Communication Appliances: Shared Awareness for Intimate Social Networks

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ABSTRACT

In the context of a three-year longitudinal participatory design project with six multi-household families in Sweden and France, we collaboratively developed and tested a series of "communication appliances" in their homes. Each prototype enabled family members to share a particular type of information, including hand-written notes, candid photographs, sounds and video. These commmunication appliances were designed to be as simple as possible, yet open to reinterpretation and exploration by their users. We conclude with a discussion of the requirements necessary for creating such communication appliances in the real world.

Author Keywords: Communication Appliances, Domestic Technology, Intimate Social Networks, Multidisciplinary Design, Participatory Design, Technology Probes

ACM Classification Keywords

D.2.2 [Software Engineering]: Design Tools & Technique – Evolutionary prototyping, User interfaces, H.1.2 [Models & Principles]: User/Machine Systems – Human factors, H.5.2 [User Interfaces]: User-centered design, H.5.3 [Group and Organization Interfaces]: Collaborative computing

INTRODUCTION

The computer industry has repeatedly demonstrated its skill in developing faster, cheaper, smaller, and smarter networked devices, but, as Leffingwell (1997) points out, "the most difficult challenge in application development remains truly understanding and satisfying user needs". Hindus (2001) argues that this is particularly true in home settings, where designers have poorer access and less well-defined measures of success. Thus, one of the major challenges today lies in understanding *what* technology will meet the needs of ordinary people, in the course of their everyday lives.

Much recent attention has been focused on providing consumers with greater access to information. For example, Eustace (1999) envisions a *universal information appliance* as "the average person's device for hosting tailored interfaces to the entire electronic universe–interfaces to virtually any device or software program." We question both the implied complexity of such devices and the assumed universal desire to purchase public information.

Our own studies show a greater interest in what we call *communication appliances,* defined as a simple-to-use, single-function devices that let people communicate, passively or actively, via some medium, with one or more remotely-located friends or family. The underlying technology metaphor is that of a toaster, which performs a single function simply and well. An aesthetically-pleasing example is Strong & Gaver's (1996) feather, which wafts gently into the air and floats earthward whenever a physically-distant loved one views a photograph of the feather's owner. The perspective is not access to external information, per se, but rather shared awareness among people, maintaining what Aronson (1971) calls *intimate social networks*. This paper describes our work with distributed families in home settings, the communication appliances we collaboratively developed with them and our suggestions for how to make such communication appliances feasible in the real world.

CONTEXT: INTERLIVING PROJECT

The interLiving project was a three-year participatory design project under the EU's Disappearing Computer Initiative. We began long-term relationships with six multi-household families in France and Sweden and engaged in a wide variety of participatory design activities with family members. Our goal was to explore a design space, not driven by a particular technology but rather to discover real needs and desires and to design technology that meets them.

Research approach

We used a multi-disciplinary approach, triangulating (Mackay & Fayard, 1997) with existing design methods while developing new ones, particularly technology probes (Hutchinson et al., 2003). We used ethnomethodological studies and home movies to collect data about families and collaborative film and cultural probes (Gaver & Dunne, 1999) to inspire them and ourselves with ideas for novel technologies that will fit within the context of daily life.

We conducted nine day-long workshops (fig. 1) that involved story-telling and scenario-building exercises, collaborative games and design exercises, as well as regular and video brainstorming. Together, we created mock-ups of technologies and video prototyped (Mackay et al., 2000) how family members might use them. We also tested our own prototypes prior to installing them in family homes. Workshops varied in size and composition, usually involving several French or Swedish families, but

sometimes focusing on a single family and twice bringing French and Swedish families together. Some of the results are described in Westerlund et al. (2003). In addition to our intensive work with these families, we tested a new design method, the *Interactive Thread,* (Mackay, 2004) that helped us learn about family communication from several hundred conference participants, using techniques ranging from critical incident interviews to cultural probes.

Fig. 1: Playing a word game at a French family workshop

Technology explorations

Approximately one year into the project, we began implementing technologies to be installed and tested across family households. The first such *technology probes* (Hutchinson et al., 2003) combine the social science goal of gathering data about family communication and the design goal of inspiring novel design ideas. The MessageProbe lets family members share hand-written notes across households, using a stylus on a touch screen and a zoomable interface to manage the notes.

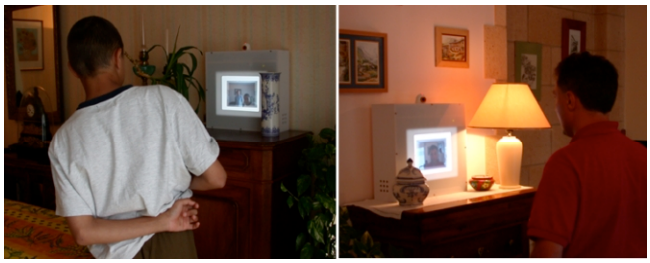

Fig. 2: VideoProbes in two French families' living rooms.

The VideoProbe (Conversy et al., 2003) has a tiny video camera and a screen and shows a live video image of the people in the room (fig.2). It takes a snapshot if there is a 3-second pause in movement. The resulting snapshots are shared across households. The StoryTable uses a tangible card interface (with RFID tags) to collaborate on editing shared videos. The latest probe is a Knocking device, called TokiTok, which detects a knocking sound and reproduces the sound pattern at a remote location.

These technology probes evolved into the concept of *communication appliances* and inspired a number of additional projects. MirrorSpace (Roussel et al., 2003) explores an intimate form of communication. What initially looks like a mirror displays the overlaid images of each person approaching each MirrorSpace. Participants control the sharpness of the image via their proximity, creating a sense of distance or closeness according to their relative positions.

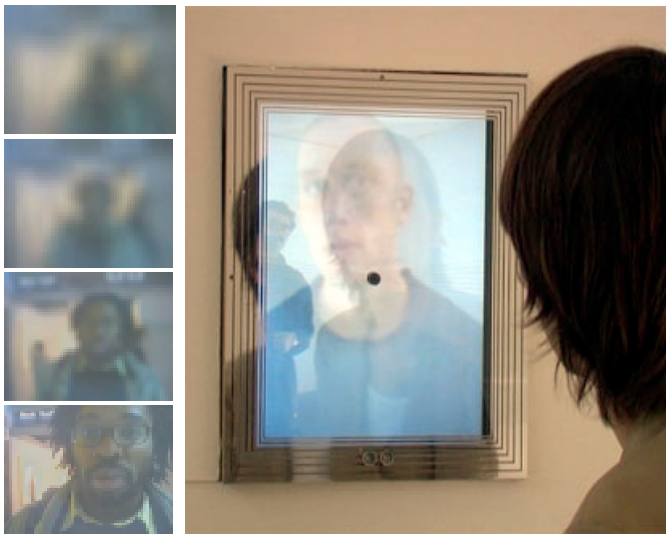

Fig. 3 Images taken at a MirrorSpace exhibit in Paris

The Video Probe, Message Probe and StoryTable were all installed and tested in family homes. The MirrorSpace has been tested in the researchers' homes, as well as at conferences and exhibits, including Paris' Pompidou Center and the Villette Science Center. Our goal was to implement these technologies so they are robust enough to be installed and used by family members across multiple households.

Selected findings

InterLiving family members produced a wealth of stories about themselves, as well as a variety of technology ideas that reflect their interpersonal relationships. This section presents selected findings that have influenced our understanding of inter- and intra-family communication as well as their desires for new technology.

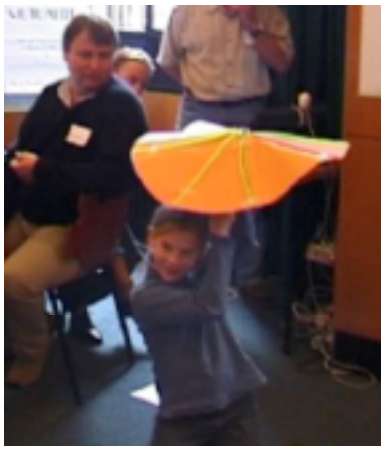

Fig. 4: An umbrella link to your best friend.

Several themes emerged: Some relationships are asymmetric. Children were more interested in new ways to play with their friends than with their grandparents. One girl invented an umbrella, which if opened outside, would let her talk directly to her best friend, assuming the friend's

umbrella was also open (fig.4). Grandparents also wanted ties with their grand-children, sometimes to the exclusion of the parents. One envisioned a direct connection to a place in the grandchild's room that would send pictures of drawings, notes or special objects the child brought home.

Some relationships are special. Many couples wanted unique ways to stay in touch with their partner, beyond telephones and email. Several couples prototyped ways of saying "I'm thinking of you": shared rings or watches to touch (fig. 5) or a gentle burst of air that would blow through the house when the other partner came home.

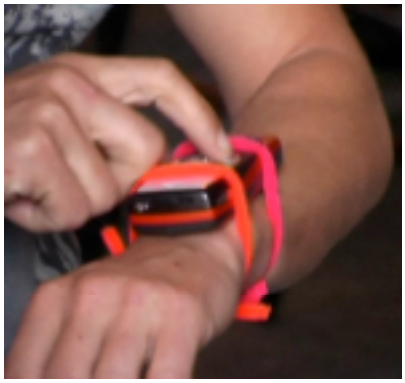

Fig. 5 Staying in touch, literally, with a loved one

Sometimes the needs are practical. When the six mothers from the core families got together, they collaboratively designed a shared calendar system that would help them keep track of everyone in the house. Other needs are personal. One girl created a "mood indicator" to broadcast her mood. She later hung the paper prototype on her door and she (and her mother) used it to reflect her mood. A Swedish boy prototyped a *bongo fax* that would teleport him to another room if he thought he might be in trouble.

Group membership changes in special circumstances. Several scenarios revolved around surprises intended for someone who had to be kept in the dark. One family made a video prototype showing how their grandmother in Australia could participate in a surprise party (fig.6). Several teen-age girls protoyped a system for tracking the overlapping members of a dance and a theater group.

We also encouraged family members to explore potential break-downs. A two-household family collaborated on a film script, drawn from recent family events and their experiences with a VideoProbe that connects their homes. In one scene, Marie's father stops by her uncle's house. He had already turned off the connection to his home VideoProbe, so she wouldn't see him arriving with the tell-tale box. He doesn't realize that Marie will visit her cousin that night and see Dad's image in her cousin's VideoProbe.

To summarize, almost three years of work with these six multi-household families revealed little interest in general-purpose information appliances. However, families repeatedly expressed the desire to stay in touch with small groups of family members, close friends, and sometimes church or sport groups. Membership in these groups was mostly stable, but they needed ways to temporarily add or remove someone from the group. Although most use the phone, they wished for less obtrusive, more peripheral ways to communicate and enjoyed experimenting with sound, images, text and touch. Family members, especially parents and grandparents, wanted to informally share personal information and leave traces of themselves via notes, voice, snapshots. A majority of the family-created scenarios and prototypes could be interpreted as *communication appliances.*

Fig.6: VideoPrototyping a device for connecting with grandmother and her family in Australia on Dad's birthday

Related Work

Both the design and HCI research literatures have explored intriguing ideas for communication appliances. Many exemplify what Weiser & Brown (1996) refer to as *calm technology,* which engage "both the center and the periphery of our attention, and in fact move back and forth between the two". Dunne & Raby (2000) explore the social uses of space and of creating "translucent" connections among people. In addition to the shared feather mentioned earlier, Strong & Gaver also propose devices that use objects to transmit scent and touch to distant loved ones. Hindus (2001) describes prototypes that let lovers carry or wear a small token that glows if the remote token is touched, and distributed decorative objects that, upon sensing activity in the remote location, glow more or less brightly according to the level of movement. Digital Family Portraits (Mynatt et al., 2000) obtain sensor information from a remote senior's house and present it as a "qualitative reflection of his or her activity level".

Perceptual haptic user interfaces include ComTouch (Chang et al., 2002) which sits on a mobile phone and converts hand pressure into vibrational intensity and Hand Jive (Fog et al., 1998), which lets remote users play together: if one physically moves a ball in one location, the distant ball moves as well. In Touch (Brave & Daley, 1997) transmits touch by preserving physical analog movement of rollers. Heart2Heart (Grimmer, 2001) allows two people wearing digitally-enhanced vests to exchange a "remote embrace" using touch to wirelessly convey heat, pressure, and heartbeats. LightWidgets (Fails & Olsen, 2002) provide ubiquitous interaction that does not require users to carry any physical devices.

Other projects let people communicate over time and space. The Living Memory Box (Stevens et al., 2002) provides a

way to archive memories of personal events and objects, to be retrieved later in time. Philip's Home Lab (Aarts, 2002) shows several collaborative spaces, including an image of two young girls collaborating on a shared drawing surface with a projected image of the remote child.

ARTICULATING THE PROBLEM

The technology prototypes described above are appealing and many clearly fit with the kinds of technologies desired by the interLiving families. Yet none of these technologies has made it from the lab to the home. Why? Is this simply a question of time or is something missing?

In fact, none of these technologies provide a way to specify how to establish the underlying technical and social networks. Just *how* do I hook up the *FloatingFeather* that I bought at IKEA? Most of the above prototypes involve pairs of people, but our families often wanted more than two. How would I tell my Digital Family Portrait to send Mom's sensor information to me and my sister, while ensuring that it goes to nobody else? Could the two little girls collaboratively drawing in Philips' HomeLab tell the system that they now want to draw with someone else?

One could argue that these devices could be hooked to a computer, but this would defeat the elegance of these works. Earlier, we likened communication appliances to toasters: for some, even a telephone dial is too complex. The interLiving families find devices like PDAs far too cumbersome: they have better things to do with their time.

This is the crux of the problem: How do we create the toaster equivalent of managing intimate social networks? We clearly need a method for allowing users to easily configure their networks, without resorting to a separate comuter or even a telephone.

DIRECTIONS FOR FUTURE RESEARCH

In this paper, we argue that one of the most useful outcomes of extensive field work is a clear articulation of a novel design problem. Following this logic, we report findings from our studies of six European families as part of interLiving, a 3-year participatory design project. Through scenarios and design prototypes, the family members revealed a strong desire for lightweight, often peripheral communication among overlapping subgroups within their intimate social networks. We developed a variety of prototype communication appliances and installed them in the families' homes, linking multiple households. This experience helped us to identify a key missing component in both our prototypes and those reported in the literature. We articulate the following design problem:

> In order to create effective *communication appliances*, we need way for non-technical users to create and manage small, secure intimate social networks.

We believe that finding the solution to the above problem is the key to deploying a wide variety of hitherto impossible shared awareness technologies, specifically, communication appliances.

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