

Understanding Challenges in Designing Interactions for the Age of Ambient Media

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Abstract. This work builds on the existing knowledge, experience, and practices for designing interactive systems while it tries to develop an understanding of technologies and techniques that are most suited for interacting with ambient media. There are many computing trends emerging today ranging from desktop or mainframe scenarios up to mobile solutions and ubiquitous computing preferred by on-the-run consumers. Developments in processing and communication technology have been accompanied by new interactive devices and techniques needed to provide usability and make such technology advancements available and accessible for end users. We discuss in this work current practices for interacting with ambient technology with a special focus on using mobile devices and natural gestures for interfacing public ambient displays.

Keywords: human-computer interaction, ambient media, natural interfaces, mobile devices, smart phones, public displays, ambient content, gestures, novel interactions.

1 Introduction

This work addresses the interaction aspect in the new emerging age of ambient media. Next to important issues such as *content creation* (what is the message? and who creates it?), *content presentation* (how does the message gets through? what are the technologies?), and *addressability* (to whom is the message addressed? and in what context?), *interacting with ambient media content* represents an important research challenge.

As technology develops in terms of processing power, communication, and miniaturization (towards invisible and ubiquitous), new interfaces, devices, and techniques are needed in order to truly benefit of these technological advancements. This is a particularly important issue for ambient media where content is conveyed in a large variety of forms and formats. Factors need to be addressed such as usability, intuitiveness, and ease of interaction for an increasing variety of contexts, user groups, and technologies: tabletops and horizontal surfaces, remote displays, immersive displays, personal tangibles and smart devices [8]. We therefore identify several important questions to be addressed by the research community of (semantic) ambient media:

- What interfaces should be developed for interacting with ambient content?
- How can users/customers access, create, and share content?
- Which interaction techniques are the most appropriate?
- What types of interactions are most suited (passive or implicit vs. active or explicit)?
- Could natural interaction provide an answer?
- What interaction techniques are being proposed today by the research and industry communities?
- How do general interaction principles apply to semantic ambient media?
- How does semantic content help achieving fluent, effective, and efficient interactions?

2 Designing interactions in the ambient era

The questions being raised represent a considerable challenge. It is important therefore to look at how current interactions are being designed today by both research and industry and try to understand how they apply to ambient media. We focus in the following on novel interfaces which have been designed in order to accommodate the changing needs of end users as they move towards new computing paradigms (mobile, ubiquitous, and ambient). We specifically address the two most frequent solutions being proposed today for interacting with ambient media content: the use of mobile phones and natural (gesture-based) interaction. Figure 1 illustrates the concepts being discussed.

2.1 Mobile phones and smart devices

Mobile phones seem to hold a privileged position as physical computing devices for performing everywhere and anytime (ubiquitous) interactions. The features exposed by the various operating systems together with the hardware additions such as accelerometers, touch and multitouch screens, and video cameras have transformed mobile phones into *smart* devices. The challenge is to use all these *smart* computing capabilities in order to create intuitive and user-friendly interactions [1, 10, 25].

Different ambient media require different interaction techniques to be developed and remote displays represent a common manifestation of ambient content. Mobile devices are frequently proposed in order to control information on remote displays [2]. Vatavu [21] applied remote control of ambient displays using personal mobile devices as interfaces for controlling emotional manifestation of users with the purpose of enhancing human-human interaction.

The mobile phone needs firstly to connect to the system that employs and controls the ambient display. This is usually achieved by establishing a connection to a network through Bluetooth, IR, or wireless LAN. After the device connected successfully, a number of techniques are available for interacting with the public display: using the graphic interface of some software already existing (or downloaded and installed temporarily) on the device; sending SMS messages;

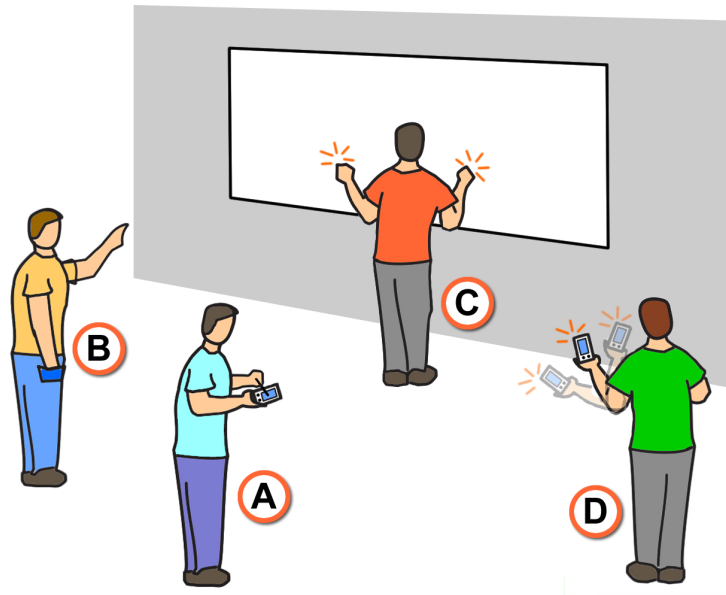


Fig. 1. Current interactions with public ambient displays: (A) using the GUI of software installed on mobile devices; (B) natural interaction via pointing and gestures; (C) touch-based interactions; (D) combining mobile phones and gesture motion commands.

or via motions and gestures captured using the sensors embedded in the device (accelerometers or the video camera) such as tilting and throwing [5].

Several studies have begun to address the social acceptability of performing gestures in public via the mobile phone [17, 18]. Rico and Brewster [18] found that the users' willingness to perform gestures is influenced by location and audience. These studies come to address the specific issues of using mobile gestures and they accompany previous research on the acceptability and perception of mobile phone use in public [3].

2.2 Pointing and gestures

Within the new paradigm of natural interaction, gestures represent the preferred way to interact with objects and to convey information, meaning, and intentions. With this respect, they are perceived as ideal interfaces by the general media due to several attributes such as familiarity, intuitiveness, and naturalness. Therefore, much research effort has been dedicated for developing acquisition technologies, recognition algorithms, and interaction techniques [7, 13, 21, 22] but also for understanding implications of gesture-based interactions.

Remote pointing and gestures have been investigated for interacting with information on large displays. Vogel and Balakrishnan [22] explored freehand pointing and clicking interaction. Also, they provided a comprehensive discussion

on the transitions between interacting with personal and public information [23]. Shoemaker et al. [19] introduced the shadow reaching technique which uses a perspective projection of the users' shadow on the remote display. The advantage is easy access over the large area of the display as well as immersive implication. Rakkolainen and Lugmayr [16] investigated interaction opportunities with novel immaterial displays. Next to remote displays, touch-enabled interactive surfaces are becoming more and more popular. A good example is Peltonen et al. [15] that describe observations from their CityWall installation with respect to parallel interaction, collaboration, management of conflict, as well as the restructuration of the public space with respect to this new interactive technology.

Wearable devices could provide an answer for future interactions with ambient media. The Sixth Sense project of Mistry, Maes, and Chang [13] lets users interact with their hands with a very large area of possible applications and scenarios (including outdoor environments). Sixth Sense is a wearable interface consisting in a video camera that detects four of the users' fingertips and recognizes their motions and actions in accordance with context. Going much further, the imaginary interfaces proposed by Gustafson et al. [7] introduce a very interesting concept. The interface exists only in the users' short memory which allows them to perform spatial interaction with empty hands and no visual feedback. The interesting aspect here is that the interface is being *imagined* hence it must be the *right* one (e.g. providing the expected functionality in accordance with context and being adapted to the user).

With respect to the industry, gesture-based interfaces are being proposed in the form of multitouch tables [4, 6, 12], free-hand gesture interfaces [6, 9], and motion sensing devices [26]. Considerable attention has been focused towards computer games in order to augment players' interactive experience [9, 26]. The Wii Remote especially has been found popular and explored for different innovative interactions by the practitioners community [11]. Also, playful interactions have been previously proposed for ambient intelligent platforms [24].

3 Conclusions

The question of how should we interact with ambient content is still to be answered. While incredible progress is being achieved in sensing and understanding of human input, applying the current knowledge and experience in designing effective interfaces may prove a challenge for ambient media. Should the interaction be implicit, explicit, or should transitions be allowed? Which interaction techniques are the most appropriate? How does content and the interfaces to interact with content rely to each other? This position paper comes to elicit and provoke discussions on what interfaces and interaction techniques should be developed for interacting with public ambient displays and with ambient content. The community needs to address such important questions in order to assure the usability of ambient media for its customers.

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