Chapter 8
On Ambient Information Systems:
Challenges of Design and Evaluation

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ABSTRACT

The rise of the Internet, the ever increasing ubiquity of data, and its low signal-to-noise ratio have contributed to the problem of information overload, whereby individuals have access to more data than they can assimilate into meaningful and actionable information. Much of the success of Web 2.0 has been achieved after an effective tackling of this problem. Ambient Information Systems take the battle into the physical world by integrating information into the physical environment in a non-intimidating and non-overloading fashion. After two international workshops on Ambient Information Systems, we outline our vision for the field, consolidate a new definition, identify the key concerns of the research community, and issue a call to arms for future research.

INTRODUCTION

Various multimedia and Internet technologies have fueled strong cravings for information within our culture. Today the average American spends more time using various information communication technologies (ICTs), such as personal computers, cell phones, iPods, television, radio, etc., than any other activity throughout the day (Papper, 2005). About 30% of the day is spent with such ICT usage as the *sole* activity versus 20.8% spent on work activities, while an additional 39% of the day is spent using ICTs along with some other activity (ibid.). Such frequent use of ICT stems from an emergent desire to be constantly informed, and always aware of what is occurring around us.

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Rhetorical reports supporting both the pros and cons of this hunger for information have been discussed, with some touting the advantages of being always connected versus others claiming a pseudo-attention deficit disorder emerging among the populace (Richtel, 2003). Regardless of the possible benefit or determent, the world is moving toward greater and greater quantities of information being made available; the real question is *how* we are going provide this level of information without overloading people's senses. Similar problems have been addressed on the Internet using information filtering, aggregation, and personalization (cf. Brusilovsky et al. 2007), but since Ambient Information Systems (AIS) are deployed physically in the world around us they require new thinking about how to handle information overload.

Recently there has been a distinct shift in the medium that people use to interact with broadband information from the exclusive domain of the desktop computer to the laptop, phone, and handheld video game console. As display and computing technology continue to become widely available, it is inevitable that users will be able to interact with information on everyday household devices that up to now have not had this capability. However, it is apparent that if broadband information is allowed to constantly interrupt in all aspects of our daily existence, our lives could become much more confusing and difficult. Smoothly integrating this overwhelming abundance of information into the environment around us in such a way that it is available in a calm, non-overwhelming, ambience is the central goal of AIS research. Successful AIS require consideration of information modeling and filtering techniques, the societal impact of information technology, the psychology of human attentiveness, user experience, and emerging technologies and materials. AIS is inspired by a number of earlier movements, and overlaps with many paradigms, including *ambient displays* (Wisneski et. al., 1998), *peripheral displays* (Matthews, 2007), *slow technology* (Hallnäs, 2001), *glanceable displays* (Stasko, 2007), *informative art* (Holmquist, 2003), *unremarkable computing* (Tolmie, 2002), and *calm technology* (Weiser, 1995). AIS make use of existing artifacts and physical spaces to deeply integrate information so that is minimally distracting, but in some way perceivable even when not being directly concentrated upon. The classification of AIS are not restricted to the application of visual displays (as with peripheral displays), a particular level of efficiency (as with glanceable displays), scale of implementation (i.e. a single artifact vs. a large system of artifacts), or any particular type of hardware or software platform. Some recent AIS research investigates delivering information beyond the visual sense, using smell (Kaye, 2004), touch (Hemmert 2009), and sound (Hazlewood, 2008).

After two successful workshops on Ambient Information[1], with twenty oral presentations, two half-day discussion sessions, and engagement with a growing community of researchers, we have decided that it is time to consolidate the recent work of the community in this journal special issue. Our goal in this work is to use our engagement with the community to refine a definition of AIS, examine the issues that arise in terms of design and evaluation, and provide a set of challenges for furthering research in this domain. In the following sections, we structure our definition by stating and elaborating on the essential qualities of AIS. We follow by describing particular issues in both designing and evaluating this form of information delivery. We finish by laying out a series of grand challenges, which we feel are essential to further AIS research.

REFINING A DEFINITION OF AMBIENT INFORMATION SYSTEMS

It is tempting to try to understand AIS technologies by thinking about possible information devices that could exist exclusively in the periphery of attention, but in daily life our focus of attention