Connectibles: Tangible Social Networks

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ABSTRACT
This paper presents "Connectibles," a prototype instantiation of a *tangible social network*, a new type of social network application rooted in physical objects and real world social behavior. This research is inspired by theoretical work that suggests that gifts act as physical symbols of social relationships. The Connectibles system leverages gift-giving practices, presenting users with gift objects ("connectibles") that they exchange with one another. These objects automatically form always-on communication channels between givers and receivers. As a user collects more and more of these objects, he or she begins to acquire a dynamic, physical representation of and interface to her social network. The community of users' interactions implicitly represent the structure of the social network; these data can be accessed with a GUI application, allowing users to explore and interact with their social network. This system was implemented and subject to three user studies. The overarching goal of this work is to examine how a set of devices might naturally and harmoniously interface the physical, virtual and social worlds.

Author Keywords
PC-Based Social Network, Tangible Social Network, Social Object, Gift, Communicative Social Object, Connectibles, friendFrame

ACM Classification Keywords
H.1.2: Models and Principles: User/Machine Systems. H.5.2: Information Interfaces and Presentation: User Interfaces. K.8.0: Personal Computing: General. J.7: Computer Applications: Computers in Other Systems

INTRODUCTION
PC-based social networking applications such as Facebook and MySpace have soared in popularity; "social networking" is a potent buzzword, and social networking tools are becoming incorporated into many kinds of online spaces. It is clear that many people have a desire to create, maintain and display their social connections; PC-based social networking applications have demonstrated that digital media can support these desires quite effectively. However, these PC-based social networks[1] have a number of limiting characteristics. This research aims to explore how physically-based, tangible interfaces – *tangible social networks* – might address some of these limitations, providing a new way to harmoniously support social behavior in the physical and virtual worlds. While tangible social networking applications are not meant to supercede or eliminate PC-based social networks, the benefits (and drawbacks) of tangible social networks ask to be explored.

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BACKGROUND AND PRIOR WORK
This section briefly describes some limitations inherent in PC-based social networking applications. It then covers theoretical background exploring the ways in which people attach personal meaning to physical objects. This background establishes a definition for a tangible social networking application.

Limitations of PC-Based Social Networks
What sort of characteristics might limit the value of PC-based social networking applications? First, PC-based social networks are tied to the conventions of the GUI, keyboard and mouse. While the GUI paradigm is without doubt hugely successful and important, its limitations have been well documented. [1] These include, for example, its poor ability to support collaborative work, its single point of control (the cursor), its poor ability to properly take advantage of foreground and background attention, and its homogenization of task execution. [2] Especially for social applications, the way in which GUI-based interactions fail to seamlessly and ambiently integrate into the user's

[1] Following common parlance, we will use the term "social network" as a shorthand for "social network application" when it is clear from context that we are using the term to refer to an application, not a person's set of relationships. I use the term "PC-based social network" or "virtual social network" to describe applications that accessed via the PC GUI, and are typically web-based.

physical world reduces their power to support a user's social behavior – behavior that often occurs (and up until recently, always occurred) in the physical realm.

More importantly, PC-based social networks often induce social behavior that strongly differs from behavior found in the physical world, due to the ways in which purely virtual spaces differ from physical ones. For example, in virtual settings, identities can easily shift and multiply; message cost is almost nil: a message can be just as easily sent to a thousand people as to one, and information is generally freely available and searchable by the public. [3] It is common to find users who have literally thousands of friends in an online space; such a number would seem ridiculous in terms of the physical space. While more in-depth analyses provide some reasons for this [4], it suffices to note that social networks in the virtual realm need not strongly correlate with social networks situated in the physical realm. By no means are these characteristics inherently bad, but they do suggest a significant break from pre-digital forms of social behavior.

Gifts and Social Objects

A great deal of theoretical and empirical scholarship has explored the ways in which people attach meaning to physical objects. [5] Following some of this work, we define *social objects* to be a physical object in which the symbolic value of the object lies in how it represents a social relationship or relationships. A wedding ring is a fine example: its role is chiefly symbolic, and it symbolizes the commitment two spouses make to one another. A social object can also symbolize wider group membership; fraternity pins, military dog tags and safety pins (for punks) all have this function. Social objects are thus intimately entwined with our social lives; they serve as physical referents to our relationships and influence how we construct and maintain those relationships.

Camerer [6] points out a specific type of object that is likely to shape social relationships: gifts. Gifts can be treated as signals of one's investment in another person. Put simply, a good gift is a physical symbol of a social relationship. Any gift – whether it is a greeting card, teddy bear or engagement ring – contains information about the relationship between the giver and the receiver. First and foremost, each gift denotes the existence of a social link between two people. Second, the cost of the gift – how much time, money and knowledge are required to acquire and present it – represents the strength of that relationship.

A network of gifts thus sketches out the links of a social network. If we could capture this information, we might expose social networks that have both more detail and greater consonance with a user's "reality-based" social network than current PC-based social network applications. We would also be able to build up social networks automatically, without forcing users to build their networks from scratch via clicks and email invitations. These features remove the barriers to entry and use that PC-based social networks entail, and may thus allow the natural integration of social networking into a larger group of people's lives. Finally, a system that consists of *communicative social objects* – objects that provide a communication channel between the givers and receivers – "closes the loop" on a social networking application: it provides a medium for social display *and* communication.

We thus define a tangible social network to be an application consisting of communicative social objects that allow users to create, maintain and display social connections. In particular, the tangible social network described here, Connectibles, consists of a network of exchangeable gift objects, where each pair of exchanged gifts implicitly represents a social relationship, and where each pair forms a communication channel between the two exchangers.

Prior Work

A good deal of prior work has explored how physical objects can acquire meaning, and how designers can engage these meanings with tangible user interfaces.

Chang et. al. [7] explore the power of objects as intimate communication channels with "LumiTouch." This work recognizes that photographs often act as social objects. LumiTouch augments photograph frames, allowing them to act as direct, ambient communication channels. In this way, two people can connect over distance through objects that represent their relationship. LumiTouch thus reinforces the metaphorical role photographs already occupy. Tangible social networks can be seen as extending the closed, dyadic relationship supported by projects like LumiTouch: tangible social networks allow many users to participate in a networked system, consisting of many such objects connecting many people.

Elise van den Hoven and others has recently argued that tangible interface research should include personal objects, or mementos. [8] Her work includes both theoretical discussions of this argument, as well as experiments with tangible interfaces that include mementos. Mugellini et. al.'s Memodules [9] is one of the first research projects that explicitly cites these arguments.

Kikin-Gil created a design prototype for a bead system that supports social communication. Her "BuddyBeads" [10] are strung together as a bracelet. Each bead is associated with either a person or an agreed-upon message. A user can make the message beads of different members of the group vibrate by pressing on message and person beads on her bracelet. The beads as a whole act to link a network of people via dedicated physical objects. Though it is not clear whether the BuddyBeads system was fully implemented, it provides direct inspiration for the Connectibles concept.

As a class project at the MIT Media Lab, Norton, Liu and Laibowitz prototyped a system that also provides direct inspiration for Connectibles; indeed, they coined the term "tangible social network." [11] Their "Clique" system

consisted of customizable, tradable dolls, each doll representing its creator. These dolls were to be exchanged among a group of friends. These dolls thus act as social objects, by both explicitly representing their creators, and by being gifts. The "Clique" system represents a first prototype of a tangible social network. Indeed, the Connectibles system is in some ways an elaboration and fuller implementation of some of the ideas latent in the Clique prototype.

THE CONNECTIBLES SYSTEM

We begin this section with a scenario describing how Connectibles might be used, then describe the system in more detail.

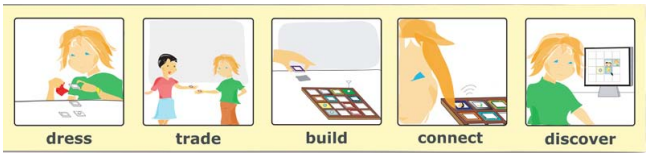

Figure 1. A cartoon illustrating the use of Connectibles. A user decorates her connectibles, customizing them for her friends; she exchanges them; she arranges the connectibles she's received in her friendFrame; she uses the connectibles as an ambient, persistent communication channel to her friends; she uses the Visual application to explore her and her friends' social network structures.

Scenario

Mary, a freshman in high school, returns home from school in the afternoon. She checks the mail, and sees that her Connectibles set has finally arrived. Excited, she opens the package. Inside she finds a rectangular *friendFrame*: the front has small empty cells arranged in a grid and it has a stand to prop it up, like a photograph frame. One connectible can be plugged into each cell. There are also eight connectibles inside the package. Two of them have metal knobs on top, two have plastic buttons. The last four look like small, thin displays.

Mary and her friends Michelle, Kate and Esther are always sending each other pictures over Facebook, so she decides to set aside one display, or "pic," connectible for each of them. Michelle is Mary's best friend; they share everything. Mary decides to set aside a knob and a button for her. Mary chooses to save the other connectibles for later and tosses them in her backpack. Mary then starts decorating the connectibles. Rustling through her drawers, she grabs some glue, felt and stickers and goes to work, personalizing each connectible.

The next day, the four friends meet up at lunch. They all exchange connectibles with one another. Mary and Michelle exchange two knob connectibles, and agree to crank the knobs low when they are feeling lonely, and high if they are in a good mood. The friends finish exchanging connectibles as the bell rings for class.

When Mary gets home, she places the connectibles she just received on her desk. How should she arrange them? Mary decides to cluster all the pic connectibles in the center of the friendFrame. Since Michelle was really the person that introduced all the friends to one another back in junior high, she places Michelle in the center of the frame.

Once the connectibles are plugged in, they light up. A picture of Esther and Mary from a field trip appears on Esther's connectible; a picture of koala appears on Michelle's pic connectible. Excited, Mary turns Michelle's knob connectible all the way. Not long afterwards, the knob connectible lights up all the way: Michelle must be sitting in front of her friendFrame, turning Mary's knob connectible.

Mary goes to her computer and logs onto the Connectibles website. Once logged in, the Visual application starts up. With it, Mary sees her arrangement of connectibles represented graphically. She loads up some pictures from a folder on her computer; they pop up in a window next to the connectibles arrangement. Mary drags a picture from seventh grade over to the connectibles on the screen, thereby sending them to her two friends.

Mary decides to check out her friend's arrangements. She clicks on Michelle's connectible, and sees Michelle's arrangement. It must have twenty connectibles! She scrolls over the connectibles; it looks like Michelle's whole family is represented in one cluster. Well, Michelle is pretty close to her family, after all. In fact, it looks like she has a couple buttons and a knob just for her mom. That makes sense; Michelle's mom hates using computers. The button and knob connectibles work without needing to use a computer at all.

Mary then finds her own connectible: next to Brandon's?! Mary wonders why Michelle would do that; she does know that Mary likes Brandon. Maybe this is her way of sending a hint to them both. Mary clicks over to Brandon's arrangement to see who's on it. Ritik, from Mary's old summer camp; Mary wonders how Brandon knows John. Something to talk about at lunch maybe?

Over the course of the summer, Mary glances at her friendFrame, checking to see how Michelle is doing, calling her if her knob is low. She adds a few more friends, and changes the arrangement. She is able to browse through her friend's arrangements, and look at how they change. Mary likes glancing at her friendFrame as she works on her computer or reads a book, just get to a sense of what her friends are up to. She's grown especially fond of Michelle's pic connectible, browsing through all the pictures she has received with two small buttons on the connectible itself.

Mary decides to take the FriendFrame with her to camp, and puts it by her bunk, so she can be close to her friends even though they are not around. She brings some extra connectibles with her, hoping that she might make a few new friends there as well.

Connectibles Design

The above scenario describes how Connectibles are used; we discuss the system in more detail here. The system consists of connectibles – small physical tokens that can instantiate a communication channel between two people, and the Visual application, which allows users to explore their own and their friends' connectible collections and arrangements.

The Connectibles Themselves

Connectibles can be of any interaction modality: visual, tactile, aural, or anything in between. In our implementation, we chose three kinds of connectibles: "buttons," "knobs" and "pics." Each supported different types of interactions. We classify interactions into three categories: *high bandwidth* or *low bandwidth*, *evanescent* or *persistent*, and *self-contained* or *PC-dependent*. We wanted to explore how users responded to each kind of interaction within the context of a tangible social network.

High bandwidth interactions allow users to send rich messages, such as pictures or music. Low bandwidth messages are more compact; such messages might cause a partner connectible to simply light up. Evanescent messages appear and fade away; persistent messages permanently change the state of a connectible until another message is received. Self-contained messages can be initiated using just the affordances and display on the connectibles; PC-dependent messages require the use of a computer to send a message. For example, sending a picture to a pic connectible required a PC.

Figure 2. The three types of Connectibles.

Button connectibles consist of a large button and a ring of LEDs under a frosted acrylic cover. Pushing the button causes its partner to slowly light up, then fade out. The bottom LED is reserved for feedback to the sender: it glows when the user pushes the button, indicating that the system did indeed capture and send the message. Button messages are thus low bandwidth, evanescent and self-contained.

Knob connectibles have a metal knob and a ring of LEDs under a frosted acrylic cover. The lights on a knob connectible reflect how far its partner's knob is turned. The bottom LED is used as feedback, like the button connectible's, to indicate to the sender that a message has been sent. Each knob has a pointer painted on it that indicates what position it is currently in, and thus the state of the partnered connectible's ring of lights. Knobs are thus low-bandwidth, persistent, and self-contained.

Pic connectibles are the most complex connectible. They consist of a full color OLED display, with four buttons hidden under each corner. A user can press these buttons by pushing on the corner of the display. A user can send pre-set animation messages to their friend's partner connectibles using the top two buttons: the left button sends a series of flashing "Hi!" graphics, which last about five seconds. The right button sends a series of animated hearts, which also lasts about five seconds. Users can send each other pictures using the Visual application. The pictures appear on the partner connectible and remain there until changed by the sender. Each pic connectible stores the sent images, with space for approximately one hundred pictures. Using the bottom buttons, the user can browse through all the pictures sent to that connectible; the left button browses backward, the right forward. Pic connectible messages are thus high bandwidth, both evanescent (the animation messages) and persistent (the image messages), and both self-contained and PC-dependent (again due to the animation and image messages, respectively).

All the connectibles support some degree of physical customizability: in line with the theory on the value of gifts, we felt it was important for users to customize their connectibles in order to create a stronger, more specific association between connectible and person. The knobs and buttons included paper faceplates that could be attached and decorated; the pic connectibles could be customized on-the-fly by sending new pictures to them.

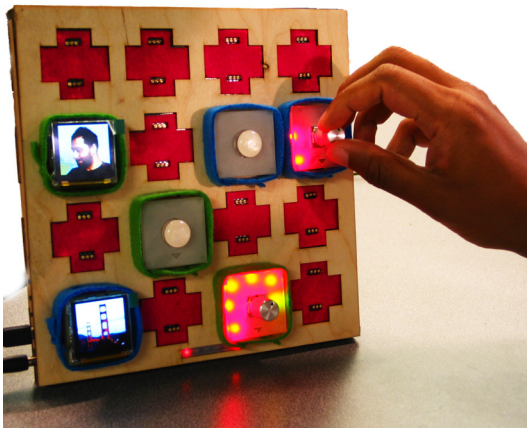

Figure 3. Connectibles arranged in a friendFrame.

Exchanging and Arranging Connectibles

Exchanged connectibles automatically form always-on communication channels between givers and receivers; users do not need to engage in any special or contrived behaviors in order to pair exchanged connectibles. Once a

pair of exchanged connectibles are plugged in to their respective friendFrames, they automatically find one another and create an persistent communication channel. This channel cannot be broken, even if the connectibles are powered off or moved[2]. The friendFrame provides both power and a connection to the internet.

The Connectibles network architecture instantiates a fully tangible, TCP/IP framework, allowing synchronous communication across large distances among many users.

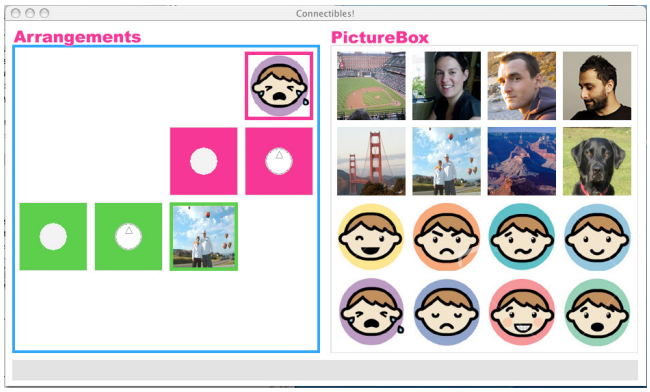

Figure 4. Screenshot of the Visual application, showing a representation of a user's connectible arrangement on the left, and images that this user can send to pic connectibles on the right. The lefthand window automatically updates whenever any user changes the physical arrangement of his or her connectibles.

The Visual application

The Visual application supports the specifics of a tangible social network and the Connectibles prototype system. First, the Visual application directly reflected the physical arrangement of the users' connectibles. Each connectible type was displayed with its own icon. Users could navigate to a friend's arrangements by double clicking on a connectible that user had given out. By clicking on subsequent connectibles in other user's arrangements, users could hop from their friend's arrangements, to their friend-of-friend's arrangements, and so on. This prototype did not include privacy settings, which is a clear priority for future work.

The Visual application also supported connectibles with PC-dependent messaging. In this case, it allowed users to send images to pic connectibles with a drag-and-drop interface. The user sends an image to her friend by dragging the image onto the representation of the connectible given to her by that friend. Unfortunately, the Visual application used during the evaluations supported only sixteen possible images; users could not input arbitrary images from the web or their own collections into the Connectibles system.

[2] This seamless exchange was supported by a network and addressing protocol technology developed specifically for this research. Interested readers can learn more by reading the appendix of the thesis that describes this research, find it at [link stripped for anonymity].

Importantly, users did not need the Visual application to use the Connectibles system. If the user did not care about the arrangements of other users, and did not care to either use pic connectibles or send images to them, he or she would never need to use the Visual application. The Connectibles system works without relying on a GUI running on a PC.

EVALUATIONS

We subjected the Connectibles concept to three different evaluations. The first was with cardboard prototypes. This study was conducted to test whether people could use arbitrary physical objects as symbols for other people in their lives. This study also explored how people map qualities of their social network onto arrangements of these symbolic physical objects. The second and third studies were conducted with the full, working Connectibles system, and were meant to elicit users' responses to the system and the tangible social networking concept in general.

To be sure, evaluating prototypes that presuppose a large community of people using a system over a long period of time poses obvious problems, especially when such a system consists of physical objects. Developing a robust system of large numbers of networked, electronic physical objects was clearly outside the scope of this research. The two final evaluations were thus designed to illicit responses from users that would apply to a full system using the prototype we developed.

Evaluation One: Mapping the Social onto the Physical

Each subject in this study was given a set of cardboard puzzle pieces, and asked to label each piece with a post-it note. The subject was asked to write on the post-it the name of someone to whom they were close. They were then asked to arrange these pieces in any way they saw fit. Each subject was asked to do this task under a few different conditions; each condition varied different factors, such as the shape and size of the puzzle pieces. This study was run with five subjects, four male and one female; each session lasted about one hour.

Summarizing the results of this study, we found that individuals do readily map social structures to arrangements of physical objects, and they typically do so according to simple rules. For example, physical proximity of two objects means that the people represented by those objects are socially close. Second, the limitations of physical objects encouraged rich mappings. The physical design of the objects prevented certain kinds of actions. For example, each physical object could not be connected to all the others, since it had a limited number of connection points. The kind of node-edge graph often used to visualize social networks could not be easily translated into the puzzle piece design.

This design actually encouraged richer mappings than the more flexible node-edge structure. Because subjects had to make choices, it required them to carefully think through their arrangements. One subject wrote, "I struggled with the

shapes at first ... It took a while to think of nuanced meanings. But I began to see them ... I could make explicit what I was just defining and negotiating in my head."

This study suggested that a tangible social network system might have some merit: people can associate physical objects with particular people, and arrangements of these objects contain social meaning.

Evaluations Two and Three: Response to Connectibles

Evaluation Two, or the "short-term study," was conducted with twelve subjects, 7 male, 5 female. They were recruited via email, all were undergraduate or graduate students. Each session included three subjects; four sessions were conducted. Each session lasted around one and a half hours. The subjects were each given one friendFrame and six connectibles: two buttons, two knobs, and two pics. They were also provided with a Mac Mini running the Visual application. The subjects were placed in the same room and physically separated by foam core walls, preventing them from seeing what the other subjects were doing. This separation also simulated a condition in which the subjects were in different locations.

The subjects had the experiment explained to them orally and in writing. The subjects were provided with paper faceplates, markers, pens and stickers with which to customize and decorate the button and knob connectibles. Subjects were invited to exchange connectibles, if they chose, with any of the other subjects, at any time. Subjects were invited to use the connectibles to communicate, to use the Visual application, and to rearrange the connectibles, if they chose. We provided technical assistance if the users encountered any problems or had any questions; the system functioned fairly robustly. Minor problems were encountered, but these were resolved in less than thirty seconds or so.

Overall, the study took a relatively freeform approach, inviting subjects to use the system in any way they saw fit. They were asked to provide any comments orally, if they chose; these comments were written down. The subjects were presented with a written survey at the end of the session. Both the subjects' comments and observation of their behavior led to a list of results.

Evaluation Two was obviously too short for the subjects to fully use the system for its intended purpose. While we attempted to set up groups of subjects that had pre-existing friendships, such that they would have some motivation to use Connectibles, we could not completely control for this. However, the short-term study did allow us to run a larger number of subjects.

In order to remove the confounding conditions of the short-term study, we conducted a seven day investigation with three subjects, Evaluation Three. This study's subjects were all male. Two were students, the other was postdoctoral research staff.

This study simulated more realistic conditions. The friendFrames were located in the subjects' real workplaces. Two of the subjects worked on opposite sides of a large office space. Lab equipment prevented them from seeing one another while they were at their desks. The third subject worked in a different office on the same floor. The subjects knew one another, were friendly, and worked together, providing a pre-existing impetus for social behavior. Given the length of time this experiment took and the constraints on appropriate subjects, one session was run.

This experiment took the same freeform approach of the short-term study; subjects were welcome to use Connectibles however they chose. Like the short-term study, each subject was given two knobs, two buttons and two pics, as well as faceplates and access to markers, pens and stickers. Subjects were asked to fill out a short survey at the end of each day, as well as a long survey at the end of the experiment.

These two evaluations yielded a number of results. Subjects had a number of suggestions for the system, both in terms of specific improvements to the current design, as well as new possible features. Some subjects had mixed reactions to the concept; they noted that it was something they might like to use if a number of other people were already using it. This is of course unsurprising for a networked system. Happily, some groups of subjects used Connectibles in unpredictable ways, suggesting it provided an open interaction space. The key results are discussed below.

Arrangements do not mean much?

Unlike in Evaluation One, almost all subjects did not interpret the others' arrangements in any particular way. One short-term study subject wrote, "I didn't really develop a clear logic [about my own arrangement], and did not assume that anyone else had either." This would seem to contradict the results of the first experiment.

These results may have had more to do with the conditions of the experiment than the design of the Connectibles. As one subject wrote, "I'm not sure the arrangements could be that meaningful with only three connectibles per person." Clearly, the fact that only two people could be represented on a friendFrame severely limited the amount of play that could go on with the arrangements, in terms of mapping social relationships. Further, the subjects of the short-term experiment may not have had enough time nor strong enough relationships to the other subjects for any kind of mapping process to take hold.

Still, the design of Connectibles may have itself contributed to the attenuation of meaningful arrangements. First, as one subject pointed out, it was not that easy to move the connectibles around the friendFrame. The act of plugging them into a cell felt more permanent than sliding pieces of cardboard around. The friendFrame itself also lent a more stable, furniture-like feel to the system. While we thought

the design had maintained its puzzle piece like quality, these design issues may have actually taken that sensibility away. In that sense, the Connectibles design emphasized its role in ambient social connection more than its role as a facile tangible interface.

Customization and exchange are important

The subjects enjoyed the customization process particularly in the context of the exchange; it allowed them to both establish the message semantics as well as invest a little bit of themselves into the connectibles they gave away. A few joked about taking back the connectibles if the recipient was not responsive. It was clear via observation that the gift giving aspect of the system was well understood and clearly endowed the connectibles with symbolic meaning as indicators of a social link.

Meaning (usually) takes time

Two of the four groups of short-term subjects did not establish much of an interaction language with the connectibles, in terms of assigning meaning to the messages. Many noted, again, that there was not enough time to do so. The buttons seemed the most arbitrary. However, the other two connectibles did take on some straightforward meanings. Most subjects correlated the knob settings with overall mood. The pic connectibles supported emoticons, which had clear interpretations.

One group in particular quickly endowed the connectibles with strong (and humorous) meanings. These subjects customized most of the connectibles with written, imperative messages. For example, one subject decorated a knob which, when changed, told its receiver how loudly to demand Oreos from someone nearby. These subjects had a lot of fun with Connectibles, and built their own personal game with it, in a way that we had not predicted. This was a satisfying result, showing that people can endow the purposely abstract connectible messages with personal meaning.

This group also begs the question as to why they had a different experience than the others. They clearly already knew each other well (as they indicated on the written survey); their relationships were already informal, friendly and playful. This fact made it clear that the Connectibles system, which is meant to support intimate and friendly relationships, offers little to social groups built on formal or weak relationships.

The seven-day subjects generated some specific, rich semantics for the connectibles, especially the knobs and pics. Apart from the buttons, they did not have trouble assigning meanings to the messages. For example, one subject decorated a knob to indicate his current belief that his research would bear fruit: near the lowest setting he wrote, “in our pipe dreams”; near the highest he wrote “in stores by fall, baby!”

However, it took these subjects a couple of days of using the system to settle on some meanings. After a few days, two of them decided to use the pic connectibles to show the other where they were on campus. Four pictures respectively indicated “in the office,” “in the lab,” “in a fabrication lab somewhere else on campus,” and “at home.”

These observations suggest that Connectibles can indeed support a rich and varied set of user generated semantics. However, the participants need to be able to use the system for a longer period of time and have some pre-existing relationships. This, of course, bodes well for a fully implemented system.

No such thing as too much feedback

Subjects wanted more feedback about the state of other people's connectibles. For example, the painted pointer on the knob was not sufficient feedback as to the state of its partner. The Visual application could have reflected the state of the knobs and pics as well, instead of just their position on the friendFrame. All these observations point to greater, more salient feedback and a tighter coupling between the physical state of the connectibles and their virtual representations. It was clear that subjects wanted greater insight into the behaviors and actions of other users, which is a very positive sign for a social networking application.

A tangible social network is not a PC-based social network

Most importantly, when subjects were explicitly asked to compare Connectibles to virtual social networks, almost none of them found them to satisfy the same needs. There were a few common remarks. First, Connectibles was about deeper, and thus fewer, social relationships. That also meant that the types of social behavior a tangible social network should support are different than those a virtual social network should. One subject wrote, “Connectibles is more suited for the few most intimate [people] in your lives, that you want constant ‘connections.’ Web-based [social networks are more suited for] the mass friends in your life.” A sense of social connection is more important with one's inner circle. This subject seems to indicate that this kind of communication is different than what one might want or need from a PC-based social network.

One subject summed up key aspects of the system, writing, “The physical objects are nice. They feel like you've exchanged a real thing. Unlike the stupid ‘gifts’ you can buy for people on Facebook.” Another wrote, “The physical objects are more personally meaning and precious.” Another said, “There's something about the token aspect and the desire for a connection that makes me think of memories as well as social networks. In that way, I think I would use [Connectibles] in situations and relationships that I would like to remember.” The physicality was clearly important, especially for establishing a sense of social connection.

The series of evaluations revealed a lot of new directions for the Connectibles concept. They also indicated that the idea has promise, since many users left with positive impressions of the system. The evaluations indicated that the system works best for people who have pre-existing, friendly social relationships, which bears out a hypothesis of the Connectibles design. By the same token, users who do not have strong relationships with other participants do not easily see Connectibles' value.

Most important, the physicality of the design seemed critical to almost all the subjects; physical objects clearly embodied a deeper sense of social connection than virtual representations of social relationships. This fact supports the theoretical claim of the importance of objects as symbols of social relationships.

Future work would include a tighter coupling between the Visual application and the physical connectibles, a better industrial design that allows more facile arrangement of the connectibles themselves, use of more precious materials to allow connectibles to seem more like typical keepsakes, and production and deployment of connectibles in much larger numbers.

CONCLUSION

This research suggests a new kind of tangible social network application rooted in physical objects and real world social behavior. A prototype application, Connectibles, was built to explore this vision. This prototype demonstrated the promise such a system has for allowing people to feel intimately socially connected to their friends and family. Its evaluation shed light on its flaws and offered direction for future improvements.

Most importantly, the physicality of the system generated an enthusiastic response among the subjects. Tangible interfaces are often criticized for their cost: physical things cannot be easily copied and distributed, they can become worn over time, they are hard to replace. In this case, it is precisely these properties that engendered the users' positive response. The theoretical framework suggested that signals in the form of physical objects would better represent close social relationships than purely virtual signals. These two different kinds of media entail different inherent costs; these costs influence how reliably these media can signal the strength of a social relationship. This framework led to the idea that customizable, physical gifts entail greater costs in the domain of the quality being signaled -- the strength and existence of a social relationships -- than generic, inexpensive virtual signals. The higher costs inherent in a physically based system tacitly cause users to signal only their close relationships, pruning out weak acquaintances and strangers.

Connectibles was designed to explore this hypothesis. Happily, the evaluations support it, and suggest there is more work to do.

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