Sharing Availability Information with InterruptMe

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ABSTRACT
Workplace collaboration often requires interruptions, which can happen at inopportune times. Sharing availability information can reduce many of these untimely interruptions. However, designing a successful availability-sharing system requires finding the right balance to maximize the benefits and reduce costs for both the interrupter and interruptee. The main challenges for finding such balance lie in the acquisition of availability information from the interruptee and its delivery to the interrupter. In this demonstration, we show how common technical approaches in ubicomp can address some of the problems typically encountered in availability sharing. We present InterruptMe, a novel availability sharing system that uses sensor information to calculate multiple availability measures for each interruptee and that delivers this information in the periphery of the interrupter's attention by using a projected peripheral display and monitoring implicit inputs to the system.

Author Keywords Workplace awareness, availability, interruptibility, InterruptMe

ACM Classification Keywords H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces—collaborative computing

General Terms Design, Human Factors

INTRODUCTION
Effective collaboration in the workplace requires various modes of interaction. Co-located and remote colleagues may interact face-to-face or over different media such as the telephone, instant messaging, and email. Above all, they must maintain a general awareness of one another. Researchers have explored multiple ways of providing support for this kind of awareness through a class of computational systems that are generally characterized as *awareness systems*. Awareness systems are motivated by the observation that workplace awareness leads to more interactions between colleagues and a general improvement in performance [12]. However, while increased collaboration is generally considered beneficial, it also incurs costs: people can interrupt their collaborators at inappropriate times, leading to increased task switching, redundancy in work, and stress [11].

Guided by the premise that better timing of interruptions decreases their disruptiveness [1], a subset of awareness systems focus on communicating the availability of others with whom one collaborates. The goal of these systems is to help collaborators identify the most appropriate (and least costly) times to initiate interactions. Designing a successful availability-sharing system requires striking the right balance between maximizing the benefit for, and minimizing the costs incurred by, each of the participants in a collaboration. In [8], we discussed this balance, characterizing it as a series of preferable positions within a design space for availability sharing. For the *interrupter*—the person who is initiating the interaction—the system should facilitate making a quick, accurate decision about whether, when, and through what communications medium it is appropriate to interrupt the other person. In contrast, the main cost to be minimized for the *interruptee* is the disruptiveness of the communication. However, previous research shows this information and the systems themselves often fall into disuse due to the costs associated with privacy [3, 13, 10], to getting awareness information at the time of the interaction, and to the intrusiveness of data acquisition. Hincapié-Ramos et al. [8] present a detailed discussion about the balance of needs and costs between interrupters and interruptees.

We present InterruptMe, an availability-sharing system designed to balance the costs and benefits between the interrupter and the interruptee, and that can lead to new directions for research and development in this domain (Figure 1).

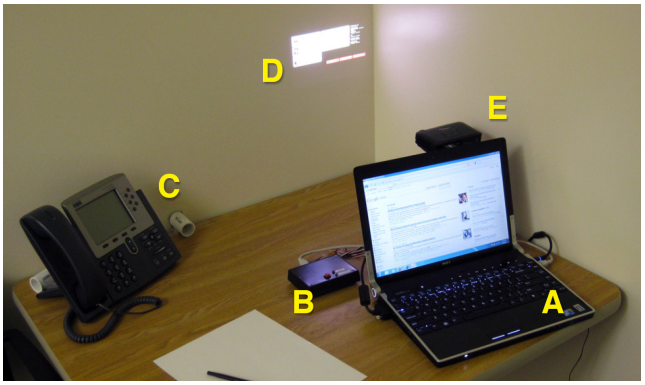

Figure 1. InterruptMe uses a set of sensors (A,B,C) to trigger (D) the peripheral availability display, generated by (E) a pico-projector.

RELATED WORK
Early explorations of availability include *media spaces*, which sought to connect individuals using continuous audio and video links [3, 13] or slowly updated images [2], thus enabling remote collaborators to estimate the availability of remote colleagues before initiating interaction. Later research, though, showed that human interrupters are not very good at determining the availability of another person from these high-fidelity channels alone [4].

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Other research emerged to explore the value of calculating a person's availability from various cues. Peepholes [6] provided information about its users availability by using iconic presence indicators. This system introduced the idea of modeling availability based on users network connectivity and computer activity levels. Automatic data collection has been studied in several systems, such as ConNexus [14] and MyVine [5]; these systems all used a combination of computer activity, location, calendar information, and manual user input to model a user's availability. Although these approaches were generally well received according to user studies, several problems were identified, including increased privacy concerns, misinterpretation of awareness cues, and high interaction costs of accessing the availability information provided by the systems. Finally, some researchers have questioned the assumption that availability information is a single and comprehensive measure. Horvitz and Apacible [9] investigated how the disruptiveness of an interruption depends on the communication channel, and Harr and Wiberg [7] found that *being busy* does not mean *being unavailable* but changes the likelihood of using a communication channel and the expected response.

INTERRUPTME

Figures 1 and 2 show InterruptMe, a novel availability-sharing system that occupies a unique position in a design space for availability-sharing systems [8]. This design contributes to the ubiquitous computing discussion of availability-sharing systems in two ways. First, the system uses physical sensors (e.g., chair lumbar pressure, audio level, desk and doorway motion sensors and a telephone hook sensor) and virtual sensors (e.g., general activity on a computer and use of e-mail and IM client applications) to calculate a different availability value for each communications medium (e.g., telephone, IM, email, or face-to-face). This availability is calculated by a rule-based engine and shown using a binary value for each communications medium (i.e. the interruptee is either *available* or *unavailable*). This approach facilitates data interpretation by sharing an easily interpretable value for each communications medium, but does not disclose raw sensor or computer activity data, leaving little room for alternative or incorrect readings and preserving the interruptee's privacy.

Second, InterruptMe provides an unobtrusive, context-sensitive user interface for the interrupter. The system avoids the effects of display blindness by showing the interface only upon request or when the user implicitly prepares to use a communications tool; the rest of the time, InterruptMe keeps the projection blank. The projected interface becomes visible when, for example, the user picks up their telephone handset. InterruptMe detects that the interrupter is about to place a call and grays out those contacts who are not currently available to receive phone calls. A similar response occurs when the user activates an IM application or email client on their desktop computer. By using implicit interaction, InterruptMe provides interrupters with availability information as an interaction is being initiated. This information helps them to decide whether to carry on with the intended interaction (when the user is available), to delay it, or to try a different communications medium.

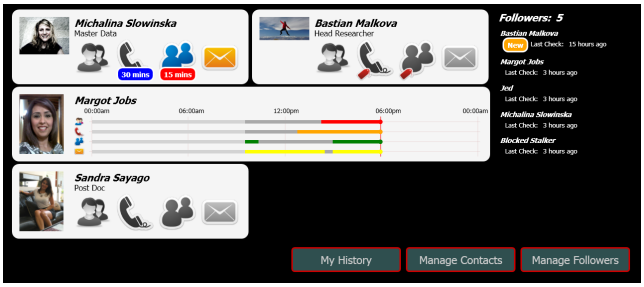

Figure 2. InterruptMe user interface. Color icons indicate availability; gray-scale icons, unavailability.

In conclusion, InterruptMe illustrates how ubicomp technologies like sensor platforms and peripheral displays can provide new insights for established research domains like availability sharing. Our system also serves as a test bed for innovations in the design of better sensors, alternative representations of availability, and studies of people's awareness sharing preferences. Finally, we are currently evaluating InterruptMe as a tool for real-world information workers.

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