Mobile Collocated Interactions: From Smartphones to Wearables

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Abstract
Mobile devices such as smartphones and tablets were originally conceived and have traditionally been utilized for individual use. Research on *mobile collocated interactions* has been looking at situations in which collocated users engage in collaborative activities using their mobile devices, thus going from *personal/individual* toward *shared/multiuser* experiences and interactions. However, computers are getting smaller, more powerful, and closer to our bodies. Therefore, *mobile collocated interactions* research, which originally looked at smartphones and tablets, will inevitably include ever-smaller computers, ones that can be worn on our wrists or other parts of the body. The focus of this workshop is to bring together a community of researchers, designers and practitioners to explore the potential of extending *mobile collocated interactions* to the use of wearable devices.

Author Keywords
Collaboration; handheld devices; multi-device; multi-user; device binding; wristwatch; finger ring; jewelry

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

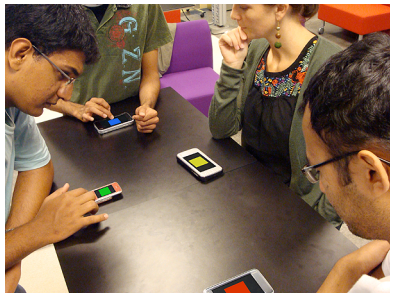

Figure 1. Kapteeni, a distributed memory game on mobile phones based on 1978's Simon game.

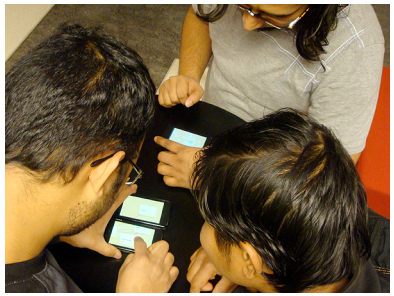

Figure 2. MindMap allows a workgroup to create, edit, and view virtual notes on any table.

Figure 3. Pass-them-around allows people to share photos using the metaphor of passing printed photos.

Introduction

Mobile Collocated Interactions

Mobile devices such as smartphones and tablets were originally conceived and have traditionally been utilized for individual use. Research on *mobile collocated interactions* [6][11][16] has been looking at situations in which collocated users engage in collaborative activities using their mobile devices, thus going from *personal/individual* toward *shared/multiuser* experiences and interactions (Figure 1).

Several researchers have explored *mobile collocated interactions*, encouraging people to share their devices to create a collective experience or reach a common goal. Various physical and social contexts of use have been taken into account, such as teamwork at the office [7] (Figure 2), sharing media content at home [8] (Figure 3) and outdoors [3] (Figure 4), public expression in a theme park [4] (Figure 5) and in a pub [9] (Figure 6), and for sharing educational stories in rural, developing-world contexts [17]. More recently, researchers have been looking into simple ways to bind such devices together [10]. Most of this research has been looking at the use of smartphones (and tablets) to study *mobile collocated interactions*.

Wearable technologies

Computers are getting smaller, more powerful, and closer to our bodies. Computers have transitioned from being in a large room (e.g., ENIAC), to our desks (e.g., PCs), to a bag (e.g., laptops), and to our pockets (e.g., mobile phones). Wearable computers (e.g., the WIMM watch [1] or iPod Nano[2]) have continued the trend towards ever-smaller computers, ones that can be worn on our wrists (e.g., Apple Watch[3]) or other parts of the body (e.g., Google Glass[4]).

Researchers have actively looked into novel input wearable devices. For example, Nenya [1] (Figure 7) consists of a magnetic finger ring that provides an always-available input mechanism. It allows for simple input actions such as twist to select and slide along the finger to click. A wrist-worn sensor tracks this small and socially acceptable ring. Facet [14] (Figure 8) is a multi-display bracelet consisting of multiple independent touch-sensitive segments. It supports multi-segment touch, yielding a rich set of touch input techniques. BitWear [15] (Figure 9) is a prototyping platform for small, wireless, interactive devices. BitWear incorporates hardware, wireless connectivity, and a cloud component to enable collections of connected devices. *NotifEye* [12] uses a rub pad placed on people's index finger to provide input to interactive glasses by means of small, subtle finger movements. A natural first step for this line of research has been to look into individual use of these wearable devices.

Towards Mobile Collocated Interactions with Wearables

Mobile collocated interactions research, which originally looked at smartphones and tablets, will inevitably include ever-smaller computers in different form factors. The focus of this workshop is to bring together a community of researchers, designers and practitioners to explore the potential of extending *mobile collocated interactions* to the use of wearable devices.

[1] WIMM One. www.wimm.com/

[2] iPod Nano. https://www.apple.com/ipod-nano/

[3] Apple Watch. https://www.apple.com/watch/

[4] Google Glass. https://www.google.com/glass/start/

Figure 4. Mobiphos allows a group of collocated people to capture and simultaneously share photos.

Figure 5. Automics allows people to capture, share and annotate photos amongst theme park visitors.

Figure 6. MobiComics allows groups of collocated people to create and edit comic strip panels.

Workshop Goals

In previous workshops on the subject of *mobile collocated interactions* at MobileHCI '11 [16] and at ITS '13 [2], several design and evaluation challenges were identified as being the core of this research area: group size, physical distance, device-binding, operating systems, privacy, extending to public displays and tabletops, and conducting in-the-wild evaluations. One question that was introduced in our first workshop and that still remains unanswered is *how can we move beyond just designing for smartphones?*

We are currently witnessing how computers are getting smaller, more powerful, and closer to our bodies. As Google Glass, Pebble, Android Wear and Apple Watch gain popularity, we will soon be considering situations where people want to use a rich ecosystem of small wearable devices and engage in *mobile collocated interactions*. Such interactions may include clothing, eyewear, wristwatches, rings, pendants, and jewelry.

In this workshop we want to continue exploration of *mobile collocated interactions* and promote research into this domain. In particular, the focus will be on creating a deeper understanding of designing and evaluating collocated interactions with wearable devices. The goals of this workshop are:

- Identify key opportunities for *mobile collocated interactions* with wearable devices.
- Investigate how devices will be bound together.
- Consider more intimate or personal ways for interaction, as these devices get closer to our bodies.
- Explore interaction paradigms that can be (re-) appropriated for such interactions.
- Examine adequate ways of prototyping and evaluating such systems.

Workshop Plan

The aim is to bring together a mix of researchers and practitioners from disciplines such as interaction design, human factors, computer science, art, and HCI who are interested in exploring mobile collocated interactions with wearable technologies.

The first half of the workshop (the morning) will be dedicated to introducing emerging forms of mobile collocated interactions with wearable technologies and the presentations of the individual attendees. Time will be spent preparing a list of topics for the afternoon.

The second half of the workshop (the afternoon) will consist of a 'hands on' session, where we will split into three teams and try to create three working prototypes using wearable technologies. We will scaffold this activity by introducing participants to Lundgren et al.'s design framework for mobile collocated interaction [13]. Each team will take a particular aspect of transitioning from mobile collocated interactions with smartphones to wearable technologies (presented or identified during the morning session). We will bring Bluetooth Low Energy devices, WIMM, and Arduino to sketch mobile collocated interactions. We will then work out a concept for collocated interactions based on wearables and create a simple working prototype. This activity will stimulate discussion on how to prototype and evaluate such concepts.

Figure 7. Nenya is a magnetic ring allowing simple input actions such as twist to select and slide to click.

Figure 8. Facet is a multi-display bracelet consisting of independent touch-sensitive segments.

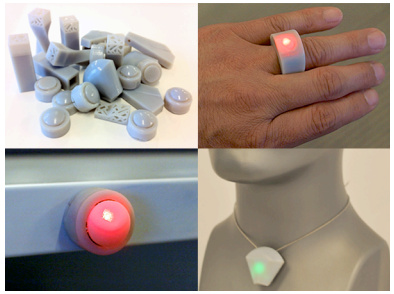

Figure 9. BitWear is a prototyping platform for small, wireless, interactive devices.

The results of the workshop will be summarized and published on the workshop's website[5]. Depending on the maturity of the submissions and the outcome of the workshop, we intend to write a special journal issue with an appropriate publisher to promote this research area.

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