FAMILYWARE
Communicating with someone you love

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Abstract: In this paper, we propose the concept of *Familyware*, a group of tools for communication among people who have close relationships. Familyware seeks to increase the feeling of connection among people through the exchange of simple messages without disturbing other tasks. Target users are members of an extended family, including close friends. In this paper, we analyze core needs and requirements for Familyware, and describe prototypes using scenario-based design techniques. We see the design of Familyware applications as a project on design methods; therefore, we also discuss a scenario-based process of envisioning family communication, creating storyboards, developing prototypes, and conducting formative interviews with potential users.

1. INTRODUCTION

We use communication systems to say just hello. We use them to obtain the feeling of connection to others. It is typical nowadays that family members, relatives, best friends, and boyfriends/girlfriends communicate with a variety of technologies. For example, if you fall in love with someone, you talk to him/her on the telephone and/or send email. You want to share the experiences and feelings even when you cannot be together physically. The organization of modern life presents many constraints on sharing feelings and experiences anywhere and anytime, however. For example, the adults in a family work many hours each day in their offices;

they travel, sometimes to other time zones. Children go to school, and then participate in an extensive schedule of after-school activities. Many times during the day, parents and children may think fondly of one another, but they have no means of communicating this. We can easily imagine many such scenarios. You might be in your office, and just glance at the photograph of your husband/wife. He/she might be in a distant place at business meeting. It would not be easy to talk to one another just then; you might not want to disturb him/her. All you really want to do is to take his/her hand for a moment. Later that day, your spouse is waiting at an airport, and thinks of you; he/she does not really have a message to communicate; just a feeling of missing you and looking to forward to seeing you soon. You might think of your son/daughter while they are at school. You do not want to call the school and possibly embarrass your child or annoy teachers; you cannot call just to say hello. You'd really like to just give your child a hug. Family structures are themselves often complex, and present further challenges to communication. The members of a divorced couple may not want to meet one another, yet each parent still wishes to maintain strong connections to their children. Grandparents may live far away and see or communicate with grandchildren only rarely. A further complicating aspect of this sort of communication is that initiating an interaction merely to say "Hello" or "I love you" may seem to be insufficient grounds for interrupting the other person's on-going activity. This could cause people to hesitate in instigating such interactions, even though from a broader perspective of family health or personal emotional health, such communication may be among the most important people can engage in. The design dilemma of Familyware is that while it is possible to initiate formal communications to address these needs, doing so is often socially difficult and typically more "heavyweight" than what seems to be required. We would like to be able to show our feelings to the important other person in a more lightweight manner. We propose the concept of *Familyware*, a group of computer-supported communication tools to communicate feeling to another person anytime and anywhere, but privately and without disturbing him/her.

Envisioning scenario. Wendy, a five-year-old girl, picked up her favorite teddy bear and took it to a corner of her room. In the corner there is a TV, and when she approached it, the TV turned on automatically. An electric card is displayed on the TV screen; it is from her dad. The card plays back his voice, "I am going to come home with a puppy!" Sean, Wendy's dad, is working with a software company in College Park, Maryland. He has been gone all week from his home in Blacksburg, Virginia. Wendy loves him and is looking forward to the weekend. Wendy was excited by the news: Dad is going to come home with a puppy! She held her teddy bear tightly then

shook it (Figure 1). These are Sean and Wendy's special actions — if she thinks of him, she squeezes and shakes the teddy bear. Though she is not aware of it, inside the teddy bear there is an electronic device with a wireless connection to the Internet. The device sensed the shaking and sent a message to Sean's computer. In his office, Sean was composing a project report on his computer. On the screen there is a small window displaying a photo of Wendy (Figure 2). He noticed that it changed to a big smile, and understood that she was thinking of him. He also smiled and thought about the coming weekend.

Figure 1. Wendy is holding a teddy bear, her interactive device to a communication medium
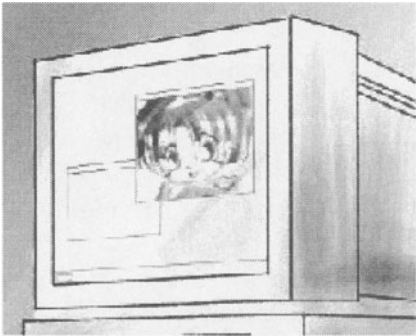

Figure 2. Sean's computer display is showing Wendy's photo

2.   FAMILYWARE CONCEPT

Familyware provides specific support for small and intimate communities, as opposed to the global, public community of the Internet [18]. It does not exchange text-based information; it does not facilitate video and audio mediated communication; rather, it supports sharing the *feeling of connection* by sharing objects with simple signals.

2.1   Basic needs and requirements

2.1.1   Shared feeling of connection

Starting our project, we conducted informal interviews in order to collect potential uses of Familyware. A college professor explained her experiences with her children:

Scenario. Alison is a college professor and she lives with two children. Her children did not want to go to school at first, so she stayed in their classroom on the first day. Next day, she sat in her car, watching classroom activities through the window. Then, she told her children that she would watch them from her office (on campus) with a telescope — though it is physically (geographically) impossible to do so. However, the children were comfortable going to kindergarten because they felt that their mother would still be together with them. Now, the younger child sometimes says, "I was doing that. Did you look at me?"

This scenario shows a potential opportunity for Familyware. In this episode, the children wanted to keep in touch with their mother, to have some feeling of connection, and thereby to share experiences.

2.1.2   Wider view of social activities surrounding technology

One of the key features of Familyware is that it aims to not disturb on-going work outside of the communication channel. In other words, sharing feeling is a subordinate work activity, relative to the one's primary work responsibilities in school, job, and so forth. For example, when you are in your office, your primary work may be paperwork, e-mail, phone calls, office meetings, and so on. Thinking of your children during business hours is not a primary work responsibility; however, it is important, perhaps ineluctable, to each of us as human beings. Indeed, *not* being able to share feelings anywhere and anytime, to communicate feelings to loved ones, could lead to *more*, not less, distraction from primary work. Perhaps if

people could more easily communicate feelings when they occur during the day, they could then more easily set aside personal concerns and focus on primary work responsibilities. In contrast, we frequently face the situation in our real life that we would not like to be disturbed by anyone else. The following scenario is derived from the informal interview with the same college professor.

Scenario Alison is writing a research paper for a conference. The deadline is coming shortly, so she has been staying late at her office. Kaz, Alison's son, has been worrying about her: "Why doesn't Mom come home?" He felt he had to do something. In the kitchen, he found his grandmother's phone number on the wall. He called her and asked for his Mom's office phone number. Then, Kaz called Alison's office. She was surprised but also happy to hear from him. For the rest of the evening, Kaz called to her office every ten minutes. Alison could understand his behavior; nevertheless, she eventually became annoyed.

2.1.3   Communication among the small, local, private community

We assume that the target user groups for Familyware already have close relationships. That is, we are not focusing on the establishment of emotional relationships, but on the maintenance of such relationships. These groups contain immediate family members (e.g., husband and wife, parent and child, and brother and sister), extended family members (grandparents, cousins, uncles, aunts), and boyfriends/girlfriends and best friends. In the modern life, each of the members has his/her own work, which is unrelated to Familyware communication. For example, the primary adults in a family go to their offices. During office hours, they have to do their own work. This work is the primary activity; communicating with their family members is a subordinate activity in their office. The community set up in office is not the same as the family. The office community is larger, more global, and more public than family or close friends. This private community is neglected officially while workers are in business. We want to provide interaction technologies for this small, local, private community within the larger, public work setting.

2.1.4   Familyware as groupware

In their milestone article, Ellis, Gibbs, and Rein proposed the time space taxonomy of groupware [8]. It consists of (a) face-to-face interaction, (b) asynchronous interaction, (c) synchronous distributed interaction, and (d) asynchronous distributed interaction. The Familyware concept discussed in

this paper is an instance of the fourth category. It allows users to overcome geographical distance, but should be asynchronous in order to avoid disturbing the user's primary work responsibilities.

2.2   What is not Familyware

Several technologies are partially related functions to Familyware. Considering them is a useful way to further clarify the concept. These technologies include baby alarms, video and audio mediated media spaces, and text-based communication systems on the Internet. Baby alarms are microphones placed near a baby's bed, linked to a loudspeaker in another room. This simple communication device is not Familyware; it is a device that provides an alert when a baby who should be sleeping and quiet becomes active and noisy. The key important function of a baby alarm is to interrupt a parent or other caregiver, who may be engaged in some other activity, and to notify them that the baby started crying. Familyware, in contrast, does not disturb the recipient's activity. Various video and audio mediated media spaces (e.g., [1], [2], and [12]) have a very similar aim to that of Familyware. Viewing the other community members with video camera from a distant location, in fact, can increase the feeling of connection among its users. However, the messages conveyed in media spaces are almost arbitrarily rich and complex: The original vision was that a media space extends a physical space. Familyware seeks to convey very specific affective messages among a very limited community. Media spaces can also be passive in the sense that users do not need to take a specific action in order to initiate a communication; in many cases, the media space is a permanent, on-going communication channel. Familyware communications are explicitly initiated; they are conceived of as discrete events with specific (affective) meanings. Finally, media spaces are typically conceived of as communication infrastructures for primary work activities. People carry out their work in a media space. Familyware is intended to separately complement primary work activity; our notion is that it should remain distinct for users. Familyware is also distinct from online text chat system, news groups, e-mail list-servers, and other text-oriented communication systems. These systems are often used to support online social activities, including the sharing of members' feelings [15]. These exchanges can be quite elaborate. However, Familyware is concerned only with exchanging simple and specific communications about feeling, not with extensive or elaborate discussions about feelings. It is concerned only with the smallest, most intimate and stable of social communities, rather than the fluid communities of Internet. And it focuses on sharing feelings by sharing interactive physical objects, not text

2.3   Alternative technology

Some current technologies can be used as Familyware applications. Many mobile phone systems, for example, have vibration mode. In this mode, the phone device vibrates instead of disturbing people nearby when it receives a call. Thus, when a user sets the vibration mode of his/her mobile phone, he/she can feel that somebody calls without explicitly disturbing his/her primary work. This technology is not Familyware, since it signals a call, not a shared feeling, and is part of the public communication system — the call could be from anyone. However, this kind of device could be adapted to incorporate Familyware functions. Some mobile phones have a function that can set different calling sounds for different callers. There are no mobile phones that can set different types of vibration, but there could be. Such a phone could reserve some vibration signals for Familyware applications.

2.4   Challenges

The success of Familyware applications depends on interactive interfaces that go beyond the now-traditional graphical user interface (GUI) paradigm. In this sense, the concept of *tangible interfaces* [10] and interpersonal haptic devices such as Fogg et al's *HandJive* [9] is quite important: young children and babies cannot type on keyboards. The Familyware concept can address issues of generation gaps between adult users and children. As illustrated in the envisioning scenario, the target users of Familyware naturally contain a span of generations and both genders. Interaction devices for Familyware should be small, portable, and personal — incorporated into everyday things such as toys for children, backpacks for students, and handheld accessories for adults. In this paradigm, there is no reason that all users should have the same interaction device. Indeed, for different people, different types of objects will necessarily count as "personal". Recognizing and accommodating these differences can help to address generation and gender gaps. Evaluating Familyware applications also is challenging. We cannot conduct interviews with all types of family members, for example, babies; we can only observe their activities. Moreover, because we seek to support inherently private interactions, it may be awkward or inappropriate to obtain certain kinds of usage information. Nevertheless, to understand the feasibility and utility of Familyware, we feel it is essential to focus on evaluation in real settings. We intend to provide robust prototypes of Familyware applications to actual households and to conduct ethnographic field studies.

3.   DESIGNING FAMILYWARE

We are developing Familyware applications using scenario-based design techniques [4], [5]. Scenarios are a powerful tool for envisioning the future use of a system before the system has been constructed. We use scenario-based techniques for designing Familyware prototypes because it requires rich expressions of use before developing it.

3.1   Scenario-based design

We are approaching the design of Familyware systems and applications as a project in design methods, as opposed to merely a design project. Therefore, we have been recording various roles of scenarios in our design activities. In developing the Wendy scenario, our first envisioning scenario, we started by forming a design team. We contacted colleagues and graduate students in Yamanashi University, as well as in other institutions. We always initially explained the basic concept of Familyware to them using the scenario. All seemed to quickly grasp the idea of Familyware. Their reaction to the scenario was uniformly positive. We described further scenarios for Familyware prototypes (described below) to a variety of potential users. Many of them suggested variations or further scenarios for Familyware applications. For example, one graduate student said after he got the Rattle–Photoframe scenario (described below), "That's interesting...How about a voice sensor for an alternative interactive device to the baby rattle? Babies do cry and show their feeling... " What he mentioned is a similar concept to that of the baby alarm although he'd never seen it. This is not a surprising episode; it supports the power of scenarios as a source of creative ideas. A similar outcome was observed during the informal interview with the college professor mentioned before. After she talked about the episode involving her children and their first three days of kindergarten, she said that she did not want to be disturbed frequently while she was working. This gave us the idea on an agent system for children, an asynchronous communication system for children and their parents. In the following subsections, we illustrate three prototypes of Familyware: (1) Teddy bear–Photoframe, (2) Rattle–Photoframe, and (3) Necklaces. In each prototype, we show a scenario, a claims analysis [4], [5],and a design artefact.

3.2   Teddy bear–Photoframe

Scenario The Wendy scenario presented earlier is the initial envisioning scenario of the Teddy bear–Photoframe Familyware. In the scenario, Wendy was excited about her father's message and expressed her feeling by shaking

her teddy bear. The feeling inside her is expressed in a physical behavior that serves as the trigger to signal her father.

3.2.1   Claims analysis

We carried out a claims analysis for the technology features in the Wendy scenario. It lists pros and cons of each technology element.

Electronic card on TV
....can be implemented by a conventional e-mail system.
....but requires a networked computer for both sender and receiver
The Internet as background communication channel
....provides global access from anywhere in the world
....but might be expensive to use,
....or might require authentication actions from the user.
Teddy bear as an interactive device
....is an everyday object for children
....allows a younger child to express his/her feeling by physical manipulation.
....but does not provide feedback that a message is sent.
*Photoframe as a window on the PC screen*
....is an everyday object for office workers
....displays photos of his/her children.
....could display various photos depending on the message from a teddy bear through the Internet
....but does not provide feedback that a message was received.

3.2.2   Design artefact

We developed the first prototype of the Teddy bear–Photoframe Familyware that implements part of the Wendy scenario. The prototype is relatively low-tech one; to be precise, it has a teddy bear that contains a simple electronic switch. The switch is physically wired to a PC. Also, the prototype includes a window on another PC that displays Wendy's photo. These computers have the access to the Internet; therefore, they can exchange messages in various ways. In order to make the prototype simple and flexible, we exchange messages using e-mail between the PCs. Short Tcl/tk scripts were written to send, receive, and interpret the messages. The prototype is shown in Figures 3 and 4.

Figure 3. The first prototype of Wendy's teddy bear, which implements part of the initial envisioning scenario
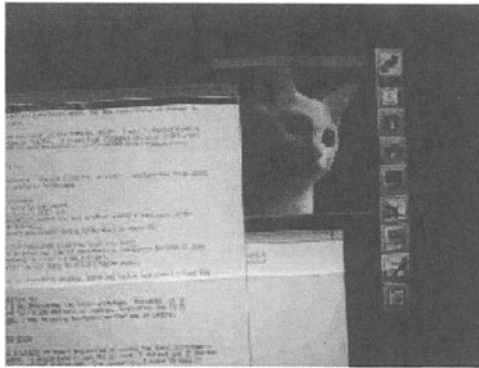
Figure 4. The first prototype of Sean's photoframe; for ethical reasons, we replaced Wendy's photo by a photo of a cat

3.3   Rattle–Photoframe

The Rattle–Photoframe prototype aims to support communication between a baby and his/her parent.

Initial scenario Mom gave a small, colorful rattle to her son. It seems that he likes it very much; he shakes it frequently when he is active. When he shakes it, the photo of him in a photoframe on her office desk animates corresponding to the frequency of the rattle. She feels that her son is actively playing with the rattle when she glances at the photoframe.

3.3.1   Claims analysis

Through conducting a claims analysis of the Rattle–Photoframe Familyware, we identified the importance of interactivity among Familyware users.

Rattle as an interactive device for a baby
….is an everyday object for babies
….allows a baby to express his/her feelings by physically manipulation
….but does not signal the baby that a message was triggered by this action, or that the message was received.

Based on this analysis, we decided to create additional scenarios

Additional scenario When she gets into her office, Mom notices that her son's photo in the photoframe on her desk changes to a big smile. She picks up the photoframe and smiles. The action of picking up the photoframe causes her office computer to send a signal to her son's rattle. The rattle begins playing comforting music that the mother has hummed to her son on prior occasions

3.3.2   Design artifact

A member of our design team developed storyboards of the Rattle–Photoframe Familyware, which are shown in Figure 5.

3.4   Necklaces

Necklace is a Familyware application, which supports adult users.

Scenario A couple, a boyfriend and a girlfriend, have necklaces. The necklaces can exchange a simple signal: temperature of the mounted stones. When the boy holds the stone of his necklace in his hand, It becomes warmer. This action triggers the transmission of the stone's temperature data to the girl's necklace. In turn, this causes the stone of her necklace to become warmer. She can feel that her boyfriend is thinking about her through the stone
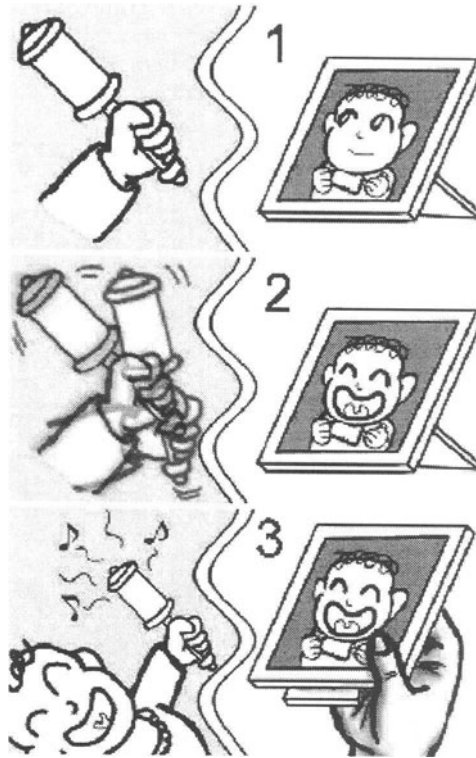
Figure 5. Storyboards of the Rattle–Photoframe Familyware: (1) A baby is playing with his rattle, an interactive device for babies; (2)Photos in the photoframe may change depending on the vibration of baby's rattle; and (3) When the photoframe is picked up, the rattle starts to play music.

3.4.1   Claims analysis

We conducted claims analysis of the necklace scenario to investigate pros and cons.

Necklace as an interactive device for adults
… .is an ordinary accessory object
… .is a portable device
… .allows its user to send and receive information on the temperature of its peer necklace
… .but information about body temperature might be difficult to sense
… .but might be difficult to reply to a signal; when a necklace receive a signal
… .but the two necklaces might create an infinite loop of temperature signals.

The claims analysis revealed that the necklace scenario was technically challenging, both devices are senders and receivers, and both are untethered. Yet the device seems quite appealing.

3.4.2   Design artifact

A concept drawing of the necklace Familyware is shown in Figure 6.All these prototypes: Teddy bear—Photoframe, Rattle—Photoframe, and Necklaces are in the initial phase of iterative, exploratory design process.
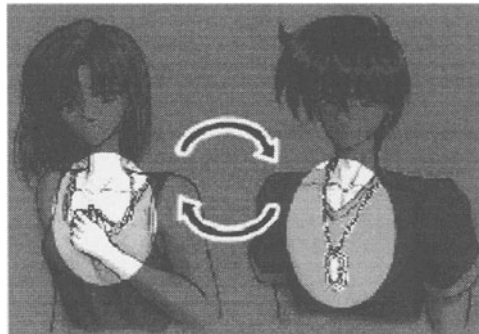

Figure 6. A boy and a girl are sharing their feelings by means of their necklaces

4.   RELATED WORK

The ideas behind Familyware are related to many other lines of research and development.

4.1   Technology for the local community

We focus on technologies for the local, small community [18]. In fact, the target user group of Familyware is the smallest community: family members, friends, and so forth. In these communities, a member's feeling of connection to the community is critical. Even in a somewhat larger local community, people want to keep connected to their community. The Blacksburg Nostalgia project [6], for example, reported an episode in which a former resident of a town in south west Virginia, who subsequently moved to Colorado, posted messages regarding his old memories to a history base on the Internet, trying to remain a member of the local town community.

4.2   Interaction technology

Tangible interface technology [10] is a key for implementing Familyware applications. Brave, Ishii, and Dahley's *inTouch* is a device to provide synchronized interpersonal communication [3]. It consists of two sets of rollers connected using force-feedback technology. When a user manipulates rollers at one end, the rollers at the other end have a physical reaction that its user can feel. In this way, *inTouch* allows its users to share the rollers. *Water lamp* and *pinwheels* [7] are interactive devices that people can feel the others' activities. These devices are used to project digital information in cyberspace into physical architectural space surrounding us; that is to say, water lamp projects "bits" into water ripples by raindrops, and pinwheels project "bits" into patterns of pinwheel spin. As Dahley, Wisneski, and Ishii mentioned, the devices may be implemented as displaying someone's heartbeat with a wearable sensing device like a special wristwatch. Another key technology is about interactive toys [17]. *HandJive* by Fogg, Cutler, Arnold, and Eisbach[9] is an interactive haptic device, that allows users to exchange the movements of one device to another.

4.3   Subordinate communication in social context

Preece pointed out the importance of private communication channels through her work on empathic online communities [15]. Though she focused on online discussion and sharing empathic feelings through words in public, we believe that this is one of the important steps to investigate the high level communication inhuman activities. Familyware is a complementary approach; it focuses on a specific social context for offline communities.

4.4   Scenario-based design

Scenario is a powerful tool to envision the future use of a system. Recent research on scenario use in system design is expanding its target application from the conventional human–computer interaction to groupware systems [5], [19]. Though the scenarios illustrated in this paper are simple one-to-one communications, they are groupware scenarios. Thus, they illustrate the complexity of explaining multiple actor's background information and the difficulty of illustrating temporal relationships among many events.

5. CONCLUDING REMARKS

It is not surprising that we have less knowledge on affective communication among humans, such as love and other emotions [14],[20]. This is a very challenging area; providing technologies to support it may not be simple. We see Familyware as a first step toward research and technology for affective communication: providing shared feelings of connection to others. Our project is in early stages; we are creating many scenarios, developing prototypes, and working with users. We want to conduct continuous fieldwork. Venkatesh [21] said, "Don't assume that what the technology can do in the household is the same as what the household wants to do with the technology." We agree this; we need to provide prototypes of Familyware applications to target users and mutually discuss and analyze their use. We have been learning many important roles of scenario in the early analysis of potential Familyware applications. In particular, we believe that the readers of this paper have already started generating new ideas for Familyware based on the concrete Familyware scenarios illustrated in the paper. This shows the power of scenarios in early stages of system design, and more particularly, may help us to move to the next step in this work.

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