

Devices for Sharing Thoughts and Affection at a Distance

Khai N. Truong, Heather Richter, Gillian R. Hayes and Gregory D. Abowd

College of Computing & GVU Center
Georgia Institute of Technology
Atlanta, GA 30332-0280 USA
{khai, hrichter, gillian, abowd}@cc.gatech.edu

ABSTRACT

Interpersonal communication involves more than just words. Many forms of communication involve physical acts showing warm thoughts and affection, such as giving flowers or displaying photos. Yet these forms of personal communication are difficult at a distance. In this paper, we describe the concept of devices for communicating affection and thoughts from a distance. We detail two devices that we are exploring to support many of these physical interpersonal interactions—an augmented candy dispenser and a digital picture frame—and discuss design issues we have encountered as we investigate this interesting application space.

Author Keywords

Distance communication, ubiquitous devices, gumball machine, picture frame.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

In homes and workplaces, many individuals adorn walls, tables, and desks with photos, art, toys and other personal items. This personalization may add elements of comfort to the physical space, and can also be a form of communication and expression of self to those who inhabit the space for even a brief time. Visitors can view and discuss photographs and handle any physical artifacts, such as awards or toys, thereby expressing interest in the owner individually. Additionally, people leave expressive items for each other, such as chocolates from a trip or a funny comic from the newspaper. These physical tokens are a way of communicating affection without explicitly leaving a note. This type of casual but personal communication can be very difficult at a distance, given the restrictions on physical access to the personal spaces and artifacts of others. We are exploring new ways of allowing distant friends and colleagues to communicate in an analogous manner, by altering physical spaces remotely as the means for expression of personal thoughts and emotions. We also want to enable both those co-located and those at a

distance to share in the same personal interactions and artifacts.

Many researchers have investigated different methods for conveying information in the physical environment. However, these projects have typically focused on providing specific information in a non-intrusive manner using ambient/peripheral output [4, 7]. We are not concerned with conveying specific information, but instead conveying affect, the impression of thinking about or sharing something personal with someone, interacting with another's personal artifacts in a manner of which she is aware, and doing so in a physical and semi-persistent way.

Some ambient display projects have explored support for interpersonal communication, such as LumiTouch [2], the Peek-A-Drawer [6], and the 'TSUNAGARI' Communication project [5]. However, these projects limit the interactions through 1-to-1 communication. Often, personal interactions exist between more than two users. A person can receive a token of affection from virtually anyone they meet. Thus, we are exploring ways to support the interaction between many-to-1, and many-to-many participants. In these design scenarios, there is the question of who can communicate with whom. In some situations, supporting these personal interactions between a closed group of users may make sense, reducing the inherent level of concern about privacy while easing 2-way communication and the ability to reciprocate affection. However, closed groups increase the barrier for participation and potentially the number of participants. Thus, we have chosen to first focus on open groups.

We are exploring this space of affective communication at a distance using a variety of ubiquitous devices. We now present two prototypes we have built that support the ideas previously described, along with our experiences using them. We then discuss the design guidelines and issues we have uncovered in exploring this application space.

PROTOTYPES

Our current prototypes explore the space of many-to-1 communication, open to anyone to participate. We have focused on Web-based initiation of communication that affects a physical device in the user's personal space. Because distance typically makes it difficult for those communicating to view the physical outcome of their actions,

each design focuses on the ability to give feedback to the initiators on the results of their actions.

Gumball Machine

Motivation

Some forms of communication, such as an emotional gesture or token involve more than just words. When a grandfather visits his grandchild he brings with him a gift. Individuals may also take a mint from lunch back to the office for a friend. These are examples of simple friendly gestures and/or tokens of affection that people make when they are physically co-located with others. As distance separates people, it becomes harder to perform these gestures. Email or IM can bridge the physical distance by allowing people to explicitly express to someone "I was thinking of you." However, this more explicit communication of affection is very different from the more subtle physical acts described above. Thus, we designed a simple way for distant friends to leave a physical token, a gumball, which can express some affect.

Implementation

We augmented a gumball machine with a Servo Phidget [3] that controls the dispensing of the candy (see Figure 1). Additionally, we networked the gumball machine and provided the ability to automatically control it from a personal Web page. Every visit to the Web page is regarded as an *I-thought*. I-thoughts are then translated into a physical token of affection. When a customizable number of people visit the Web site, five for our experiments, the machine dispenses a gumball to inform the owner of the Web page of these I-thoughts. We log each Web visit storing the IP address and the city where the Web surfer is located. We perform this reverse IP address to physical location lookup for two reasons. First, we number and show the IP address and the physical location of the most recent visits to the Web page to allow the remote Web visitor to know that her visit has been logged. Because every fifth visit dispenses a gumball, the viewer can also determine if her act dispensed candy. Second, this allows the gumball machine owner to guess which friend(s) caused the last gumball to dispense, while still preserving some anonymity to other Web visitors.

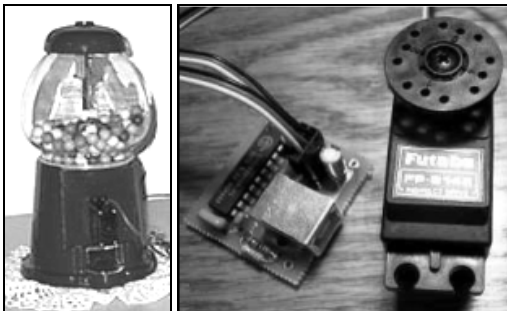


Figure 1. Gumball machine (left) augmented with a Servo Phidget (right) to control the dispensing of candy.

Experience

We created and deployed two gumball machines in different locations. The first gumball machine has been in use since May 2003 and is running now. The second gumball machine ran for 6 weeks. Each gumball machine is attached to a Web page that, in addition to describing how the gumball machine works, also provides updates about the owner's life, see Figure 2. This created the following implied interaction cycle: when friends think about the gumball machine owner and want an update on her life, the Web page enabled them to express this interest while also reading about the owner's recent thoughts and life events.

The first gumball machine has had 1516 visits to date, thus dispensing 303 candies. While novelty led to many Web hits immediately, sometimes with friends humorously attempting to over-run the gumball machine, the machine continues to be used and valued by the owner and his friends, with 117 direct visits in the most recent 2 months. The most telling sign of this was when the Web server went down, many friends of the gumball machine owner inquired about when it would work again. Furthermore, the updates on the Web page have acted as starting points for later conversations, much like changes in someone's personal spaces update co-located friends and can prompt conversation. Thus, in addition to being able to keep friends updated with what is going on in their lives, gumball machine owners have personal motivations for maintaining the Web page. To receive the candy and to know that someone was thinking about them was a pleasant experience that they wish to continue. For the owners, the candy really does feel like a physical token of affection.

Future Directions

The above implementation describes a way for open, semi-anonymous control of the gumball machine. However, users often wanted to let the owner know who was thinking of them and giving them candy. Thus, we are currently investigating a way for identified communication using email. Additionally, this will allow us to create a closed group of users from the owner's address book if that is desired. However, the email should still be initiated from the Web page to maintain the feedback to the users.

Digital Picture Frame

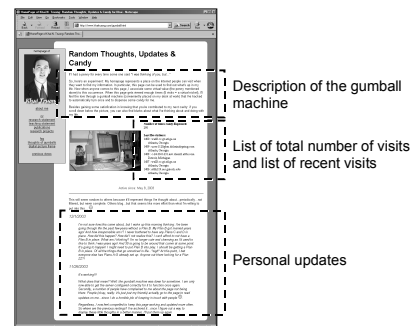


Figure 2. Personal Web page that displays personal updates and controls the gumball machine.

Motivation

Photographs are an important part of many people's lives. They may arrange personal pictures on their desks and around their homes. With the advent of digital photos, users can also share pictures with distant friends and relatives through email. Commercial products, such as the Ceiva system [1] are becoming popular for displaying personal digital photos. Ceiva provides an LCD display in an attractive frame that cycles through pictures that are uploaded and configured through a Web service that allows a frame owner to configure which photos to display as well as who can provide photos.

The Ceiva product allows a many-to-1, closed group, sharing of photos. We are exploring open participation, with additional feedback to the users. We want to make it even easier, and instantaneous, for remote friends to share and direct attention to a photo. Additionally, we allow remote friends to view the current photo on a picture frame, along with the entire collection of previously shared photos.

Implementation

The Digital Picture Frame allows anyone on the Web to upload and choose a photo to display on a particular person's picture frame. The frame is composed of several components: the Web client, the Web server, and a frame client. The Web client shows the current picture and information about when and from where the photo was uploaded, a set of thumbnails of all the photos that have been uploaded, and a simple Web form for uploading a new photo. Visitors to the page can either upload a new image, which becomes the current image on the picture frame, or scroll through the set of photos and select an existing one for display (see Figure 3). To provide further feedback to the Web page visitors, the Web page includes an image of the frame sitting on its owner's desk or shelf. We manipulate this image to show each new photo in the frame, making it more obvious that this picture is actually being viewed at the user's desk (see Figure 3). We log users' IP addresses for all visits. Thus, like the gumball machine, users are semi-anonymous.

We have implemented the frame client on several different hardware platforms, including a Fujitsu Stylistic 1200 tablet, a Massworks USB display, and a Vadem Clio tablet. All devices are essentially a small LCD display, and any such display should suffice. We believe the use of an external screen that resembles traditional frames is important, giving the frame a physical presence in the user's personal space.

Experience

The frame has been deployed to two people in the same lab, the first since July 2003, and the second since October 2003. The first frame owner sent an email to his close friends and colleagues to tell them of the existence of the frame, while the second frame has not been advertised to anyone. The first frame has had 46 pictures posted, by approximately 25 different people. The average time between posting or changing sessions is 18.45 hours. Since his initial announcement, these interactions have remained relatively



Figure 3. Web interface for posting or browsing images on the picture frame (left) and an image of the picture frame on the desktop included on the Web page to provide additional feedback to the users (right).

the same, postings or changing sessions have still occurred every 18.85 hours in the past month. Alternately, the second frame has had 17 pictures posted, by 5 different people, most of these were unsolicited and posted after client users found the Digital Picture Frame by browsing the frame owner's Web page.

Both owners report enjoying the frequent changes to their frames and the conversations the photos have seeded. They intend to continue using their picture frames, and others have expressed interest in obtaining a frame. Friends of the frame owners also have reported visiting the Web pages to view the entire set of photos. Occasionally, a visitor clicks on a number of thumbnails in succession, changing the photo on the frame rapidly. Online image browsing behaviors become noticeable to the frame owner in a manner analogous to someone walking up to a friend's desk and browsing a physical photo album. Additionally, owners were often able to determine if the visitor was a friend, depending on which photo was chosen in the end, one that a friend posted, or the one that was previously displayed.

Future directions

We are continuing to develop a number of features and examining new uses of the Digital Picture Frame. For example, one colleague has implemented a feature that enables him to post pictures to a frame directly from his camera-enabled cell phone. In this case, each new photo replaces the previous one from his phone, enabling him to send frequent "sights" of his daily life. We are also exploring the sharing of frames between family members and friends, both with multiple people viewing the exact same photo, and with collages of photos shown over multiple frames, thus exploring many-to-several and many-to-many communication of photos.

Although we have yet to deploy this prototype to a larger population, the desire of the current users to keep their frames, and the request for frames from colleagues shows the potential desire for this type of communication. We are planning a wider deployment and user study of the Digital Picture Frame.

DISCUSSION

Beyond the two prototypes we describe here, we are experimenting with different media and devices for affective communication at a distance. For example, we are exploring

audio as a means of communicating into a space, so far implementing a simple service to turn text typed into a Web page into speech that is played over speakers in our lab. However, we can envision using other types of audio, such as music or other sounds, to allow friends to communicate moods, thoughts, and affections in a less intrusive manner than speech. Our exploration of these prototypes has allowed us to uncover issues and design guidelines for this application space.

Throughout this paper we have emphasized the importance of the physical nature of the connection. This allows the communication to have some persistence in space, benefiting both the owner and those interacting with him. We have found through feedback from client users that detailed immediate feedback to them is important in letting them know their interactions are successfully being reflected in physical space. In the gumball machine, this was accomplished through the Web page showing recent visits, while in the picture frame this was accomplished by showing the current photo and the image of the picture frame sitting on owner's desk. Without this explicit feedback, the physical nature of the action may not be understood. For example, the second owner of the picture frame did not originally have an image on the Web page of the frame sitting on her desk. This led to difficulty as one friend posted a photo, without realizing that the photo was actually being displayed on her desk until told so later.

Beyond just providing feedback about interactions, the Web pages for our prototypes help form a 2-way communication loop. The pages serve as a window into the personal space of the owner and communicate some information about the owner, while allowing the visitor to send a thought or share a photo. In the case of the gumball machine, the first version of the Web page did not include personal updates about the owner, just a description of the machine. However, once a version that did include personal updates was deployed, the owners observed more consistent use. Friends reported returning to the site for these updates. With the picture frame, users reported returning to view the photos that others have left. Thus, they could learn about the owner through the owner's friends, many of whom may be part of a shared social group. This communication loop thus strengthens the social connections between the people. Additionally, this form of communication often led to later conversations—about the devices themselves, the personal updates or the contents of a photo—further strengthening the existing social ties.

Another important issue we have identified is that of anonymous versus identified communication. In both our working prototypes, users are only identified with an IP address. This allows anyone to participate without particularly worrying about their privacy or how their actions would be received. However, friends often reported wanting to let their affection and thoughts be known to someone, not

just guessed through knowledge of the IP address. However, this does not have to result in a closed group. Using email for the gumball machine, or providing text attachments to a photo would allow users to identify themselves without requiring it.

CONCLUSION

When distance separates people, many forms of interpersonal interaction become harder to achieve. Existing communication tools do not allow us to easily express casual thoughts and affections in the tangible semi-anonymous way we can when co-located. We are exploring devices to enable this kind of personal communication at a distance. We have presented two such devices, a gumball machine and a digital picture frame. Our personal experiences using these devices lead us to believe that they have the potential to connect distant people in meaningful ways. We plan to explore other interactions and study these devices in use by more users to expand our understanding of remote interpersonal communication.

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