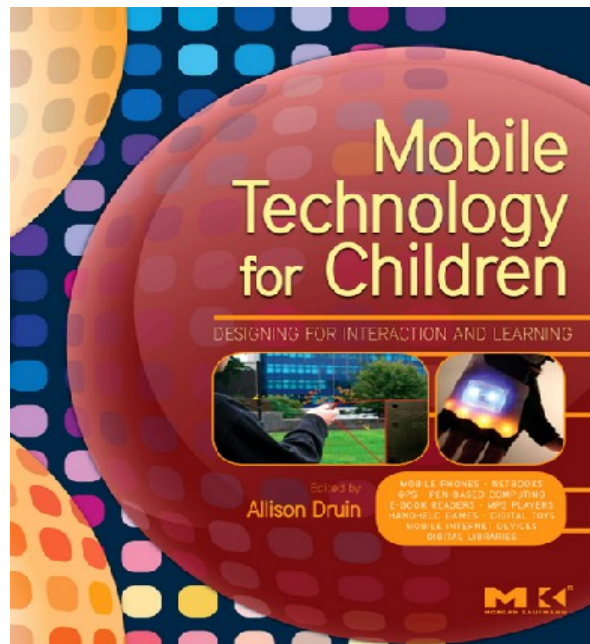


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CHAPTER 14

Mobile Technologies for Parent/Child Relationships

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Many parents and young children face frequent periods of separation, from short-term ones such as business travel to longer ones such as between shared-custody visits. Technologies such as telephone, videoconferencing, and email provide some support for these families but do not meet all parents' and children's unique goals and needs. Rather than simply looking for a communication medium, families require technologies that help support and preserve the care and play interactions that are so key to their relationships. Mobile technologies point to new directions in this domain by creating opportunities for spontaneous sharing of media, immediate feedback, and on-the-go sensing. In this chapter, we present five case studies of novel designs that employ diverse mobile technologies to provide parents and children with new opportunities to share experiences and have fun together while being physically separated.

BRINGING CHILDREN AND PARENTS TOGETHER

The parent is the child's earliest educator and plays a central role in supporting the child's social, emotional, and cognitive development as he or she grows up. The amount of communication between the parent and the child, and the parent's interest in the child's life, are critical factors for the child's well-being. Even parenting styles that are considered "authoritative" and characterized by monitoring and control (Cooper, DeHart, and Sroufe, 1999) are effective only when

there is meaningful communication and interactions (Gray and Steinberg, 1999). Children value the instrumental care and emotional support that parents provide (Milkie, Simon, and Powell, 1997). Mutual participation in play activities was particularly valued in fathers. Maintaining closeness through communication and creating opportunities for care and play seem to be necessary factors in raising successful and confident children.

Today some families might be struggling to maintain this level of interaction, since parents and children are spending less time together (Sandberg and Hofferth, 2001). More than ever, parents are likely to travel for work-related business—an increase of 14% between 1994 and 2001 with an expectation for further growth (Travel Industry Association; ITA.org). Long-term separations for reasons such as parental employment, migration, military deployment, or incarceration are also becoming more prevalent in some countries, dividing the family (Applewhite and Mays, 1996; Mumola, 2000). Additionally, increasing rates of divorce and separation are leading to a significant proportion of children living in a different household from one of their parents. For example, in the United States 32% of children live apart from one of their parents (Census, 2005). Of these, about 25% of the children live not just in a different household but in a different city from their nonresidential parent (Flango, 2003). This increase in geographic mobility makes it even more difficult for parents and children to maintain frequent and meaningful contact necessary for effective parenting.

What unique characteristics of the parent/child relationship should inform the design of technologies for these users? How can mobile technology be leveraged to create opportunities for parents and children to stay in touch in meaningful and natural ways? What design choices contribute to positive outcomes when such technologies are used by real families? In this chapter, we present five case studies of novel mobile technology designs for parents and children. We draw across our diverse experiences to find common themes and articulate the opportunities and challenges that speak to these driving questions.

RESEARCH LANDSCAPE

In designing technologies for communication between parents and children, we draw on a rich history of studies of household computer-mediated communication and research on the parent/child relationship. Though not all of these investigations directly involve mobile technology, they define a research landscape to inform our own explorations.

Technologies for family communication

The telephone still forms the primary way through which interaction occurs between geographically separated parents and children (Kennedy, Smith, Wells, and Wellman, 2008). More recently, videoconferencing has risen in prominence as a potential medium for family communication because of its capacity for making interactions more engaging (Flango, 2003). However, the use of video-

conferencing is limited in many families due to the difficulties in scheduling and setting up the interaction, often requiring the help of a collocated adult (Yarosh, Chew, and Abowd, 2008). The research community has taken up the challenge of exploring ways in which asynchronous, age-appropriate sharing of diverse media can help address these issues of timing and coordination to connect geographically separated families.

Some home communication systems seek to leverage familiar metaphors to simplify use. For example, the Peek-a-drawer (Siio, Rowan, and Mynatt, 2002) employed a furniture metaphor to simplify sharing digital images of physical artifacts between children and their grandparents. When one user put an object into the upper drawer of the chest, an image of that object would appear on the screen of the lower drawer of the sister chest in the other household. Similarly, the Hermes@Home system (Saslis-Lagoudakis, Cheverst, Dix, Fitton, and Rouncefield, 2006) for sharing notes and sketches cited the fact that it was as easy to use as an appliance as contributing to its success in increasing contact. Our case studies highlight some ways that mobile technology can create opportunities for exploring metaphors, such as familiar games and toys.

Asynchronous technologies help reduce coordination and scheduling costs. For example, the Casy system (Zuckerman and Maes, 2004) allowed families to asynchronously exchange video snippets recorded at a convenient time but targeted for delivery later. For example, a child could record a goodnight message that would be played for his or her grandparent when the grandparent decides to go to bed. The Inter-Living Project (Hutchinson et al., 2003) explored similar playful interaction and coordination between households. Though the message boards and video-sharing technologies it introduced were successful for communication between adults, children showed less interest in sharing than was desired by other family members. Mobile technology could help encourage sharing by making asynchronous contact more spontaneous. The ASTRA system (Markopoulos et al., 2004) combined a camera and PDA to allow family members to exchange messages that could then be viewed at leisure in the home. One of the findings of this work was that sharing was much more likely to occur if images could be captured and shared immediately. Later in this chapter, we continue exploring how mobile technology can enable spontaneous sharing to connect families.

Maintaining awareness and peace of mind are pervasive themes in designing for families. By digitizing already maintained calendars, Shared Family Calendars (Plaisant, Clamage, Hutchinson, Bederson, and Druin, 2006) built a family's awareness of each other's activities without extra work to enter and share information. The investigation of this system highlighted the benefits of leveraging existing activities to create awareness and motivate sharing. The Digital Family Portrait (Mynatt, Rowan, Jacobs, and Craighill, 2001) allowed an adult child to receive information about their elderly parent's routine gathered through motion sensors throughout the house and displayed as an ambient picture-frame visualization. This project showed that sharing small bits of infor-

mation preserved the parent's privacy while still allowing the younger family member to maintain awareness and peace of mind. Bentley and Metcalf (2007) demonstrated that mobile motion sensing can extend these benefits outside the home to help maintain close relationships.

Many of these systems did not investigate use by children, and those that did often emphasized the unique needs of this audience. What characteristics of the relationship between parents and young children must we take into account to design for this audience?

Supporting the parent/child relationship

Designing for parents and young children requires a different approach than doing so for friends or adult family members due to the asymmetry in goals and needs between the parent and child, the challenges posed by the cognitive and emotional limitations of young children, and the focus on play and care rather than direct communication.

Work in designing for parents and children draws from past research in supporting close relationships. The Mediating Intimacy project (Vetere et al., 2005) investigated the role of technology in personal and intimate communication. Cultural probes, interviews, and focus groups were used to document expressions of intimacy between family members. Simple expressions of affection within notes, emails, and mobile technology carried weight because they were used regularly and reciprocally. Such exchanges might have seemed trivial to outsiders, but they were laden with emotional significance for the participants. This study informed much of our work but did not speak to the unique nature of the parent/child relationship; though strong-tie relationships often involve symmetric goals and an equal involvement in relationship maintenance, the parent/child relationship is characterized by asymmetry.

Dalsgaard et al. (2006) extended this work to parents and children by deploying cultural probes in conducting contextualized interviews with members of three families. They found that the parent carried a greater responsibility over maintaining the relationship by creating a setting for trust and unity, providing care, and participating in play. Children rarely verbally expressed affection and self-disclosed less than their parents desired. Modlitba (2008) conducted semistructured interviews with five families in which one or both parents traveled frequently for business (five mothers, three fathers, and six children ages 4–10). She found that parents and children have different emotional responses to separation; children are likely to experience anxiety *before* the parent leaves, whereas the parent is more likely to experience a sense of guilt during the absence. Yarosh et al. (2008) conducted semistructured interviews with five children, five residential parents, and five nonresidential parents from divorced families to understand the challenges that they faced in maintaining closeness. Sharing on the part of children was oriented toward the current moment; if they were unable to share something when it occurred, they were unlikely to remem-

ber to do so in the future. On the other hand, parents were more concerned about interrupting the routines of the other household and were unlikely to contact the child spontaneously. We explore asymmetric interfaces and asynchronous interaction as potential strategies for addressing this characteristic of the parent/child relationship.

Designing for children holds another challenge: The child's cognitive and emotional limitations sometimes make long-distance contact difficult. As the child develops, he or she can begin to separate mentally from the here and now to imagine past and future events, comprehend how others see the world, and understand representational images of the world (Cooper et al., 1999). Modlitba (2008) found in her interviews that it might be difficult for a young child to visualize where their parent is traveling and how long he or she will be away. Preschool children in interviewed families required the assistance of a collocated caregiver to initiate and make sense of their interaction with the remote parent. Another limitation is that children have a limited capacity to handle changes in their routine, so transitions often bring about separation anxiety and unsettled behavior for the child (Kelly and Lamb, 2000; Modlitba, 2008). Both Modlitba (2008) and Yarosh et al. (2008) found that families used the telephone as the primary means to stay in touch while apart, focusing on maintaining routine by calling at bedtime. However, these parents often struggled with time-zone differences and expressed dissatisfaction with the limits of audio-only communication. It was difficult to keep a phone conversation engaging; both parents and children instead sought ways to maintain contact through shared activities and routines but found little technological support to do so while separated. Technologies presented in our case studies explore the use of age-appropriate media to overcome this challenge.

One of the distinctive characteristics of the parent/child relationship is that closeness is built more through play and care together than through conversation. Perhaps this is unsurprising, since children have been shown to spend less than a one hour per week participating in "household conversation" but more than 20 hours per week participating in playing, reading, studying, and hobbies (Hofferth and Sandberg, 2001). Dalsgaard et al. (2006) found that parents and children build intimacy through care and play. Children and parents participate equally in mutual play, collaborative activities (doing a puzzle, reading, or cooking together), playing with shared artifacts (action figures or a board game), and physical play behaviors. On the other hand, care is unidirectional from the parent to the child and includes activities such as setting rules, providing resources for learning, giving physical care, and assisting with everyday tasks and activities. In separated families, the nonresidential parent rarely has an opportunity to contribute to the child's care in these ways (Amato, 2001; Yarosh et al., 2008; Furstenberg and Nord, 1985). Yarosh et al. suggests that this might be in part due to the difficulty of maintaining awareness of the child's state and activities while apart (2008). Development literature emphasizes the importance of parental involvement in *both* care and play activities, to build secure relationships (Kelly and Lamb, 2000). In the next section, we present five case

studies of mobile technologies that provide opportunities for both of these behaviors beyond verbal communication.

CASE STUDIES

Virtual Box

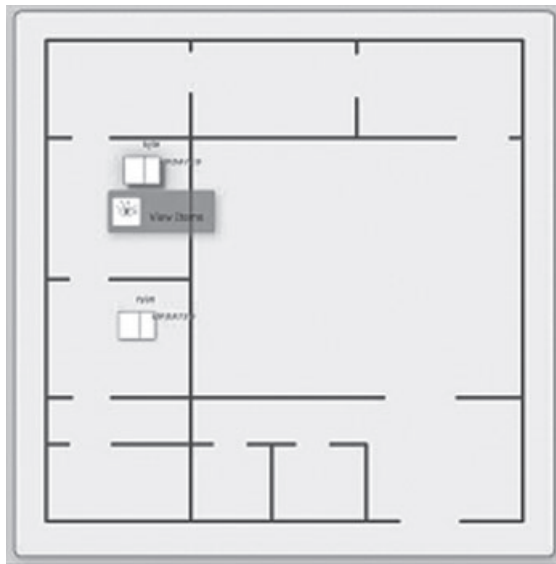
The Virtual Box employs location sensing and a mobile PDA device to extend a familiar hide-and-seek game to a digital platform that a parent and child can use to playfully interact while apart.

DESIGN OVERVIEW

The aim of the Virtual Box is to understand and support child/parent intimacy. This system illustrates an asymmetric design seeking to support the unique characteristics of parents and children. It attempts to facilitate four themes identified in child/parent intimacy (Vetere, Davis, Gibbs, Francis, and Howard, 2006): (1) *setting*, where the parent deliberately creates an environment supporting intimacy; (2) *play*, the child's immersing activity in which the parent may participate to create engagement; (3) *reciprocity*, which denotes the co-engagement in a dialogue that speaks to the interest of both children and parents; and (4) *expression*, as the communication of meaning of both verbal and nonverbal character.

FIGURE 14.1
Virtual Box. (a) Floor plan of a child's house; (b) the Hider interface.

The Virtual Box is based on the game hide and seek. The parents control a Hider interface through an Internet browser, allowing them to hide content such as pictures, text messages, and animations as "virtual boxes" on a floor-plan representation of the child's house (see Figure 14.1). The Seeker interface is accessed



a



b

by children using a mobile device such as a PDA as they move through their physical home to locate and view these hidden boxes. Utilizing indoor positioning technologies, the Seeker interface provides both visual and audio feedback according to the child's relative proximity to the hidden box. On discovering the box, the child can view and modify its content and hide it for the parent to find later. Virtual content is exchanged back and forth between children and parents, building a record of familial historical exchanges. More information on Virtual Box can be found in Davis, Skov, Stougaard, and Vetere (2007).

DEPLOYMENT METHODOLOGY AND RESULTS

The Virtual Box was subject to a laboratory-based evaluation to investigate how the four design aspects could influence the social interaction between children and adult family members. Parents, grandparents, and children (5–10 years old) representing three families participated in the evaluation. The protocol consisted of three parts: (1) collecting content from parents and grandparents to seed the evaluation, (2) observation of parent/child interaction with Virtual Box in a laboratory setting, and (3) semistructured interviews with participants about their experience with the system.

Our results show that the participants generally appreciated the system and that they found it enlightening, interesting, or fun to use. However, the asymmetric design proved only partially successful. The asymmetric interfaces supported a shared context in which children and adults could establish a play situation for maintaining engagement, but reciprocal interaction was limited on the adults' side because they could not participate in the physical act of finding a box hidden by the child.

Several parents and grandparents stressed that the system provided a useful setting for creating and maintaining closeness over a distance. Particularly, they mentioned that the act of creating and hiding content created a feeling of presence while apart:

"I feel closer to her when I create the box. I think of her and how she will react when she finds the box and looks at the content."

"I can picture it ... her finding the box and opening it up and enjoying what's in there."

The evaluation demonstrated that the implementation of play as hide and seek with virtual objects in a physical world facilitated engagement on the part of the child. However, some children had difficulties differentiating between the physical and virtual worlds created by the game (such as not seeing the virtual box in the physical world). A child's physical play manifests itself in a three-dimensional world, not a two-dimensional representation implemented in the prototype. Reciprocity was considered very important for the system because children and parents found it vital that they interacted continuously with the box. Participants considered and created content with their receiver in mind (e.g., parents sent animations or pictures of situations that the children would

recognize). Surprisingly, the children showed remarkably reflective signs of such behavior as well.

CHALLENGES AND OPPORTUNITIES

One of the major challenges identified by Virtual Box is how to create a setting for asymmetrical reciprocal play over distance. In a physical world where a child and a parent are collocated, the parent can create a setting (around the dinner table or playing in the living area) where reciprocal play can take place while maintaining some asymmetrical properties (i.e., only the parent may initiate certain interactions). We attempted to implement these properties in our design by implementing asymmetrical interfaces. This was somewhat successful, but we found that children wanted parents to engage more symmetrically in the play.

Another challenge was in creating and managing personalized content. We found that both children and adults wanted to create content that would carry a special meaning for the receiver. To enable long-term use of the Virtual Box system, we would need to consider easy ways for users to seed the system with personalized content.

The Collage

The Collage is a technology for collecting, displaying, and interacting with a family's image and text communications. It uses mobile camera phones as an input device and a touch screen for synchronous interaction between distributed family members.

DESIGN OVERVIEW

The Collage is an innovative application built on everyday technologies and existing infrastructures. It was created to investigate playful activities between grandparents and their grandchildren (Vetere, Davis, Gibbs, and Howard, 2008) but was also significant in child/parent interaction. Each system uses multiple mobile camera phones and touch screens, operating on both broadband services and mobile phone networks (see Figure 14.2).

Parents and children use the mobile phones to create text messages or capture photographs to share via Multimedia Messaging Service (MMS). Mobile phones already tend to be part of everyday activities, ensuring that messages and photographs are typically composed *in situ*. Shared items appear on all the touch screens spread across

FIGURE 14.2

The Collage uses mobile camera phones as a means of capturing familial events. Photographs and text messages are displayed on a touch screen.



the multiple homes of the distributed family. The sent items are displayed as a cascade moving down the touch screen, with recent items foregrounded and cycled more frequently. Items can be manipulated by dragging to change their size or orientation. These changes are visible in real time on the other touch screens, affording a sense of synchronous interactions.

Over time, the shared items create a digital archive of family events, but without the formality and structure of a traditional family album. Any attempt by one family member to arrange the items thematically or chronologically was likely to be quickly undone by another family member. This impermanence created an essential characteristic affording exploration and play and allowing photographs and text to be juxtaposed in unexpected ways, evoking serendipitous associations (Leong, Howard, and Vetere, 2008).

DEPLOYMENT METHODOLOGY AND RESULTS

The Collage was evaluated through a case study installation with a single family consisting of a mother (age 38), father (39), and two sons (9 and 4). The older son's biological father maintained visitation with him on alternate weekends and holidays, requiring the boy to spend that time away from the family. During the eight-week deployment, the family was given no prescriptive instructions on how the Collage should be used, but they were asked to attend to it at least once a day. The touch screen was situated on a table in a thoroughfare between the kitchen and the lounge room where it could become peripheral yet ever present (like furniture or a decoration).

When visiting his father, the older son would share photographs of his visit with the family. By posting photographs, he succeeded in maintaining a connection to his family, particularly to his younger brother. In addition, the family was able to achieve a sense of awareness of his daily life. The shared photographs suggested what was happening, rather than providing a detailed account of activities, and became the focus of family conversation in the older child's absence. The items sent to the Collage were used to motivate conversation with the boy upon his return. The mother noted that as a result of the Collage, conversations became easier to initiate. Postings to the Collage provided a clear point of entry into a discussion. The mother would ask questions informed by the context of the photographs, facilitating an informed and balanced conversation (e.g. "What score did you get in your archery?") rather than a bland interrogative interaction (e.g. "What did you do today?"), as she previously described. The Collage not only motivated conversation, it also facilitated shared interactions around the touch screen, such as opportunities for "show and tell."

The children's motivation for posting to the Collage was separate from the benefits gained by their parents. The boys enjoyed seeing themselves on the display and playing with the images on the touch screen. On the other hand, the parents emphasized gaining a sense of reassurance from the information displayed. The mother said,

“The photos come back (with them) smiling and happy, so you know they are enjoying themselves. It is just another level of reassurance.”

The Collage helped to create a sense of connection between the parents and their absent son. It was important to the family that the interaction resulted from child-initiated postings rather than through parent-controlled monitoring. This allowed the child to maintain his privacy while acknowledging some responsibility on his part to maintain the connection. The children typically took photographs of everyday, unremarkable activities, such as their grandfather watching television, a new Lego construction, or the like. The mobility of the camera and direct connection to a digital display afforded capturing “real-life stuff” (Mother) rather than contrived settings. These everyday moments were captured and made available immediately, to be enlarged, rotated, and repositioned against other moments on the touch screen. This created a sense of magic for everyone (“wow” moments), but it was particularly poignant for the youngest child.

CHALLENGES AND OPPORTUNITIES

The Collage’s strength was that it functions at several levels. It was a source of amusement and wonder for young children and a source of technological achievement for older children while simultaneously being a source of reassurance for their parents. The child-initiated connection and sense of reassurance are paramount when children are frequently away for days, as was the case for the family in this study.

Even though the Collage could display both text and images, the children predominantly shared photographs. It might not be surprising that they composed few text messages, given the difficulty of composing these messages on a mobile phone. The photographs provided a fragmentary repository of family events that served to seed conversation and afford playful manipulations. However, the images could also become a potential source of tension. For example, when visiting his biological father, the older son would occasionally post photographs of himself engaging in activities that the mother wouldn’t normally approve of. These images troubled the mother, but she acknowledged that it was important to “go with the flow, whether you fully agree or don’t” with what was taking place in her absence. She noted that the Collage was successful in bridging the gap between separated parents because she still has a good relationship with her ex-partner; it is possible that the system would not be as successful if their relationship was less amicable.

The children had one mobile phone, which they shared. Though this was not a problem initially, as they became accustomed to the Collage each child wanted his own phone. This became evident when they were apart and wanted “evidence” of their respective day’s activities displayed on the Collage. Having a single phone resulted in a biased display showing new photographs of only the older brother while he was away. It was important to the younger brother to continue posting new photographs of familiar and comforting objects such as his teddy bear in his brother’s absence. In this way, the Collage could provide a sense of affirmation that his activities were as important as his brother’s.

The Collage is an example of a new technology that operates to reaffirm the importance of children in families through the collection, display, and interaction of digital images. It functions both asynchronously, as shared items that persist to be viewed later, and synchronously, by providing the ability to manipulate images in real time. The Collage's success is that it enables and empowers children to initiate and engage with family members in ways that are important and meaningful to them. We can envisage a range of situations in which the Collage could operate where there is a desire for continued connection with parents across a distance. These situations span both temporary estrangements, such as children visiting their grandparents, and permanent separations—for example, when siblings reside in different homes.

eKISS

eKISS is a system designed to support communication between children and parents while separated by automatically sharing pictures captured with a camera phone throughout the day.

DESIGN OVERVIEW

The primary contribution of eKISS is to address three challenges identified in child/parent intimacy: (1) parents find it difficult to achieve a continuing insight into the lives and well-being of their children while separated, (2) when united after separation, the parents have problems understanding and relating to the experiences the children have had while they were apart, and (3) children find it difficult to describe or retell the experiences they have had while separated from their parents. eKISS attempts to address these challenges by integrating four themes of intimacy—self-disclosure, unity, commitment, and expressiveness (Vetere et al., 2005). Self-disclosure is the revelation and willingness to open one self to the other; unity is the sense of affiliation to a group with shared interests; commitment defines the ongoing process of a relationship—the joint feeling of being on a shared journey or having a shared past; and expressive acts of intimacy often include nonverbal interaction and ambiguous exchanges.

eKISS is designed as a mobile picture Weblog where children can share their experiences through pictures. It consists of a personal password-protected blog that handles pictures and texts sent from children, displaying them chronologically. eKISS displays pictures of objects, people, or situations children want to share with their parents, captured by the child using a mobile camera phone and transmitted via MMS. The blog displays the four newest pictures sent to the system along with date and time they were sent, with the newer images displayed larger. More information on the implementation of eKISS can be found in Dalsgaard, Skov, and Thomassen (2007).

DEPLOYMENT METHODOLOGY AND RESULTS

eKISS was deployed in a longitudinal field study involving four different families using the system to communicate and share experiences. The primary objec-

tive was to assess whether parents gained additional insight into their children's lives, whether it made it easier for the parent to communicate with and understand the children, and if it aided the children in sharing their experiences. During a five-week period, we conducted contextual interviews with family members. The first interview introduced the study and deployed the system; the second interview followed up on use of the system; and the third interview sought to address possible effects of the system on the families' communication and interaction.

Our results highlighted several issues concerning social interaction and mediated intimacy in families. As a key finding, the study showed that the families used the system more in some contexts than others. Most families used the system lightly during normal workdays, but when separated for longer periods of time (for example, during a business trip), the families would start using the system more systematically and frequently. The deployment of eKISS put strong focus on aspects of unity. The fact that the blog was personalized and could be accessed by only the parents gave some of the children comfort and made them feel that they belonged to a unit or group. Children also indicated that the blog made them think more of their family members, especially when taking pictures and sending them. One girl said, "I think more about what my mother is doing when she sees the pictures."

Most parents were highly satisfied with the possibilities of eKISS, which gave them a unique opportunity to follow the daily lives of their children. Some parents would check the blog several times a day to look for new pictures and updates. Other parents would even call each other when a new picture had been uploaded. One particular episode illustrated this: One child took a picture of his dog that he had to give away because the family was relocating. The emotional content of the image made the parent realize that their son was quite upset about the upcoming move. The parents coordinated via phone during the day and then addressed the issue with their son in person that night.

There were two issues that could potentially limit the adoption of eKISS. First, several families showed little interest in using the system to share or maintain awareness about the events of brief, routine periods of separation (such as being at school). Second, some children found it difficult to identify potential situations to capture and share; they were uncertain what kind of information their parents would like to receive.

CHALLENGES AND OPPORTUNITIES

The one-directional nature of the system was deliberately chosen to investigate the asymmetrical relationship between children and their parents. Our design stressed the importance of voluntariness from the children by not allowing the parents to prompt the child for more communication through the system. Unfortunately, this design decision also meant that the parents lacked this opportunity for two-way communication and that the children lacked some immediate feedback for posting images. Such feedback would only be available

through the parent's comments when the family members saw each other in person again.

A second challenge identified by our study centered on concerns over privacy and self-disclosure. The children did not necessarily want to share or disclose all their experiences when separated from their parents; in some situations, children stressed the importance of maintaining their privacy. This is due to the asymmetrical relationship between the child and parent, where the parent is responsible for providing supervision and discipline for the child. Another, perhaps more complicated but related issue was that the children did not know what kind of information to provide to engage in acts of intimacy with their parents. More children stressed their good will and intentions to engage in meaningful social interaction with their parents, but they often did not know what to share in particular situations.

eMutts

eMutts is an early prototype that consists of a series of wearable sensor toys and an online interface to address the issues of awareness on the part of the parent and encourage self-disclosure on the part of the child.

DESIGN OVERVIEW

The eMutts system seeks to address the challenges that parents face in seeding conversation and staying aware of their child's state and activities while away from them by encouraging spontaneous self-disclosure from children while still allowing the child to maintain a reasonable level of privacy. eMutts consists of a series of keychain-sized toys, each containing a sensor or a capture device. A pedometer sensor, for example, tracks the number of steps the child has walked at different times of the day; an ambient noise sensor can show how loud the child's surroundings were throughout the day. Capture devices include toys that allow the child to record audio or image messages, a stress-ball creature that records how hard it is squeezed, or a toy with buttons corresponding to different moods. Children can select one or two of these toys to carry with them during the day. At the end of the day, the toys dock to upload their data to each child's computer. The parent can use a Web-based interface to see information about the child's activities during the day and any messages or images the child recorded. The parent can then use this information as a starting point in his or her conversations with the child. Figure 14.3 shows an example eMutt toy and diagrams a sample interaction.

An online game is used to motivate children to actively wear and interact with the mobile device toys. Each sensor is represented as a different pet with preferences and a personality. For example, the pet associated with the image-capture toy gets happier if the child wears it and even happier if the child takes pictures to share with the parent. Children are given points in the online game for keeping their collection of pets happy; parents can contribute to the points by viewing and responding to the shared information. By providing playful moti-

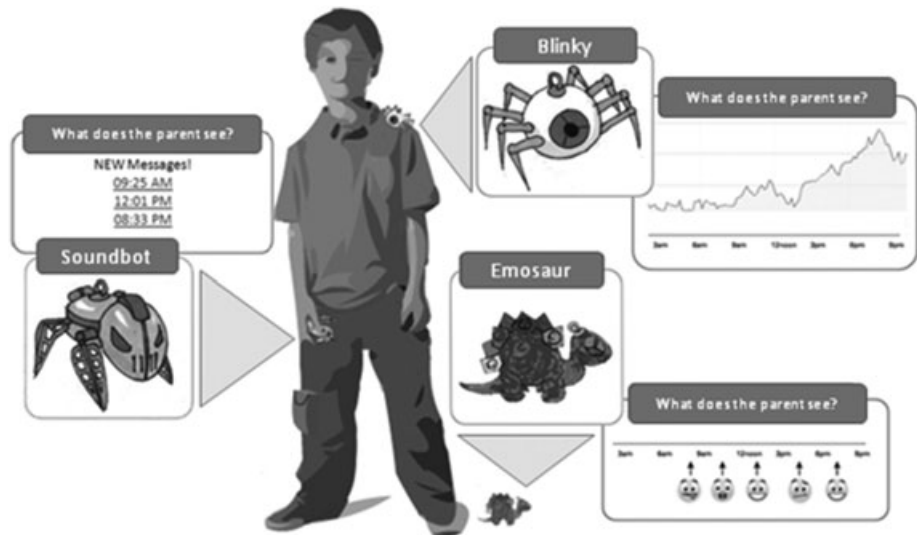


FIGURE 14.3
Examples of three eMutts and the information they share with the parent.

vation for children to stay in touch and tools for parents to stay aware of their children's everyday activities, we hope to lay the groundwork for improving parent/child communication and intimacy in distributed families.

CHALLENGES AND OPPORTUNITIES

The eMutts system seeks to empower the child to manage his or her privacy by selecting which sensors to carry or leave behind on a given day. We know relatively little about the specifics of how parents and young children manage privacy; eMutts could provide an interesting opportunity to explore this issue in more detail by serving as a technology probe. The challenges lie in balancing the conflicting needs and desires of the parties involved in the interaction and in allowing privacy to be negotiated in a dynamic fashion.

The information shared by eMutts is relatively ambiguous, requiring interpretation and further probing on the part of the parent. Though there is evidence that family members are skilled at understanding such context from ambiguous data (Bentley and Metcalf, 2007), eMutts can provide us with an opportunity to better understand how parents can combine and interpret multiple sources of information. The associated challenge is finding ways to visualize and present this data in a way that best supports interpretation.

The last challenge is that of balancing the external motivation provided for children through game mechanics with the desire to foster internal motivation to communicate. Dalsgaard et al. (2006) have suggested that children are in general less motivated to self-disclose than their parents desire. Though eMutts may structure and scaffold self-disclosure by seeking to fill this gap in motivation, eventually the goal is for the child to realize the inherent value of sharing information with the parent and be equipped to do so independently. Further investigation is required to understand the factors that affect this balance.

Globetoddler

Globetoddler is a prototype of a toy-to-mobile, always-on multimedia experience designed to support contact between a preschool child and a traveling parent.

DESIGN OVERVIEW

The main contribution of the Globetoddler system is to address issues uncovered by interviews with families of preschool children (Modlitba, 2008) by (1) increasing the overall opportunity for synchronous communication by implementing alerts, (2) allowing the parent to know when the child might be receptive to communication, (3) empowering the child to initiate interactions, and (4) increasing the chances for asynchronous communication by recording sound and/or video during play. The system has been designed around the hypothesis that a system that succeeds in making children feel more connected to their parents, and does so in an engaging fashion, will reduce the separation anxiety that many children experience before a trip, as well as reduce time-related anxiety (“Will Mum ever come back home again?”).

On the child’s end, a sensor-equipped doll, in combination with a virtual interface (see Figure 14.4), functions as the main user interface—a “portal” that leads straight to the parent. The traveling parent can use his or her mobile phone to, among other things, record audio comments, capture photos and video, and send them to the child. The next time the child plays with the doll, he or she is notified of the new content and is encouraged by the system to take a look at it on a nearby computer or TV screen. If the child chooses to do so, the parent is discretely notified of the activity and is able to see the content the child is currently looking at. This approach enables the parent to (1) if available, join in to chat with the child and comment on the content in real time (synchronous interaction), (2) if busy, leave a comment later (asynchronous communication), and (3) dynamically learn what the child is interested in and possibly



a



b

FIGURE 14.4

(a) The Globetoddler doll (Abima) with a Wii controller belly. (b) A screenshot of the child’s interactive interface.

adapt future interactions to those interests. In a similar manner, the child can use the doll to record video and capture photos or send photo requests (“I want to see what you are doing right now, Dad”) to the parent. The interaction on the child’s side is guided by an avatar. The doll and interface used by the child function as both the affordance for interaction as well as an agent that helps the child work his or her way around the content.

DEPLOYMENT METHODOLOGY AND RESULTS

The Globetoddler system was subject to three kinds of evaluation studies: (1) a long-term realistic setup in which the system was installed in the participants’ home and the parent was traveling, (2) a long-term setup in which the system was installed in the participants’ home but the parent was not traveling, and (3) a short-term session in which the child and parent were interacting with the interface for 30–60 minutes while “thinking aloud” (Modlitba, 2008). The goals of the studies were to evaluate how well the Globetoddler system meets the initial design goals as defined previously and to further explore the notion of remote parent/child interaction and intimacy.

The first theme of the evaluation results was that both parents and children appreciated the opportunity for near-ubiquitous communication Globetoddler provided. Once the system was installed and set up, it ran continuously and did not require any additional startup procedures. Each user could use the system individually when he or she wanted to use it. One traveling parent said,

“It was so cool to stand on the top of a mountain and know that [I can capture a photo that] actually gets to my kids. [I press] one button and then it is in the living room!”

A related, and equally valued, aspect was that of “ownership.” The children were happy to have a device that they could control and manage on their own. They knew that the incoming photos and videos had been captured for them personally, which seemed to make the whole experience more meaningful.

The evaluation pointed out the relative importance of social interaction rather than complex game design. Several of the parents pointed out that parent/child interaction seldom is about the actual activity but more about the fact that you do something together: “I don’t play games to win. I play for the experience; to hang out with her and hear her laugh.” Parent/child interaction does not require complex, predefined features. In fact, less defined and controlled interactions have the potential of being more unpredictable and interesting by allowing for greater self-expression.

Parents perceived great benefits of sharing their traveling experiences with those at home:

“Globetoddler made me more social. [Instead of sitting in my hotel room], I would go to things that [my family] would want to see and take photos of them.”

However, the evaluation also pointed out ways that Globetoddler could be improved to enable more meaningful sharing. One of the parents explained: “I don’t want to see a photo; I want you to show me a photo.” For him, photos and videos are static and uninteresting unless you hear somebody tell you about them. It was not enough that the system allowed the parent to record and attach audio comments to the photos. Users should be empowered to create whole storylines with a context, rather than short discrete comments. Another participant pointed out that the photos should be used for emphasizing the notion of “being together.” The children might not have understood that the underlying purpose of capturing and sending the photo and video files was to share with mum or dad. The children seemed to shy away from recording video, perhaps due to having a hard time finding a topic to discuss.

CHALLENGES AND OPPORTUNITIES

One of the challenges highlighted by Globetoddler is providing better mechanisms for affective expression. The virtual avatars are likable, but they do not provide information about the users’ expressions and reactions. Future systems could incorporate affect and expressions via multiple modalities. This could require that the avatars be replaced by real faces (video) or more sophisticated avatars. For example, by implementing facial expression recognition, a photo of the child’s face could be captured when he or she is watching a new video or photo that makes him smile. Another challenge is in designing asynchronous play experiences that retain the richness of synchronous interaction. Both the parents and the children enjoyed playing games together, in real time, the most. Asynchronous activities and games could work, but they require a strong storyline and rich interactions that make them feel more like real-time interactions, since young children are not patient enough to wait for feedback.

There is an opportunity in presenting parents and children with ways to capture and share photos and videos. The parents enjoyed sharing their experiences and surroundings with their children to try to involve them in the trip; the children enjoyed taking photos of themselves while making funny faces. This could be explored in more depth by making the child’s camera mobile. It could be embedded in the doll or in another device that allows the child to take photos of him- or herself in new ways—for example, by moving the device in different ways or by throwing it up in the air. Another possible approach is to make the child more involved in the parent’s activities by letting him or her remotely control the mobile phone camera. Furthermore, more advanced annotation facilities could provide the photos and videos with a context and story they require to be meaningful. One opportunity for creating such a context is to focus on mutual caregiving and responsibility. Families usually take turns taking care of family pets. Thus, Globetoddler could be designed around a mutual virtual pet that has to be taken care of by both the parent and the child. Fun tasks, such as feeding, exercising, and training could be implemented, as well as a platform for discussing and planning responsibilities. Though this approach might make it more difficult to incorporate features such as sharing travel

photos, it could help children and parents to maintain their routines of rich and fun interaction.

DISCUSSION

We have discussed five mobile systems that investigate various aspects of and approaches to supporting parent/child interaction. Though they focused on different types of separation, different ages of children, and different technological interventions, four themes carry through multiple projects.

The first theme that every project recognized was the difficulty of keeping a child engaged in conversation during periods of separation. Seeding conversation can be difficult. Collage, eMutts, and eKISS addressed this problem by incorporating ways for the child to spontaneously record images of his or her life for the parent to use to drive conversation later. Globetoddler also let the parent share aspects of his or her travel to serve as topics for conversation. However, perhaps a more fundamental issue than identifying talking points is that parents and children are more likely to create closeness through play rather than conversation. All five systems looked to incorporate opportunities for playfulness. The Virtual Box was a project specifically centered on a game the parent and child could play while apart. Both conversation seeding and playfulness can help address the issue of maintaining the child's engagement. One challenge for future research in this area is investigating how particular approaches fare in longitudinal deployments. Engagement needs to be sustained even after the "novelty effect" of the system fades as the child grows and changes.

The second theme lies in adapting designs to be congruent with the child's developmental stage and way of looking at the world. Children require accommodations in the complexity of the technology with which they are required to interact. They might need extra guidance to understand the concepts of time and separation. They could also benefit from getting hints and ideas for how and what to share with their parents. Several of the projects demonstrated that a collocated adult may serve this role, so interfaces should consider how the design could include them as stakeholders. In situations in which the collocated adult is unavailable, systems should seek to provide the remote parent with the information necessary to serve as a guide. However, aside from empowering parents, it is also important to maintain the child's sense of ownership and control of the device and the communication it supports. To support the child's needs without relying on adult intervention, one possible approach is to create a narrative (such as animated characters or a metaphor of taking care of a pet) in the interface to guide him or her. The major challenge is in designing such supports to fade or change as the child outgrows them.

A third theme explored in all five projects was employing asynchronous interaction as a way of avoiding some of the scheduling costs and obligations of synchronous systems. Asynchronous systems can allow spontaneous capture of material for later sharing but defer access to a time convenient to the other party. Though this setup helps manage interruptions and busy schedules, it could also make sharing less appealing due to the passage of time before getting

feedback (particularly problematic to children). Parents and children in deployments still emphasized the value of real-time contact. Designers should focus on increasing opportunities for synchronous communication, as well as design asynchronous interactions that more closely mirror an immediate feedback structure. Some of the cost of providing this structure can fall on the collocated parent, some on the remote parent (for example, by recording content to be played on certain system events), and some on the designer (for instance, through game or narrative mechanics that provide immediate feedback). Both exploration of synchronous communication and better support of asynchronous interactions are promising areas for future research.

The last theme touched by several of the projects is that of maintaining privacy and increasing motivation to self-disclose. Communication is a dynamic negotiation between the parent and the child, where the child often self-discloses less than the parent desires. In some situations, this gap might be due to the fact that the child has trouble deciding which information to share or how to talk about it. In these cases, it could be appropriate to provide hints for the child or to automatically share certain seed information. However, situations that the child expects to be private should remain so; he or she must be able to view and choose which information is shared. The privacy of individuals collocated with the child is also an important issue in some distributed families (such as divorced families) but is beyond the scope of this chapter. Understanding what is appropriate to keep private varies widely in families, so it is unlikely that the designer can ever build these constraints into a system. However, the designer must explicitly consider and evaluate how his or her technology might shift the balance of power in the parent/child privacy negotiation as well as possible negative consequences of this shift.

Designing for parent/child communication involves more than simply providing the *means* for achieving contact. Successful designs must be suited to the child's abilities, considerate of the overhead costs of interaction, and sensitive to the dynamic nature of the parent/child relationship. Above all, these systems must be *fun* to use! We hope to continue building on the work presented here to address some of the challenges we've highlighted and leverage the opportunities for making an impact in this critical domain.

Connecting to you

- Families need better ways to maintain contact with children during periods of separation.
- Parents and children build closeness through care and play rather than just communication.
- Systems that emphasize playfulness, convey multiple modalities, and highlight topics for conversation help keep long-distance interactions engaging.
- Mobile technologies provide opportunities for spontaneous sharing, immediate feedback, and on-the-go sensing, key to maintaining play and care interactions.

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