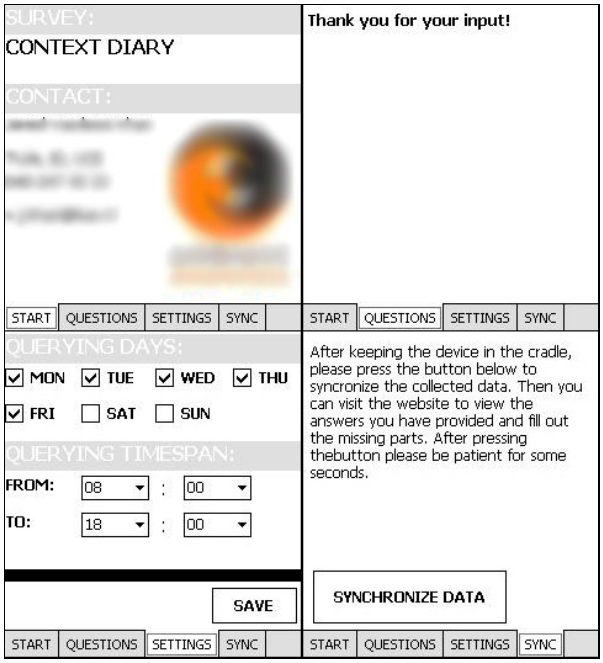

Figure 2: The four tabs of the mobile application (blurred for anonymity)

mistimed prompts and also to avoid contrived responses by participants. The fourth tab, titled "Sync" contains just a single button to be used when connected to the internet for synchronizing answers with a central database.

D. *A personalized set of queries*

An audio notification alerts participants when it is time to record information; it waits for five minutes for the participant to respond before deciding that no response could be given.

The participant is asked the following three questions: "where are you now?", "what are you active in now?", "what information would you like to automatically send to your spouse?" (Figure 3).

A customized menu of options is offered including statements according to the selections made on the website at the outset of the experiment. For example, if a participant answers on the device "office" for place and "working" for activity she will view the statements that she has linked with that place and activity only. If the participant has not linked any statements with that particular activity then she views the complete list of statements. She also views all the statements if she has chosen "Other" for place and "Other" for activity.

The participant can enter descriptions of new, unforeseen needs for awareness information by choosing the option "Other". If the participant does not check any item from the list, this is recorded as "Nothing", meaning that the participant does not want to send any information to her partner at all.

We asked participants to connect the device to a computer with internet connection and to synchronize the data at the end of every day during the sampling period. After synchronizing the data we encouraged the participant to log onto the website to review the data. While reviewing

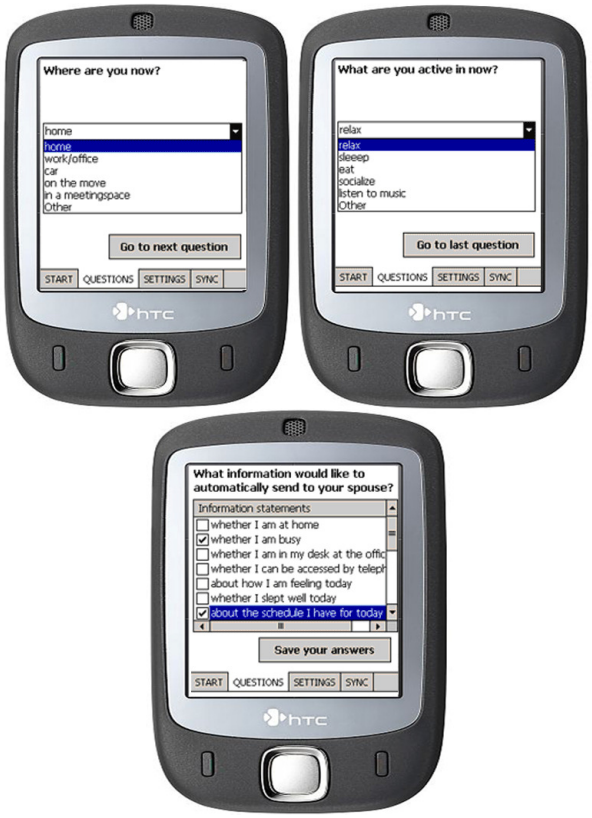

Figure 3: The three questions asked on the device

participants could fill out omissions in the logs obtained during the day. There are actually two kinds of omissions that the participant could correct at this stage. Answers she gave as "Other" (if for example she was in a place that is not covered in the existing places presented in the drop-down menu on the device) and unanswered questions.

E. Time and place dependent sampling protocol

The sampling protocol combines time based and event based sampling. First, we check when the last answer of the participant was given. If that was more than an hour earlier, we query the participant. However, if that was between 30-60 minutes earlier, we check whether the participant has changed place. If that is the case then we issue a question.

To find out whether the participant has changed place we compare surrounding WiFi access points (APs) with the stored WiFi access points of his last answer. This comparison allows distinguishing quite reliably between different addresses or different buildings and even within areas that are separated within the same floor of a large office space, assuming a sufficient number of WiFi access points is in the building.

III. RESULTS

Initially we will present the frequencies of the recorded places and activities. Then we will present the four identified needs and the evidence that support our claim.

A. Places recorded

Participants named 63 different places (mean 6.4, max: 13, min: 2, σ: 3.34). Since our participants are not native English speakers some of them used a word in their own language with the same meaning. For example, "work" was used by some as "werk", which means the same thing. Moreover, some participants used a different granularity of words. For example, one participant gave the exact details of his office instead of naming it just "office". Finally, there were differences caused by trivial text input errors. In order to have a more accurate view of the data we collapsed such categories that differed trivially in the ways described. The result of this process was 21 different place names; the ten names selected most frequently are show in Table 1.

TABLE 1: TEN MOST FREQUENT PLACES

Place name	***Frequency***
work	321
home	230
outside / on the road	104
school	51
other	28
friends place	14
market / shop	12
coffee corner	9
city centre	8
parents place	7

TABLE 2: TEN MOST FREQUENT ACTIVITIES AFTER APPLYING THE ACTIVITY FILTER

Activity name	***Frequency***
work	321
home activities	230
spending time/taking care of the children	104
meeting	51
eating / having something	28
chat / talk	14
other	12
on the way	9
e-mail / do something on the computer	8
bring / take children	7

B. Activities recorded

Participants named 194 different activities (13.5 mean per participant, max:35, min: 3, σ: 8.32) With a similar process as described above, we reduced this set to 73 unique activities (Table 2 shows the ten most frequent).

C. Information statements

Participants linked 57 different information statements to different contexts, i.e. a mean of 31.7 statements were linked per context (max: 51, min: 1, σ: 12.32). Twelve new statements were inserted by nine participants. This indicates that the enumeration of different awareness information types derived from the literature review was found sufficiently relevant for most of the participants.

All new statements are about practical matters, e.g., someone arrives or departs home, about dinner plans and about the well being of children. Dinner again stands out as the most important family activity.

D. Received questions

The time that a participant would receive a question depended on their actual patterns of movement. Participants who were more mobile would have received more questions. Moreover, we instructed participants to set the settings according to days and times which they are apart. Thus more responses were obtained during the working week and less over the weekend.

E. Do participants wish to share awareness information automatically?

Looking at the response-level data (N=815), we examine how often participants (as a group) selected the option 'Nothing' to the question "What information would you like to automatically exchange now?". The frequency of this answer was 12.2% (max: 82%, min: 0%, σ: 20.79%, standard error of mean: 4.65%).

Looking at the person level data (N=20) we had only two participants that answered "Nothing" more than 50% of the times they were questioned. One had 82% and the other 55%. The next highest percentage was 24%.

In light of these two results we can conclude that overall participants do want to automatically share awareness information with their partners during a typical day of theirs. The question that now arises is what sort of information.

IV. INFORMATION NEEDS AND TYPES BUSY PARENTS WANT TO EXCHANGE

A. Availability

Considering the total set of responses, the two most frequently chosen statements concern availability (Figure 4). Moreover, 19 out of 20 participants chose at one point during the study the statements: "whether I am available for communication" and "whether I am available only for urgent calls".

The main reason mentioned during interviews is for planning direct communication. In the words of a participant: "I filled out a lot about "can I be contacted" for not so important and important things". They fear interrupting the partner's work flow so awareness information could help them infer the availability of their partner. Yet, there is another social reason for wishing to have availability information. During one interview a participant told us: "For me it is more important (getting availability information from the partner instead of sending) since he is much more busy and would be embarrassing when trying to call at a wrong time."

A reservation regarding constant connectivity mentioned by some participants was that they did not want to give the impression to colleagues that they constantly want to communicate with their partner. They thought that such an image was socially inappropriate.

B. Micro-coordination of dinner

Statements such as "about the location I currently am", "about when I leave my workplace", "how late I will be home", "about when I am close to the supermarket" were also frequently selected.

Surprisingly, when we produced a graph of how many different participants chose a particular statement at any time during the study, the only statement that was chosen by all participants was "Whether I am home", suggesting the relevance of related applications for announcing presence at home.

Having additional information from the interviews, we can conclude that this is connected to the dinner ritual. In the words of a participant: "Also for coordinating, for example if I am close to a supermarket and when I am at home. It is important for us, for our children to have dinner at 18:00 so it is important for us to know when someone is leaving office and coming to home or when someone is

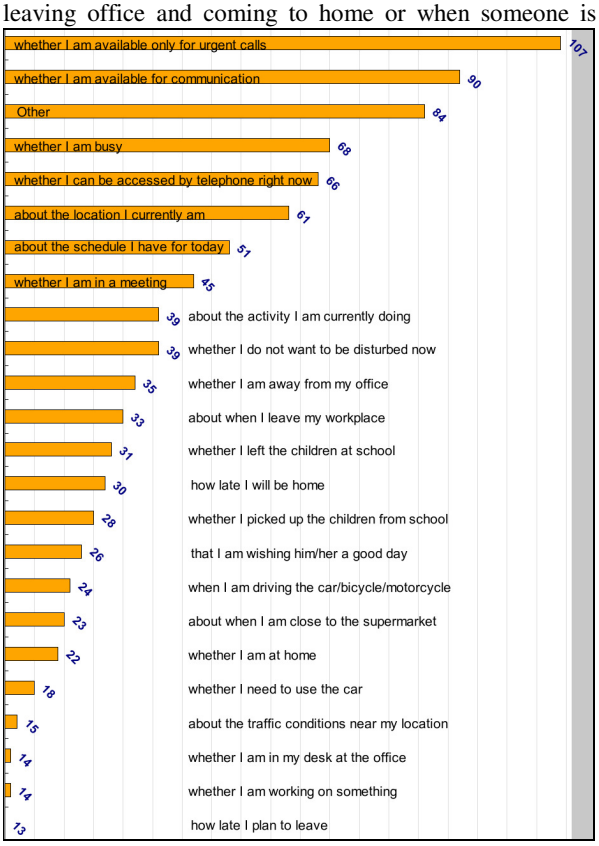

Figure 4: Frequency of chosen information statements

already home and what is the expectation time." This activity is perhaps the most salient one during the day for the family and most of the information currently communicated at least an hour before that time is to coordinate that activity.

This observation along with the frequencies of the statements: "how late I will be home" (30), "about when I leave my workplace" (33), "whether I am at home" (22), "how late I plan to leave" (12), "when dinner is served/ready to eat" (10) illustrate how parents value awareness that will help coordinate that activity.

C. Reassurance: "No news is bad news"

Statements with relatively high frequency are: "whether I picked up the children from school" and "whether I left the children at school". Through the interview we found out that whether "everything is going as planned" is

important for them. It seems that there is an implicit schedule in mind for both parents of all family members. In the words of a participant: "it (referring to her choices of information during the experience sampling) is generally about practical matters such as bringing the children, the shopping list, mostly in the morning if everything went ok with the children". There is a need of gathering information on whether this schedule is progressing as planned and especially the children's plan. Therefore, one could say that "no news is bad news" in the case of busy parents. Moreover, one of the twelve new statements inserted by participants was: "whether the children are ok". This confirms the need identified by [1] and [8] has called such a need "comfort".

D. Communicating Affect

We also observe that affective information has markedly lesser priority. In the interviews, the need of information around practical matters was stressed and no mention of a need to share expressions of affect through mediated communication was mentioned. Participants did mention that any interesting aspects at their day are communicated back home in the evening. Although down played in the interviews the statement: "that I am wishing him/her a good day" was occasionally selected during the experience sampling. Of course one cannot exclude that the need for affective communication might arise at specific contexts and times.

E. The need of "Other" information

The option "Other" was quite frequently selected. However, those 84 occurrences come from just 7 participants. We expected that a lot of those statements would be renamed using the web site in something more meaningful. Only one participant renamed a single statement.

Based on the interviews we can explain the high frequency of "Other" statements on two accounts. The first is the phrasing of statements. Some seed statements did not reflect exactly the information a participant wanted to exchange at a particular point in time. Quoting a participant: "You had in your study "dropping the children to school", but for us it is more important to pick up the children from school. And that statement we missed in the study". Others mentioned that they missed different types of information such as mood. In the words of a participant: "In the beginning of the study I had a bad day at work so at that day the "mood info" would be interesting to send".

The second reason that was verified during the interviews is that participants did not wish to spend the time to rename those statements as we requested, despite that they did return to the website to provide answers they had omitted giving.

V. SITUATIONAL VARIATIONS OF INFORMATION NEEDS

A. Comparing places with information exchange

We also wanted to find out the places that participants wanted to exchange most information at. To find out that, we calculated the following ratio: the total number of information statements chosen there divided by the number of times they were asked when being at that place (Table 3). Apart from "Other" which comes first and probably refers to variety of different places, surprisingly it is "home" where people want to share information with their partners rather than "outside / on the road".

TABLE 3: FIVE MOST FREQUENT STATEMENTS OF THE THREE MOST FREQUENT PLACES

work (321)	**home (230)**	**outside / on the road (104)**
whether I am available only for urgent calls: 59	whether I am busy: 24	about the location I currently am: 29
whether I am available for communication: 57	about the schedule I have for today: 20	whether I am available only for urgent calls: 23
whether I am in a meeting: 44	whether I am available only for urgent calls: 19	whether I left the children at school: 15
whether I am busy: 27	that I am wishing him/her a good day: 17	about when I leave my workplace: 12
whether I can be accessed by telephone right now: 27	whether I am at home: 17	when I am driving the car/bicycle/motorcycle: 12

Location *Activity* *Availability* *Affection*

This could be a by-product of the sampling method. It is harder to provide an answer when on the move or when working. Given though that participants had the option to compensate for unanswered questions at the end of the day, we can conclude that at home there is indeed a pronounced need to share contextual information with the remote partner.

Table 4 shows the five most frequently selected types of awareness information per location (looking only at the three most frequently chosen locations). We note that at home and when outside variable awareness information is needed; availability, activity, affection and location information are all high on participant preferences. At work the five most frequent statements are about availability and activity. When being on the move availability, location and activity information were most often selected.

B. Comparing activities with information exchange

We drew a similar table to Table 4 to examine what information types participants wish to share for the three most frequently reported activities (working, home related activities, on the move). It appears that availability is what they most wish to share while working. The category activity was most often indicated for sharing when performing household activities and location when someone is on the move.

However, in all three activities the same three types of

TABLE 5: PLACES WHICH PARTICIPANTS WANTED TO EXCHANGE MOST INFORMATION

Place	Ratio
1. Other:	1
2. home:	0.778
3. outside / on the road:	0.712
4. work:	0.707
5. friends place:	0.5
6. school:	0.471
7. market / shop:	0.167

information rate highest and these are availability, location and activity. Moreover, we observe that the sole statement which appears in all three most frequent activities was "whether I am available only for urgent calls". The same case was in the three most frequent places. Those two facts underline its importance.

Next in frequency comes general activity and schedule information. The statement "whether I am away from my office" appeared a few times when participants reported performing home activities. Initially this might seem bizarre. It turned out that this was chosen by people whose home activities included working at home.

C. Comparing time with information types

To analyze the information needs compared to the time of a day during a week we created Table 5. In Table 5 we first chose the three most frequent statements for each part of the day and day of the week. Then we color coded them according to what they were representing (■ for location, ■ for activity, ■ for availability, □ for affect).

When analyzing the statements in that way we observe that the chosen statements in the mornings and afternoons of the weekdays are mainly about availability and partly activity and less about location (Table 5). Thus the most salient awareness information is that which would assist parents to infer the availability of their partner during the day. On the other hand, the evenings vary more in terms of information needs.

We observe that location is the most prominent along with activity. Thus the need for information to infer availability during the day time (morning and afternoon) shifts to information that would help parents coordinate their evening. This is aligned with the variability of information wanted when someone is at home. Evening time is spent at home for almost all our participants.

The fact that more variable information is wanted during the evening relates to another observation. Participants reported to want to share awareness information most often in the evening and the least in the morning (see Table 6). In this calculation we included "Other" statements and obviously excluded "Nothing" statements.

TABLE 6: ANALYZING INFORMATION COMPARED TO A WEEK

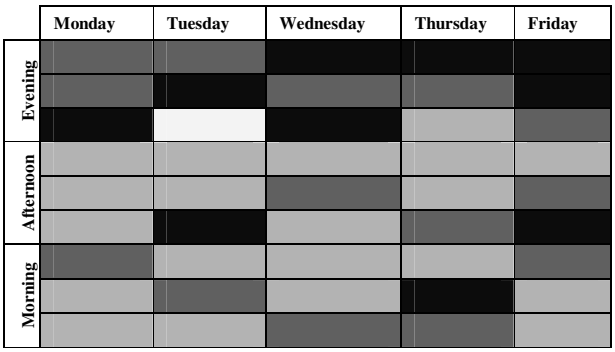

TABLE 4: MEAN NUMBER OF DIFFERENT STATEMENTS WANTED TO BE EXCHANGED PER DAY/TIME

	Mon	Tue	Wed	Thu	Fri
Evening	0.47	0.48	0.53	0.47	0.65
Afternoon	0.33	0.25	0.25	0.26	0.14
Morning	0.29	0.36	0.35	0.39	0.18

VI. DISCUSSION & CONCLUSIONS

Earlier works regarding systems that can enhance intra family awareness often assume that family members will be willing to share information about their activities and whereabouts, and will be interested to receive such information about their partners. The experience sampling study reported here has put this assumption to the test, leaving up to the participants to decide what kind of information should be shared and without making specific the nature of the system that would enable this sharing.

The experience sampling study targeted working parents of young children. Looking at the total set of responses and also looking individually at the reported preferences per participant we obtain a clear result that awareness information about each other that a system would provide automatically is very much needed.

Apart from confirming the interest in the application domain of systems that can support awareness between family members, the study has given us insight into to the types of information that such systems should capture and communicate.

In general, the need for affective communication is quite low. This is likely to relate to that our target population share the same roof and see each other daily, so they do not need to rely on communication media for affective communication. Rather, it is the need to share practical information that is their highest concern.

Awareness was mostly needed during out of work hours when partners are apart. It surrounded mostly micro-coordination for dinner or for organizing children's activities.

During working hours, awareness information needs are quite stable pertaining to availability for direct communication. Moreover, we noted a "shift of needs" during a working day. It seems that during mornings and afternoons the most prominent need is that of availability whereas in the evening it is that of coordination.

It was also surprising how pronounced is the need for information when one partner is at home and other family members are not. At home availability, schedule and location information is highest on participant preferences.

ACKNOWLEDGMENT

Removed for anonymity.

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