KidzFrame: Supporting Awareness in the Daycare

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***Abstract*— KidzFrame is an innovative system that connects working parents with their children at daycare centers. This paper reports the findings of three focus groups and a two-week long field study of the system. As conclusions of our study we offer six guidelines that are of direct salience for designers of pervasive computing services wanting to address the communication needs of daycare centers, parents and their children.**

***Index Terms*— Awareness systems, user requirements elicitation, mobile computing, daycare technologies.**

I. Introduction

Daycare, or child care, is care of a child during the day by a person other than the child's legal guardians. Compared to the communication of children with caretakers, communication between parents and caretakers is much less frequent. The content of the parent-caretaker communication is limited to the information related to the status of the child. Endsley and Minish [3] found that communication between parents and caretakers usually involves the giving of or asking for information about children's behavior, health or day at the daycare center. Communication frequency and attitudes towards this communication was the main focus of this study. Researchers have found that home-school communication, besides keeping diaries, is usually brief, primarily social and most of the time takes place during the drop-off and pick up moments [3, 10, 12].

A relationship between the parent-caretaker communication and the quality of the childcare has already been shown. That means, the better the communication is, the better the quality of the daycare is perceived. Ghazvini and Readdick [4] studied three types of communication, including one-way (daycare to home communication), two-way (daycare and home communication exchange), and three-way (exchanges between daycare, home and a community resource) communication patterns. They found that caretakers rated all forms of parent- caretaker communication as more frequently occurring and as more important compared to parents.

There are several different opinions on the amount of parent-caretaker communication that is needed. An early study of parent-caretaker relationships conducted by Powell [10] found that a vast majority of both parents and caretakers expressed dissatisfaction with existing levels of communication regarding children's activities at the center. In addition, more caretakers than parents preferred parent-caretaker communications in a parent group form. However, changes in people's life pace and communication tools, might result in changes in people's communication habits and attitudes towards parent-caretaker communication today. It is shown that parents' need for parent-caretaker communication depends on the age of the child [3]. Parents and caretakers of infants and toddlers communicate significantly more than parents and caretakers of pre-schoolers. Parents' primary motivation for parent- caretaker communication is to learn about the child's status at the daycare [3]. Besides, parents' rating for importance of parent-caretaker communication is higher than that of caretakers. A new approach of preschool education named Reggio Emilia encourages parents to be more involved in the preschool education and daily activities at daycare [2].

Although there are several systems [1, 5, 9, 11] that have been developed and researched in terms of how to support family members' awareness of each others whereabouts and activities there hasn't been much research, to the best of our knowledge, on supporting parents' awareness of their children's activities in the daycare. Yarosh et al. [13] has looked at technologies to support communication between parents and children of divorced families. Khan et al. [6] explored a system that communicated the presence of children at school along with their schedule to their parents to stimulate their involvement into children's activities. More lately, Baby Steps [8], a system designed to improve the record-keeping process of a baby's development showed in a, 3-month field study with 8 families and their pediatricians, that it encouraged parents to more frequently collect and review records, as well as provided higher confidence in reporting, and improved parent-pediatrician communication. Although related and clearly showing the potential of exploring new ways of enhancing parent-child communication, these studies have not touched upon a salient place of children's early development stages; the daycare.

With this paper we try to address this gap in literature by introducing KidzFrame [6], a system that connects working parents with their children at daycare. Our contribution lies in the lessons learned drawn from a two-week long field test study of the system for designers and developers of related technologies in the daycare. With KidzFrame caretakers can capture and upload photos and short messages using a mobile phone or a laptop. On the mobile phone an app is installed with which the caretaker can send either a photo, a photo and amessage or a message alone to the KidzFrame website (Fig. 1, 2). The parents can log in to the website during the day, and can immediately see the photos and messages, which

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have been uploaded by the caretakers, of their child and their child only.

Figure 1. Feedback message after uploading a photo

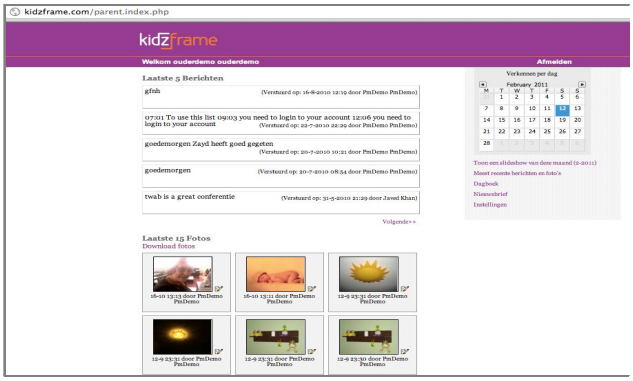

Figure 2. Parent's view of the website after login

Although the project behind this paper had several objectives, in this paper we present the evidence we gathered from a two-week long field trial with four caretakers. Apart from the question of what functionality could be added to the existing system to add to it value, our second objective was to observe the use of KidzFrame and in this way provide valuable information for designers of related systems.

II. Method

The field test was combined with contextual inquiries and interviews with the caretakers. In addition to the field test, focus groups were conducted to understand caretakers' attitudes about their work, their communication with parents and KidzFrame. Two types of focus groups were conducted for different purposes: one in which participants first used KidzFrame (at the field test), and one in which they did not use it, but got a presentation and a demonstration of it. The common goals of these two types of focus groups are to explore caretakers' experiences of their work, problems they face at work, their opinions on communication with parents, their attitudes towards paper diaries, to compare KidzFrame with diaries. Three focus groups were held. The first one, which took place at a daycare (*dc1*), turned out to be an interview with one caretaker, because the rest of the participants cancelled just before conducting the focus group. The second focus group was with four caretakers from a different daycare (*dc2*). The third one was with two caretakers from a third daycare (*dc3*). The focus group of *dc2* was held in an office located in the daycare itself, whereas the other focus groups were held at a location in our university.

In addition to the focus groups, two contextual inquiries were combined with a field test. KidzFrame was tested at *dc2*. The contextual inquiries were conducted in the meantime at the same daycare. The goals of the contextual inquiries combined with the field test were to identify:

- Caretakers' routine and new tasks after KidzFrame is adopted
- Possible usability problems of the KidzFrame website and mobile phone application
- Environmental factors, which might affect the use of KidzFrame

During the contextual inquiries the researchers let the caretakers lead the situation and imposed the least interference they could when communicating with caretakers during their work. KidzFrame was tested for two weeks. The caretakers were provided with four mobile phones and one laptop on which they could use KidzFrame. At the end of each week, an interview was held with caretakers separately to understand how they used it. At the end of the field test a focus group was held with all the caretakers to see if in a discussion conflicting opinions or new ideas would come up.

III. Results

The records of the focus groups, interviews, contextual inquiries, and the field test were collected and coded by different labels that indicate the types of information carried in the words. For example, all text records about the laptop are coded with a label "laptop". ATLAS.ti was used to complete this coding task. ATLAS.ti is software that can be used for a systematic analysis of text, images, audio and video.

A. Photos and messages

In total 195 photos and 29 messages were uploaded during the field test. The messages were always accompanied with a photo. No messages without a photo have been uploaded during our field test. Also, photos could have been uploaded with or without a message. The number of messages (Fig. 3) and photos (Fig. 4) are plotted against the time of uploading.In the number of photo uploads a trend can beobserved; the most photos were uploaded between 14:00 and 15:00 in the afternoon. Then the numbers of photos and messages uploaded were much larger than at any other time.

For both photos and messages there were significantly more photos and messages uploaded between 14:00 and 15:00 compared to other hours. Between 13:00 and 15:00 according to the caretakers it is mostly quiet and less busy. Therefore they had more time to upload most photos between these times. This is in line with the quantitative data from the frequency plots. Nevertheless, an individual difference is

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found in the frequency of photo uploads by time. One caretaker uploaded photos most frequently around 09:00, while others preferred the afternoon.The content of the photos was also analyzed (Fig. 5). The most frequently photographed event was (a) child(ren) playing (149 times). The second, frequently photographed event was (a) child(ren) eating and or drinking (42 times). Next was (a) child(ren) sleeping (7 times). Further, there were also 17 photos that could not be placed in a certain category because there was either no person on it or the activity was unidentifiable. The photos' content analysis shades more light into the previous finding. Although caretakers are comfortable in taking photos during active moments in the daycare, it seems that they choose more quiet times to go through the photos and choose which ones to upload.

Thus, designers of pervasive technologies in the daycare need to take into account that caretakers will use such technologies to upload captured during breaks. This finding is pointing to automatizing, or making very efficient, data uploading during active moments during the day, which would be probably more interesting for parents while more difficult for caretakers to upload.The messages, which were sent together with the photos, described the photos and were mostly directed towards the parents (e.g., "Hello mommy, look I am playing.").

B. Usage of KidzFrame

1) On special moments

When there are special activities or a special moment suddenly occurs, caretakers want to use KidzFrame. A participant recalls: "*I had to think of it and remind myself of using it. But especially on the special moments I remembered indeed that I needed to use KidzFrame.*"Another participant recalls: "*I used it mainly for the special moments when it was really nice to take a photo*".

The participant went on giving an example of a special moment; when the children are playing together.The caretakers want to upload photos immediately if they can, otherwise between 13:00 and 15:00 when the children are sleeping or after 16:30 when it is not that busy.If they have a shift in which they have to work until 18:00, they have time to upload photos after some of the children have been picked up around 16:30. Then they have to take care of less children and it becomes quieter.

2) It is easier to use KidzFrame when more caretakers are present

A participant recalls: "*When you are using KidzFrame, you cannot do anything else*". Due to this fact, they take a lot of photos while the children are playing outside. In that specific situation there are more caretakers present who can keep an eye on the children while a caretaker is taking photos and uploading the data.A participant recalls: "*I had some shifts where I had a group by myself, so it was more difficult to use it a lot*". Another participant recalls: "*When I am using KidzFrame, my colleagues have to take over my work*".Regarding this topic, participants felt that if more of their colleagues would also use the system, they could have easily captured interesting moments during the day. A participant recalls: "*When I am in the kitchen preparing the sandwiches for lunch, the children are playing in the hall. Of course I cannot take photos of them at the same time, especially because they are in a different room. But my colleague who is watching the children could take photos if she is allowed to use KidzFrame" the participant went on: "On many occasions there was a moment I wanted to take a photo of, but I was too busy. A colleague could have easily made a photo if she would have also been allowed to use KidzFrame*".

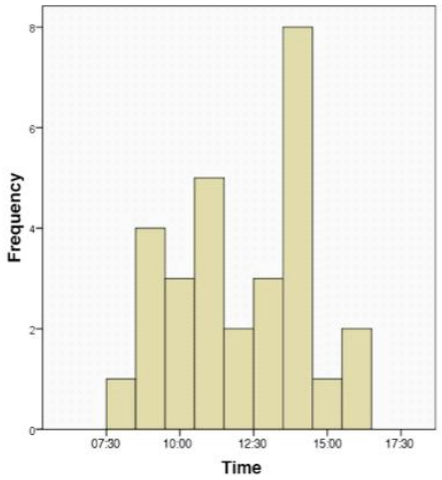

Figure 3. Frequency of messages sent during the two-week long field test plotted against time of uploading

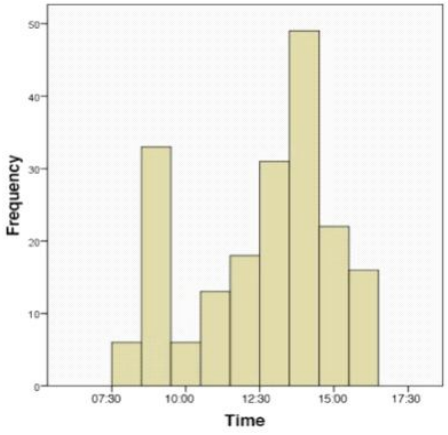

Figure 4. Frequency of photos sent during the two-week long field test plotted against time of uploading

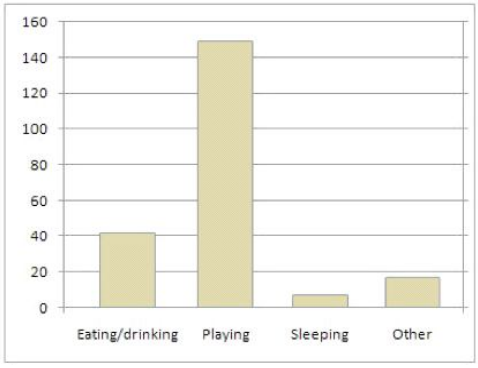

Figure 5. Content analysis of the caretakers' uploaded photos

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This finding is another salient finding for designers of pervasive technologies in the daycare. The collaborative nature of the work of caretakers needs to be taken into account. One can image for example, the automatic data capturing when the presence of a single caretaker is detected in combination with the detection of children's activity. Or automatic sharing of captured photos between caretakers that could be of a common interest.

3) Caretakers forget to use KidzFrame

A participant recalls: "*I did have time to use it, but I forgot to use it.*". They kept the phone turned on or in standby mode during the day so that it reminded them to use it and to instantly use it when they wanted to without needing to login. A participant recalls: "*I put the phone switched on the kitchen sink, so that I see it and remember that I have to use it*".This finding points into pervasive technologies being able to effectively remind caretakers of their task. Another solution could be decorating the area with, logos of the service to serve as reminders for caretakers.

4) Having time to use KidzFrame depends on the day and on the children

Although they have a fixed general schedule every day, this does not mean that they have time to use KidzFrame every day or at the same time every day. A day at the daycare can be very chaotic. Some days children do not want to listen or are full of energy running around all the time or even worse starting to fight. A participant recalls: "*When the children are quiet and calm, you can take some nice photos. I already had a couple of extra working activities this week, I had to return library books, and I was organizing an informal reception for all the employees this week, so I already had quite a lot on my mind, and therefore KidzFrame fell a little bit into the background.*"

5) Limitations of the mobile phones and of legislation need to be taken into account

A few problems have been found in relation with the phone itself. The screen is too small to have a good view of the photos. Besides, the stylus used on the phone can easily get lost. And some caretakers found it is hard to find the free time to recharge the battery for the mobile phone since the electric devices are not allowed to stay plugged in the slots at night when the phone is not used.

6) Using mobile phones might be viewed as a signal of loafing on the job by parents

One caretaker did not like the fact that the device used was a mobile phone, because when the parents walked in, it looked like she was playing with her own mobile phone during working hours instead of taking care of their children. In practice, she would prefer that the parents were notified that the web service is being used and that the device used is a mobile phone, so that the parents know that she is using the mobile phone as an extra service for the parents and that she is not using it for leisure.

7) Among the three functions photo uploading is the most popular one among caretakers

Caretakers never used the text message-only. Messagesare supposed to work as a complementary tool for photos. They think that it is boring to send a message without a photo. If caretakers want to tell parents of the children about something important and personal, they would rather talk about it when parents come and pick up their children or write it in the diary than write text messages about it. Only one of the caretakers said that she always used the photo-with-message function. The reason why this function is used is because a message can give information about what is happening in the photo to let parents have some ideas of the context. Most of the photos were uploaded without messages.

A participant recalls: "*Sending only a photo is probably sufficient for the parents. It is clear by looking at the photo what is happening. Also typing it is redundant and only takes more time, so why should I add a text message? A photo says more than a 1000 words. Only sending a photo is faster and easier.*"

C. Attitudes of using KidzFrame as a new medium of communication

We present the findings in this section of the focus groups sessions we had with caretakers.

1) Perceived threats of the system

If and when KidzFrame would be used the caretakers would feel the pressure from parents who want to have photos and messages. Therefore, caretakers are worried that parents' expectations of the caretakers would increase. They thought of examples like when being too busy to make photos and parents would start calling inquiring the reasons for not having received any photos or messages and asking if their child is doing well. Another example, which was given, was of one parent receiving five photos of his son while another parent having received only one photo at the same time. Clearly this is a major concern for caretakers. Designers of such technologies would need to take into account to either provide a rewarding mechanism to caretakers, or other incentives for the use of systems such as KidzFrame. Another possible solution addressing this issue could be automatic messages to parents reminding them of the difficulties caretakers face in the daycare in case of large intervals of inactivity.

The frequency of data uploads is relating to another interesting view. Caretakers mentioned that using KidzFrame could increase worries on the side of the parents instead of taking them away. A participant mentions: "*Parents might erroneously infer that something is wrong from the fact that there have not been uploads for a while*". This is a subtle point that designers of similar systems need to take into account.An interesting finding was that caretakers do not want parents to be able to respond via KidzFrame. When the parents would be able to react on messages/photos of their children via KidzFrame it would cost the caretakers too much time to read and respond to them. Nevertheless, caretakers can see advantages as well. For example, if parents can tell their child that they like their drawing, this is very useful for the development of the child. Besides one caretaker mentioned that reactions would be useful if parents could

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send messages like "*I will be later to pick up my child*" or "*another person will be picking up my child today*". However the costs do not weigh up to the advantages and therefore they prefer if the parents would react verbally, if they wish to.

There were more reasons expressed that could threat the use of such a system. For example, caretakers think that parents should learn to let go of the child when they bring the child to a daycare, and a system like KidzFrame would discourage that. For a child it is also really important to learn that they are at the daycare, away from their parents. One caretaker said that she is afraid that she will feel the need to show to the parents how good she is taking care of the child and thinks that KidzFrame could work very controlling. Then she would feel like parents will use it to check on how they are working as caretakers. But she does not feel like defending herself. She thinks that it could worsen the relationship between parents and caretakers.

Caretakers want to use KidzFrame "fairly". It is hard to make an equal number of photos of each child. Because not all caretakers work on all days, there is a possibility that they all make photos of the same children. So there needs to be communication between them. Also the less nice (looking) children have a chance of being less on the photos, and they feel that they have to make sure this does not happen.

2)Perceived advantages of the system

A perceived advantage of the system was its close to real-time sharing of information. Caretakers mentioned as an advantage that the parents can immediately see the photos of their child of that day and do not have to wait for a long time until the photos become available through the daycare website.One caretaker mentioned: "*I do not like having to tell the parents, we had a fun activity today. Now wait four weeks and then you can see the photos. With KidzFrame I can tell them, we had a fun activity today and I have already put the pictures online for you to watch*".

Besides most caretakers mentioned that it takes a lot of time and it is a hassle to place the photos on the website. At *dc1* the caretakers upload the photos to a website as well. However the photos cannot be downloaded from that website, so the caretakers have to send the photos to the parents by e-mail which costs the caretakers a lot of time. A caretaker said: "*as soon as the parents know that there are photos of their child they want to have them. Now they send a request for the photo via e-mail to the caretakers and it takes the caretakers a lot of time to answer those e-mails with photo requests. KidzFrame would be a welcome solution to this problem*".

3) KidzFrame versus Diaries

Caretakers view KidzFrame as an addition to the existing diaries with which caretakers inform parents of happenings in the daycare. They also feel that such a system cannot replace the diaries. One mentioned reason was that it takes too much time to type the information on the phone, which is normally written down in the diaries. However they think that this problem could be overcome when they would use a laptop instead of the mobile phone for this. However, a caretaker mentioned that a laptop is more costly than a diary and it would be claiming more of her attention, which she then could not address to the children. Besides space is scarce in daycare centers and a safe place to place a laptop is difficult to find.

II. Discussion

Trends found by the focus groups, the contextual inquiries and the field test are generally consistent with important findings in the literature review. For example, the trends justified that KidzFrame cannot replace diaries but can work as a complementary medium of parent-caretaker communication and that parents of little babies communicate with caretakers more frequently than parents of older children. However, there are still contradicting findings in caretakers' attitudes towards parent-caretaker communication: the literature reviews shows that a vast majority of both parents and caretakers expressed dissatisfaction with existing levels of communication [10], while in our study caretakers are satisfied with the parent- caretaker communication. This discrepancy may have several causes: the sample size of the current study is too small to reflect the point of view of the entire population, or the study stated in the literature is outdated and that conclusion does not reflect the current situation. However, the goal of this research is not to generalize our results to the entire population. The goal of our research is to get an idea of the richness and range of the data concerning caretaker's attitudes and opinions.

A. Functional versus emotional communication

During our research, we have noticed that two types of information are being recorded and communicated to the parents: functional information and emotional information.

Functional information is information related to how well and when the child slept, what and when the child ate and information related to the diaper changes and potty breaks. This functional information is best communicated to the parents via the diaries. Also, information like when the child is ill or when the caretakers are worried about the child's development fall under this type of information, but these are exceptions which are not communicated on a daily basis and are preferably communicated verbally to the parents.
Emotional information is information related to the activities the child participated in, if they enjoyed playing with other children and to their moods and experiences during the day.

Negative moods and emotions are typically communicated via the diary and/or verbally, but the positive emotions are emphasized. Especially for these positive emotions and funactivities merely "dry" textual descriptions fail to fully capture them. Photos would really be a nice addition to these textual descriptions, because they can more "lively" communicate the "emotional" information to the parents. Photos which record scenes of children playing and laughing may give the parents of children a more intuitive impression of their children's emotional status. This is already done by some daycare centers via their own website on which they

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publish photos and also reports of fun activities. However, a web service like KidzFrame would be an improvement compared to the existing websites, because the caretakers can then make the photos and video clips themselves and can immediately make them available to the parents.

B. Privacy

We initially assumed that privacy would be a salient issue when using KidzFrame. When caretakers were asked what would be threats for KidzFrame to succeed, privacy was hardly ever mentioned, at least with regard to the children. Some caretakers did however mention that they might get the feeling that the parents are constantly watching them. That is, it gives the parents the possibility to check if the caretakers are doing their job well, which could potentially have a negative effect on the caretaker-parent relationship. But in general, when it was mentioned with regard to the children, it was only very briefly and without expressing serious concerns. They worried more about other aspects that involved their work and their relationship with the parents.

C. Future research

This study mainly focuses on caretakers' usage, feelings and attitudes towards KidzFrame. However, it would be interesting to investigate parents' attitudes, opinions and experiences about KidzFrame, as well. Given the current findings about caretakers and KidzFrame, further research is needed to solve some questions raised by this study. Recommendations made for KidzFrame should be tested to check if they indeed improve usability and caretakers' willingness to use it. Finally, caretaker-parent relations need to also be investigated in what way are they affected by such a system.

Conclusions

KidzFrame [7] is an innovative system that connects working parents with their children at daycare centers. This paper reports the findings of three focus groups and a two-week long field study of the system. As conclusions of our study we offer six guidelines that are of direct salience for designers of pervasive computing services wanting to address the communication needs of daycare centers, parents and their children:

1.Think of ways to support caretakers' communication activities or sharing of information during quiet times at the daycare.

2. It is necessary to have several caretakers use the system, to help in capturing interesting moments during the day and to support in attending to children.

3. Pervasive technologies need to be able to effectively remind caretakers of their task.

4. The design of the capturing device itself is better not to look like a mobile phone to tackle the worry of caretakers of being viewed as loafing on their job by parents or visitors of the daycare.

5. It is important to give incentives to caretakers to use the system while at the same time inform at an early stage parents of the caretakers' added efforts and the value of the information they are sharing.

6. Pervasive technologies should not aim at replacing the diaries that are normally used in daycare centers.

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