# Privacy and Curiosity in Mobile Interactions with Public Displays

**Paul Holleis**
Research Group Embedded Interaction
University of Munich, Germany
http://www.hcilab.org
paul@hcilab.org

**Enrico Rukzio**
Computing Department
Lancaster University, UK
rukzio@comp.lancs.ac.uk

**Friderike Otto**
Media Informatics Group
University of Munich, Germany
friederike.otto@ifi.lmu.de

**Albrecht Schmidt**
Fraunhofer IAIS, Sankt Augustin and
B-IT, University of Bonn, Germany
http://uie.bit.uni-bonn.de
albrecht.schmidt@acm.org


CHI 2007, April 28 – May 3, 2007, San Jose, USA
ACM 1-xxxxxxxxxxxxxxxxxx.

## Abstract
Personal multimedia devices like mobile phones create new needs for larger displays distributed at specific points in the environment to look up information about the current place, playing games or exchanging multimedia data. The technical prerequisites are covered; however, using public displays always exposing information. In this paper we look at these issues from the privacy as well as from the curiosity perspective with several studies showing and confirming users' reservations against public interactions. Interactive advertisements can exploit this best using specific types of interaction techniques.

## Author Keywords
Mobile phone interaction, situated public displays, privacy and curiosity, advertisement

## ACM Classification Keywords
H.5.2 User Interfaces: Input devices and strategies; Evaluation/methodology; H.1.2 User/Machine Systems: Human Factors

## Introduction
Several research projects and commercial applications used and use mobile phones to interact with public displays. An example for that is the WebWall [2] that

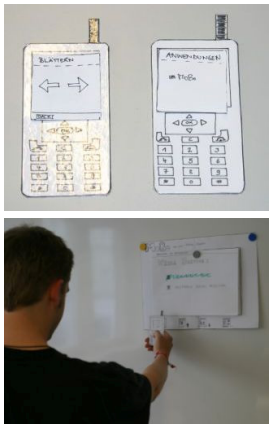

**Figure 1**. Paper prototypes of public display, mobile phones and a user.

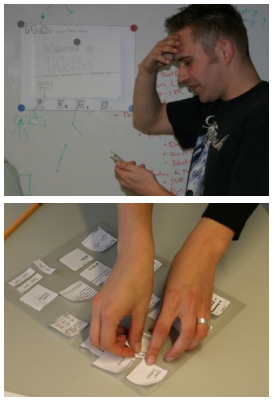

**Figure 2**. Pictures from the paper prototyping user study: Mobile phone, interaction and replacement screens.

provides functionalities for public polls, auctions, browsing, photo slide shows or personal ads. The NikeID Billboard [6] was an installation in which a sports shoe could be designed using the mobile phone.

Everyone can see information presented on a public display which leads to several implications. For private or personal data shown on such a display, privacy concerns become a major issue. An initial study in this domain answered the question if people would use a public display to view and organize their own pictures and accept that other people could see them? Possible solutions to this problem have been suggested, e.g., by Greenberg et al. [3] who explicitly define notes to be private or public in their shared notes CSCW scenario and hide private ones. Sharp, Scott and Beresford [7] implemented a framework that supports censoring of private content on a public display and moves most privacy related input to the person's own mobile device.

## Private Information on Situated Displays

People increasingly use mobile phone cameras and often share data with other people [5]. The limitations of small phone displays as well as the problem of getting (only) appropriate information on a specific location can be overcome by large displays situated in a specific context and place. However, even if such a display is public, its use can be of private nature like presenting personal pictures. Even in the case where photos are to be made public, it is often unwanted that the link between the picture and the user (e.g. during the upload) is visible. To gather attitudes about such issues, we conducted a pilot study with 6 participants, 20-35 years, 4 male with a higher technical affinity. We discussed scenarios and feelings with the participants and collected comments from observers.

*Pilot Study Using a Paper Prototype*

We presented our participants typical scenarios using short comic strips (among others, "upload a personal picture from your phone to show it to your friend"). Most of the actions necessary to interact with the public display were designed to be done with simple gestures. The design goal was to make the interaction most intuitive and increase the memorability of the actions.

In order to evaluate our questions in an early state of development, we created a paper prototype with which we could "emulate" the whole anticipated system using a magnetic whiteboard with paper screens. However, the interaction techniques were designed such that they can be implemented using various methods like built-in accelerometers or the optical flow of the camera of the mobile phone. Mobile phones were built from cardboard and paper with replaceable sticky screens and a see-through display to simulate the camera output (see Figure 1 and Figure **2**). We concluded the sessions with an informal interview and a small questionnaire to gather feedback from users.

*Results*

The observation of the participants during the study (live and taped) and the evaluation of the questionnaires showed that all participants quickly understood the setting and scenario. Menu navigation and gesture interaction did not pose any problems; most actions were immediately done correctly using only the short description given on the public display (e.g., "tilt phone to the right to …"). All confirmed that it was an interesting idea to use public displays in such a way and even suggested several additional application scenarios (e.g. billboards, adverts and multiplayer games).

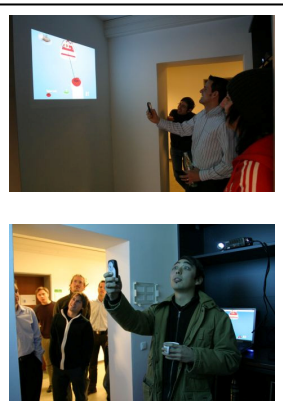

**Figure 3**. Impressions from the user study. People get curious seeing the testers interact with the mobile phone.

| curiosity level | |
|---|---|
| ignored | someone who showed no noticable interest at all |
| interested (glance) | someone who saw the setting and the game and proceeded |
| high interest | someone who stopped to watch more closely |
| try out | someone who explicitly showed interest to participate |

However, every single participant expressed huge doubts regarding privacy issues. No one wanted to have private content presented on a publicly visible display even if there was no one standing close by in that very moment. From the comments we saw that this applies to secret information but also to personal data and information, such as pictures or music. Besides feeling uneasy about what is done with the data, users were convinced that passers-by would be attracted by their activities in front of the display and could see their personal pictures. In discussions we found out that it was rarely thought that people would maliciously spy on them but that curiosity attracted them and made them watch. This opinion was given independently and unanimously by all participants and therefore we conjecture that applications handling delicate information on public displays will have difficulties to be accepted by potential users.

One of the major current uses of public displays (passive, active or interactive) is advertisement. Such displays are the more valuable the more people look at them. This means that increasing the curiosity of people is of interest for designing such systems.

## Curiosity of People

To investigate how user interfaces can be designed to increase the curiosity of passers-by and bystanders we ran the following experiment. We were interested in whether or not people really are curious and how much they show interest in what other people do in a public place using a public display. A study which included two parts was set up to collect field data. We implemented a gaming application where an item on the public display can be controlled with a standard laptop and alternatively by gesturing with the user's phone.

*Prototype and User Study*

Using a game for the experiment had various reasons. Firstly, it was suggested by several people who took part in the pilot study. Secondly, interactive games offer good opportunities for creating adverts. Thirdly, games have personal aspects that are made visible to the people around (e.g. the user's skill). We ran a game where a user controls a boat in a river either with a laptop computer or by the user's mobile phone. On the phone, a horizontal gesture based on the SWEEP technique was used (Figure 3). For this we used the iStuff Toolkit [1] which encapsulates several implementation details.

We placed a video projection in a highly frequented public place at a side wall of a passageway close to the entrance of a major university building. One after the other, we ran the two different versions of the game. With each version we undertook a session in which we observed and videotaped 76 people passing our stand. We paid special attention to categorized them according to the scheme presented in Figure 4. We assumed that the gesture input technique would gain more attention, because people were actively and very dynamically playing the game by moving the mobile phone through the air. To get comparable results we chose the same place and time of day for both scenarios.

*Results*

As can be seen in Figure 5, both scenarios got the attention of people passing by: in total, 90 out of 152 people were attracted. However, significantly more people got interested when using a mobile phone as input device compared to the laptop. When playing with an ordinary laptop, several people merely glanced at the display and only 3% showed more interest and

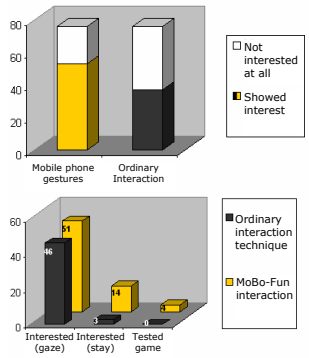


**Figure 5**. Of the 76 people who passed by during each session of the study, significantly more people showed interest in the public display when using the mobile phone interaction.

stopped to observe the game. Compared to the phone input technique, the number of people who showed higher interest was nearly 4 times higher (14 %) and they also spend more time to observe the game play.

The difference is remarkable as the visualisation on the display was dynamic, colourful, and quite amusing to watch in both cases. In the first scenario, not a single person intended to try the game. This may be because familiar input techniques hardly arouse curiosity and the laptop setting suggests a more private session. When using the phone gestures, 3 persons actively asked to play themselves, watched the game and asked questions about it and the input technique itself. This result shows that with such physical input devices the curiosity level can be considerably increased.

## Summary and Discussion

In this paper we investigated that the main concerns of people regarding a system to upload, view and share pictures using a public situated display and their mobile phone are that passers-by could be attracted by their personal pictures and take a glance just out of curiosity. With a larger user study we showed how curious people really are and how the input device used influences this.

These results are interesting in two ways. For applications that visualize personal or privacy-related data this raises central concerns. Not displaying secret data at all is only a partial solution as our pilot study revealed that users also felt uncomfortable with others just looking at personal information. On the other hand, applications that are meant to capture people's attention can benefit. Interactive adverts can be made more attractive. In our study we gather evidence that this effect of curiosity can be increased when novel and visible interactions, such as mobile phone gestures, are used. Our research shows that there is a high potential for providers of advertisements to use a dynamic and visible interaction method like that presented in this paper to raise curiosity and increase visibility.

We are currently planning to find out in detail what it is exactly that attracts people when they see the mobile phone setting (particular gestures, tighter involvement, or novelty effect?) and to deploy an application in cooperation with a shop in the vicinity of which we want to project a relevant game. One person would then play the game for some time and passers-by can see the advertisements displayed and participate to win coupons etc.

## REFERENCES

[1] Ballagas, R., Ringel, M., Stone, M., Borchers, J. iStuff: a Physical User Interface Toolkit for Ubiquitous Computing Environments. In Proc. CHI'03. 2003

[2] Ferscha, A., Kathan, G., Vogl, S.; WebWall - an Architecture for Public Display WWW Services. In Proc. WWW2002. 2002

[3] Greenberg, S., Boyle, M., Laberg, J., PDAs and Shared Public Displays: Making Personal Information Public, and Public Information Personal. Personal Technologies. 1999

[4] Interactive Game, Yahoo Press Realease, March 22, 2004, http://docs.yahoo.com/docs/pr/release1158.html

[5] Ling, R. The Mobile Connection. The Cell Phone's Impact on Society. Elsevier Inc., 2004.

[6] Nike iD Billboard Invites Mobile Users, May 2005, http://www.clickz.com/news/article.php/3502186

[7] Sharp, R., Scott, J., Beresford, A. R. Secure Mobile Computing Via Public Terminals. In Proc. Pervasive'06. Springer. 238-253. 2006