Supporting Self-Expression for Informal Communication

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ABSTRACT
Mobile phones are becoming the central tools for communicating and can help us keep in touch with friends and family on-the-go. However, they can also place high demands on attention and constrain interaction. My research concerns how to design communication mechanisms that mitigate these problems to support self-expression for informal communication on mobile phones. I will study how people communicate with camera-phone photos, paper-based sketches, and projected information and how this communication impacts social practices.

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ACM Classification Keywords H5.2 [Information interfaces and presentation]: User Interfaces.

General Terms Design, Human Factors

INTRODUCTION

> *Self-expression must pass into communication for its fulfillment* (Pearl S. Buck).

Self-expression, expressing one's thoughts or feelings, can occur through a variety of creative outlets. Hollan and Stornetta [4] define informal communication needs as "human requirements which, when met, encourage and facilitate interaction," and explain that new mechanisms for meeting those needs are required for new media. I posit that new mechanisms for supporting self-expression on mobile phones are required to meet communication needs.

My research explores supporting self-expression for informal visual communication on mobile phones, by designing mechanisms that reduce demands on attention and mitigate UI limitations. I have begun by conducting a study of photo-based communication, to expose needs that are not ideally met by current mechanisms. Next, I will explore forms of expression that extend beyond the phone: sketching on interactive paper and projecting digital information onto the physical world (Table 1).

Participants in the initial study of photo-based communication sometimes felt disadvantaged when adequate photo opportunities were not available, and they suggested that, in these situations, sketching could complement photography. To follow up on this observation, I will conduct a study of sketch-based communication: I will examine use of a mechanism for real-time sharing of sketches drawn with digital pens on interactive paper.

Form of expression	Cameraphone photography	Sketching on paper	Projecting onto world
Example			

Table 1: Research overview

Study participants also described sharing photos in person, holding up their phones or passing them around so others could view the small displays. Some also regularly checked their phones for new photos. These observations led me to consider how Pico projectors, which enable mobile phones to project large displays, could enrich collocated communication and facilitate ambient awareness. I will study how projector-phone use impacts face-to-face communication and design suitable interaction techniques.

These research projects will explore expanding the mobile phone UI. The mobile phone usage context is relatively unconstrained, yet interaction with these devices is typically bound to the handset. The photo study examines use of a mobile phone-bound UI, as a base case. The sketch study considers expanding the phone UI to include paper and pens, and the projection study considers further extending it to include the physical world.

METHODOLOGY AND APPROACH
I will build and deploy systems intended to support self-expression for informal communication. I will conduct user studies, with quantitative and qualitative measures, to evaluate the systems and observe how people use them. These studies will contribute lessons that application designers can draw on to design additional mechanisms.

Two design themes guide this research. (1) *Leveraging existing practices*. I will embed photo-based communication into the mobile workflow and sketch-based communication into paper-based practices, and I will leverage gestural practices for interaction with projected displays. (2) *Interface transparency*. To enable users to focus on communicating with people, interfaces should be

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simple and easy to use, and interaction with off-the-phone supports should take place directly via those supports.

PHOTO-BASED COMMUNICATION

The communication mechanisms now typical on mobile phones, such as voice, SMS, and MMS, require explicit interaction, which can place high demands on attention. Yet mobile phones also present opportunities for implicit interaction. People carry their phones with them nearly everywhere and interact with them regularly, and these devices could subtly provide additional information in the periphery of attention during these interactions. Engaging the periphery, what we are attuned to without explicitly attending to, is an essential component of Weiser's vision of calm technology [11]. Such systems allow flexibly attending to information without being overloaded.

To explore how to engage the periphery of users' attention for mobile visual communication, I created Emotipix [2]. Emotipix is an application that turns the background (i.e., wallpaper) of a phone's home screen into a place for photo-based conversations. Emotipix aims to support social awareness, without causing distraction, by placing the display in the background of the workflow, providing options for interaction without demanding their use, and requiring minimal explicit actions from the user. Mobile peripheral displays had been proposed for individual use [1] but their social uses had not yet been explored.

When Emotipix users take camera-phone photos, they are automatically shared with a small group of friends or family, and appear in the background of their phones (Figure 1). A subscriber can tap an icon on the phone's home screen to send *karma*, positive feedback about a photo. *Stickers* (i.e., tiny photo icons) identify the photo's publisher and any subscribers who have sent *karma*.

Figure 1: Emotipix UI in mobile phone background

I investigated the use of Emotipix through a 14-day user study with 16 participants, including 6 pairs and a 4-person group, consisting of close friends or family. To observe naturalistic usage practices, I conducted an unstructured field study, in which participants used phones running Emotipix as their primary mobile phones.

Interview responses indicated that the Emotipix display engaged the periphery of users' attention for lightweight visual communication. All 16 participants reported that, they did not find Emotipix's display distracting or disruptive to their workflow, even while regularly noticing it (e.g. while glancing at the time or checking for missed calls). All participants reported that Emotipix's automatic publication reduced the effort required to send photos, the glanceable display reduced the effort required to view photos, and the karma mechanism reduced the effort required to provide feedback. Consequently, participants reported increased mobile photo-based communication.

We categorized the subjects and uses of Emotipix photos, and the largest category (49%) depicted aspects of everyday life, such as homes, workplaces, pets, weather, and meals. These mundane photos helped participants feel aware of friends' activities and often conveyed an implicit status update or "thinking of you" message. Kuwabara et al. note that sharing implicit information, such as presence and status, may foster social connectedness [5].

Some participants falsely expected Emotipix to behave like the familiar communication mechanisms (e.g., SMS) that mobile phones typically support. For example, we informed users that Emotipix did not guarantee *if* or *when* subscribers would see specific pictures. Yet, publishers expected their friends to see new pictures promptly and sometimes alerted friends of new photos. These practices, which complement Emotipix's intended calmness, are in line with Rogers' assessment of how users appropriate technologies for their own ends [7]. We face a design challenge: to give users the control they want without increasing demands on attention.

SKETCH-BASED COMMUNICATION

To address people's needs for informal communication on mobile phones, many applications have been introduced (e.g., SMS, email, social networks). Yet, the form of interaction is derived from that of the classic computer interface (e.g., text entry via a keypad, menu selections), and the phone's small screen impacts the usability of these techniques. Paper documents have important properties yet to be achieved by digital media, including portability, flexibility, readability, and high resolution [8]. Paper-based interfaces that digitize input enable users to exploit the affordances of both paper and digital media (e.g., search, storage, modification, distribution).

We created UbiSketch to investigate paper-based self-expression. UbiSketch is a mixed paper-digital infrastructure that integrates pen and paper with mobile phones to provide a platform for developing novel applications to support informal communication. It embeds communication into existing paper-based practices, such as note-taking, hand-writing, doodling, and drawing. Research on interactive paper [12] has not explored its use for informal communication in real time.

UbiSketch enables the real-time transmission of pen-and-paper sketches to digital services. Users carry an Anoto digital pen and paper, for capturing paper-based interactions, and a Bluetooth-enabled smart phone, for connecting to the Internet. UbiSketch streamlines data capture and publication: Users simply sketch on paper, and tap interactive paper buttons to publish sketches to channels such as Facebook or Twitter (Figure 2).

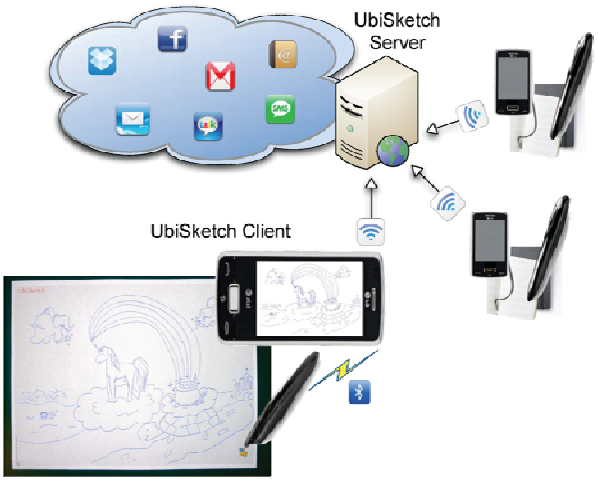

Figure 2: UbiSketch system overview

We conducted a laboratory study with 11 participants, to inform the UI design and explore the system's potential to support novel interactions. We evaluated the UI by observing users perform an open-ended sketching task with a working prototype, including an application called SketchBook that enables users to publish sketches to Facebook (Figure 3), and eliciting feedback. We also conducted interviews to discuss users' experiences, and at a follow-up meeting we asked them to reflect on Facebook interactions that resulted from posting their sketches.

Figure 3: SketchBook publishes sketches on Facebook

All participants reported that sketching with UbiSketch felt natural, just like drawing with an ordinary pen on paper. Many users were excited to see their sketches appear instantly on Facebook, describing the experience as easy and fun. The published sketches, despite being created in a laboratory, led to social interaction, some receiving many "likes" and comments on Facebook and spawning conversations. These initial observations indicate that UbiSketch shows promise to support informal communication and merits further study.

The results of our initial UI evaluation will inform the design of a revised interface in which: (1) the sketching area will be maximized and the digitized sketch will faithfully capture the detail of the original, (2) the paper UI will be portable, simple, easy to use, and the primary interface (minimizing phone interaction), and (3) the phone UI will provide feedback which the paper UI cannot.

Next Step: Field Study of UbiSketch

We will conduct a 1-month field study, including 10 sketching participants and their friends, to observe naturalistic behaviors. We will deploy UbiSketch for open-ended use and will collect data through logging and interviews. The publication channels, which can be selected via the paper UI, will include Facebook and Twitter. We will observe participants' sketching practices and communication that results from publishing their sketches.

PROJECTION-BASED COMMUNICATION

Mobile phones can help us stay connected with friends, family, and colleagues. Yet they can also isolate us from the physical world around us, drawing our attention into a private digital world. Further, mobile phones' small screen size and limited viewing angle make it difficult to share displayed information with collocated people. Large public displays, in contrast, can present information to many people and catalyze social interaction [6]. Pico projectors can enable mobile phones to provide some affordances of large displays (Figure 4), potentially bridging the physical/digital and enriching face-to-face communication.

Figure 4: Projection can enrich face-to-face communication

Next Step: Field Study of Projector-Phone Practices

Projector-phone use has many implications for informal communication. Presenters can share information with many people simultaneously, and can incorporate the projection surface, projected content, and motion of the projector into their communication practices. They can also display information without demanding that a particular person attend to it, which could reduce social barriers to interaction. However unintended viewers could also see the information, which risks the privacy of displayed content and risks invasiveness to people nearby. I have begun to

consider some of these implications [3], and will conduct a long-term, open-ended field study to investigate further.

Next Step: Gestural Interaction with Projected Displays

Currently, interaction with commodity projector phones occurs via the handset UI; users must look at the device to interact with buttons or a touch screen. Context switching may divide users' attention between the device and the projected display and disrupt ongoing conversations. Also, collocated users may have difficulty interpreting the presenter's activities as he/she interacts with the handset, and they cannot "drive" the system themselves. Techniques for interaction with the projected display could help.

We propose to leverage gestural communication practices for hand shadow-based interaction with mobile projected displays. While holding a projector in one hand and gesturing with another, a user may cast a shadow on the display by occluding the projector's light source. Shadows detected using the phone's camera provide system input.

Hand shadows are well understood by most people, providing an intuitive, embodied interface. Also, they implicitly support collocated interaction: one user can see another user's hand shadows and maintain awareness of what he/she is doing, and can interact with the other's display by casting shadows on it. Shadows have been studied for conveying presence to remote collaborators [10] and extending users' reach on large interactive surfaces [9].

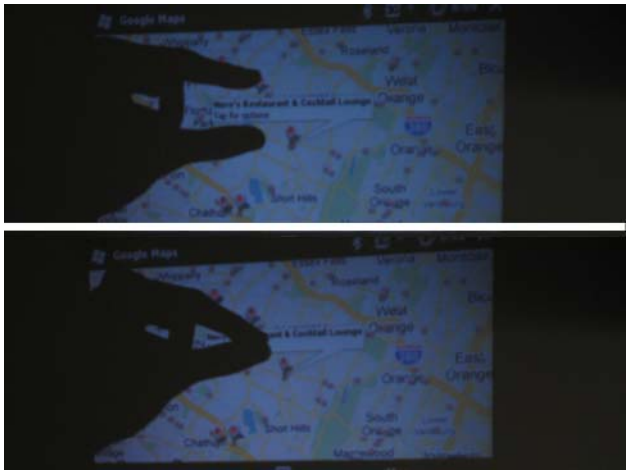

Figure 5: Shadow gesture example (pinching)

We will create ShadowPuppets to study shadow-based gestural interaction with mobile projected displays (Figure 5). Shadow input scales with display size as users move closer or farther from the display surface. Users can adjust the distance between the hand and the projector to change relative size of the shadow and granularity of interaction. We will conduct a laboratory study to examine what hand shadows people intuitively associate with common operations (i.e. select, cut, paste). We will also study the tradeoffs between coarse-grained shadow input and finer-grained input using the mobile phone's touch screen.

CONCLUSION

My research will explore how to design mechanisms for self-expression on mobile phones. I will investigate photo-based, sketch-based, and projection-based communication. These mechanisms will enrich informal communication, enabling mobile phone users to express themselves in ways that are currently not ideal or not possible. My research will broaden our understanding of how people communicate, expose unmet communication needs, and contribute lessons that application designers can draw on to meet those needs.

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