Mobile Support for Face-to-Face Social Interaction

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INTRODUCTION

Mobile devices allow people to connect with the rest of the world from anywhere. People can now be reached regardless of where they are. If a child gets injured at a school, for example, their teacher can connect with a parent immediately, even if the parent is not at home or work. People can also access information from anywhere. Before ordering dinner at a new restaurant, a diner can look up the most popular dishes on Yelp right from the table.

Ironically, however, while mobile devices connect users with the greater world, they often disengage them from their immediate environment. Individuals are isolated by their mobile devices even when they are surrounded by other people, creating situations in which people are "alone together" [14]. In a study of hundreds of enterprise workers, we found that people believe phone use interferes with meeting productivity and collaboration [1]. Mobile devices are so disruptive that we create rules to regulate their use (e.g., "No phones allowed at this meeting!").

However, like it or not, computers are increasingly present in our social spaces. A recent analysis of 456 *Law and Order* episodes from the past 20 years found that over time computers have become more prominently featured in the show's social spaces and that people are more likely to use a computer when another person is present [8]. People's mobile search behavior clearly illustrates our social use of mobile devices. Although mobile search tools are generally designed for individuals, most mobile searches actually involve groups of people searching together. For example, friends headed out to eat might work simultaneously on their smartphones to find a good restaurant. One study [6] found that 93% of smartphone users have engaged in co-located collaborative search with multiple phones at some point, and another [2] found that 65% of all mobile searches take place in the presence of others. Similarly, people share the pictures they take in real time by holding out or passing along their device so that they can experience their friends' reactions with them [7]. In this way pictures often serve to make conversation as much as to document an event.

Currently there is limited technology-based support for co-located, synchronous social interaction. However, rather than fight the creep of technology into our social spaces, there is an opportunity to build solutions that embrace it. By reframing our *personal* devices as *social* devices, as shown in Figure 1, we can design tools to enhance face-to-face interaction instead of detracting from it. Just as software for large shared displays necessarily differs from that for individual computers [10], mobile phone applications must account for the fact that other people are often present.

Personal Devices
Remove us from social context
Isolate us from companions
Encourage inattentive behavior
Distract attention
Promote passive experiences
Foster "absent presence"

Social Devices
Engage us with those around us
Connect us with our companions
Help us participate more fully
Focus attention
Promote interactive experiences
Foster collaboration

Figure 1. Currently mobile devices are treated as *personal* devices, designed to support our personal information needs. We propose reimagining mobile devices as *social* devices.

Popular social applications, such as Facebook, Twitter, Skype, and Outlook, support interaction with others regardless of location. Recently some social applications have begun to provide localized social content. It is possible, for example, for a person to see what people tweet near them using NearbyTweets.com, or meet people near them using Meetup. However, most applications that have moved into the co-located space focus on social relationships that are weak, helping users connect with or access content generated by people they do not know. This is despite the fact that many of the most successful social applications support strong social relationships; the people a person emails or friends on Facebook tend to be those closest to them. Although some applications, like FourSquare and Friends Radar, help people serendipitously connect with existing friends, there is in general a dearth of co-located social solutions to support strong relationships. We propose filling this hole by building mobile tools that augment existing face-to-face interactions.

SUPPORTING FACE-TO-FACE INTERACTION

Social mobile device use is different when users are physically co-present rather than remote in that users share a persistent communication channel and significant context.

Figure 2. Audience feedback is shown as red and green dots alongside the presenter's slides. Attendees engage with the presentation by providing feedback via their phones.

We propose co-located mobile applications take advantage of these unique aspects by not taking users' attention away from their immediate surroundings, and by augmenting existing physical and verbal communication.

Keeping Attention on the Surroundings

One reason that mobile device use tends to be seen as rude is that it often removes the user's attention from their immediate surroundings. To avoid this, mobile devices should support input and output modalities that require minimal attention to the device, leaving the user's attention free to focus on the people around them. Smartphones, tablets, and, more recently, wearable devices provide new sensors that can enable low-attention scenarios. A person, for example, can input information into their mobile phone merely by tapping their pocket [9], or get output from their phone via vibration [10].

As an example of how mobile devices might support low attention input and output, we developed a system that allows meeting attendees to provide feedback from their mobile devices during a presentation [10]. Audience feedback is aggregated and reflected back to attendees alongside the presenter's PowerPoint slides, as shown in Figure 2. The feedback, however, is incidental to the audience's primary goal, which is listening to the presentation. Using the touch screen and accelerometer, their phones can recognize their gestures and allow them provide input without attending to the device at all. For example, in one implementation of the system a phone that is face up provides positive feedback, while a phone that is face down provides negative feedback. Likewise, phones' sensors could be used to identify hand raising or clapping, and that information could be used for feedback.

While the system engages the audience and creates a sense of community among the people who use it, it can be hard for the presenter to keep track of what is occurring in the backchannel while they are talking. For this reason, when an interesting feedback event occurs a summary notification is created and the presenter's mobile phone vibrates to create awareness. Although not currently implemented, audience members' phones could also vibrate, creating a communal awareness of feedback events and re-engaging people in the feedback experience.

Figure 3. A co-located mobile search application that supports physical signaling. The two users on the left have rotated their phones to a landscape orientation to invoke collaborative search features, while the third user searches independently with her phone in portrait orientation.

Supporting Physical Signaling

In addition to not detracting from people's immediate social surroundings, social mobile devices could also be used to augment people's existing interactions. One way to do this is to support and augment people's physical cues.

We explored the use of physical signaling via a mobile search application [12]. Although most mobile search tools are designed for individuals, many mobile searches involve people searching with others [2, 6]. During these searches, collaborators transition between individual and group search, moving closer to each other and sharing their screens while discussing search criteria and results. We developed a mobile application that explicitly supports this behavior by allowing users to physically signal their willingness to share. The core application provides standard mobile search functionality when the phone is used in an upright, vertical position. However, users can rotate their devices horizontally to indicate (to the device and others) that they are ready to collaborate, as shown in Figure 3. The phone's rotation causes it to enter screen-sharing mode; subsequent group members who rotate their phones are then able to interact with the sharer's screen contents directly.

The use of device orientation to control interaction is an active area of research. For example, Codex [3], a prototype dual-screen tablet computer, activated collaboration features upon detecting the device was in an "outward facing position." Our mobile search application builds on the concept of sensor-based interactions to multi-person, multi-device collaboration scenarios, in which a device's orientation serves as a signifier of a desire to collaborate both to the controlling software and the co-located group

members. Luff and Heath [5] note that small adjustments to the position and orientation of paper or mobile devices support delicate shifts in collaboration.

Supporting Verbal Communication

We also believe that social mobile devices should actively seek to increase interpersonal discussion and augment the positive aspects of having a verbal backchannel between co-located people, while reducing unnecessary coordination costs. Communication, and, in particular, voice communication, has been shown to have a significant positive impact on cooperation and trust [4], which is essential to positive social experiences.

As an example of how a mobile device might encourage verbal communication, we developed a mobile application that identifies and describes meeting attendees in order to foster social relationships [1]. By observing the application in use across a number of enterprise meetings, we found that users valued being able to access information about the other people in the room, particularly when those people are unfamiliar. To help users engage with the people they were learning about while using their phones, we employed a gaming approach that asks trivia questions about the other attendees. This gameplay appeared to focus attention within the meeting context and spark conversations.

Similarly, the social mobile search application described earlier uses trivia questions to spark conversation during a search [13]. For example, when collaborators search for a café, they might receive a pop-up asking, "What was the first retailer to offer freshly-brewed coffee in to-go cups?" The pop-up appears simultaneously across everyone's phone, and must be dismissed for participants to continue their search. Because everyone is interrupted with the same question at the same time, this can spark conversation. However, such interruptions can also distract users as they try to complete their task. For this reason, trivia questions are timed to minimize disruption and do not appear during activities like text entry.

While society is primarily concerned about how mobile devices can interfere with our face-to-face interactions [14], there are also aspects of conversations that people may prefer to avoid that mobile devices could help offload. For example, when watching groups of co-located users search for a restaurant to eat at, we observed that the groups often had a hard time wrapping up and deciding upon a final selection. To alleviate this difficulty, the mobile search application we developed [13] provides an "I'm hungry!" button that group members can use to indicate that it is time to make a decision. When the button is clicked, the system automatically chooses the most popular result based on user feedback, and proposes it for approval.

SUMMARY

Despite the fact that successful social applications tend to support strong social relationships, there are few mobile solutions that support strong co-located relationships. We call on the HCIC community to help address this gap by building mobile tools that augment people's existing face-to-face interactions. We proposed several ways that mobile devices might be improved to help users engage with the people around them, rather than ignore their immediate social context. Mobile device use by co-located users is unique in that users share persistent verbal and non-verbal non-mediated communication channels and significant background context. Co-located mobile applications can take advantage of these unique aspects to support social interaction. Using several examples, we show that it is possible for mobile devices to not take their users' attention away from the people they are with, and to augment existing physical and verbal communication.

We are interested in engaging the HCIC community to brainstorm additional unique aspects of co-located social mobile device use, and to think about how these aspects might further be capitalized on to improve the social mobile experience. Our ultimate goal is for people to react positively when the person they are with pulls out a mobile device, rather negatively.

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