An Analysis of the Usage of Mobile Phones
for Personalized Interactions
with Ubiquitous Public Displays

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Abstract. Do personalized interactions with ubiquitous public displays make sense? In our analysis we investigate what forms of personalization and interaction styles are applicable in this context. Based on this we present a matrix relating the number of persons that can see the display to the number of people that can interact with the display. Through this we show that there are different cases where personalization of services on public displays is useful. At the end of the paper we introduce a prototype currently under development. We conclude with a set of open questions which might be answered through the development and usage of this prototype.

1 Introduction

Mobile devices such as mobile phones, smartphones and PDA's have become very popular in the last years. Furthermore processing power, quality of display (e.g. resolution, size, etc.) and the set of available network interfaces (e.g. GSM, GPRS, HSCSD, UMTS, WLAN or Bluetooth) is drastically on the increase. But the input and output capabilities of these devices is still far away from the easiness and fastness of common desktop PC's. Beside this we have seen a remarkable improvement of large screen displays, in particular increased size and resolution, falling prices, and availability of different display technologies in the last few years.

The usage of ubiquitous displays has up to now often focused on scenarios located in indoor environments (e.g. office, home) where special groups (e.g. working teams, families) interact with these displays [1]. Huang and Mynatt [2] analyzed existing awareness applications for displays and present a matrix which relates the group size for which they are designed to the type of space in which they are viewed. In contrast to this analysis we will only focus on personalization and privacy aspects of displays that can be found in public spaces.

There have been several publications investigating the combination of mobile devices and large displays [1,3,4,5]. In these works, too, the focus is not on the usage of public displays for personalized services.

2 Analysis

When first investigating this domain it appeared paradox to use personal and personalized systems on public displays. Therefore we started with the question: "Is it meaningful to use personalized services via public displays?". In our analysis we will discuss the domain and give an answer to this question.

2.1 Personalization

In principle it is possible to personalize a service for one specific person or a pair, for a specific group with common interests and preferences. If personalization is aimed at all people using a system [6], no real adaptation is performed and the service is somehow static.

Beside this we distinguish the three following levels of personalization:

(A) Personalized information that **must not be shown** in public (e.g. automatic form filling of a form for ordering a book which shows address and bank account)

(B) Personalized information that **can be shown** in public (e.g. visualization of weather information of the home town of a person and the wind conditions of the persons favorite lake because he/she loves windsurfing)

(C) Personalized information that **can be shown** in public **if no link to the initiator** can be drawn, therefore there must be a large number of potential interactors (e.g. you request a special song to be played, it will be played in public but it is not indicated who requested it)

Level B and C are very interesting from the display owner's and service provider's view because a lot of people are curious to see what others are doing or viewing.

To personalize a special service some knowledge is needed about the people involved. Generally this information can be made available through a profile of the user stored somewhere or through the observation of a user during a session. In this paper we anticipate the mobile phone as a bearer of personal data and preferences of the person who uses this device.

2.2 Interaction

There are a lot of aspects (e.g. distance between the user and the display, size and resolution of the display and the context of the user and the display) relevant for the interaction between the mobile phone and the display. But what does interaction mean in this context?

Regarding public displays we can distinguish two different cases:

(1) the display is interactive, i.e. it can react on the actions of the user

(2) the display provides information (e.g. a slide show) and the user can establish a connection to information related to the content (e.g. gets an URL), but afterwards he interacts with his mobile device only

In both cases the interaction consists of three general steps: establish a connection with the display, use services and close the connection. It is also possible to interact with the public display without establishing a connection. In the Webwall [1] system for example. the user can send an SMS to the public display without a corresponding login procedure.

When looking at how to establish a connection between a physical object and a mobile phone, different solutions are available. These solutions highly depend on the actual context of use (e.g. distance between user and public display). Often the user has to act as an active mediator, because he/she has to enter a URL or a number in the mobile phone to establish a connection. More sophisticate concepts are based on the sensing capabilities of mobile phones. Thus, service recognition might be based on visual markers recognized by the camera integrated in a mobile phone. Another example is service recognition based on the proximity of a mobile phone and the ubiquitous display.

To end a session an explicit command can be used (e.g. a simple exit command) or the user's context can be taken into account and an exit event can be triggered by recognizing that the user has left, switched off his/her device, turned away etc.
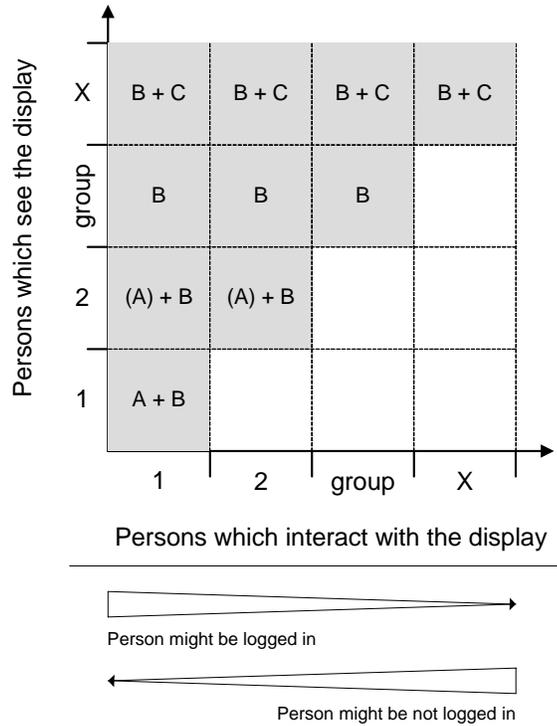
Comparing with current publicly available terminals it remains unclear: "What is the advantage of using the mobile phone?" and "Why not using a normal terminal with a touch screen or keyboard for interactions when the display is in reach?". One disadvantage of today's terminals is that they become dirty very quickly impeding the use of touch screens and virtual keyboards. Through the usage of the mobile phones for interacting with public displays the user knew already the interaction paradigms. A further point is that public terminals are very restricted in where they can be installed. There has to be physical access to the device to use it. For combined terminals using mobile phones as controls there are much less limitations for the set-up. The most important advantage appears to be personalization based on data stored on the mobile device and that the user can download information to his mobile phone which might be useful after the user has left the public display.

Besides a user triggering interaction it is also possible that an interaction is initiated by the public display; however, a lot of users may see this as an annoyance.

2.3 Personalization on Public Displays

As shown in Figure 1 there are in principal 16 different possibilities regarding the relationship between the number of people that can see the display and the number of people that can interact with the display.

Figure 1. Relationship between the number of people that see the display and those that can interact with the display

Persons which see the display

		1	2	group	X
X		B + C	B + C	B + C	B + C
group		B	B	B	
2		(A) + B	(A) + B		
1		A + B			
		1	2	group	X

Persons which interact with the display

Person might be logged in

Person might be not logged in

Both axes are subdivided in 1, 2, group and X persons. The number 2 represents a pair of people which might have a mutual trust. A group might be a number of about 10 people which could be somehow related, e.g. through a common interest in the place where the display is located (e.g. people traveling together). X people represent a larger number of people (e.g. more than 20) not related to each other. Group and X may overlap in size but the clear distinction is that people in a group are related to each other where this is not the case in X. These four different sub-sections are abstractions whereas also mixed cases might exist.

A public display which can be seen by 1-2 persons might for instance be an ATM, an extended version of a ticket machine, or a terminal at a station or airport. A display box (like a phone box) is also imaginable. The privacy of these private-public displays is limited because it is possible that someone observes the person while he/she is interacting with the display. If we think of a display at a bus station, then this is seen by a group of people that might all be related to this place because a lot of them are living near that bus station. At an airport or a concert there are displays that can be seen by a large number (X) of people.

When only one or two people interact with the public display they are probably logged in or have authenticated themselves (as when withdrawing cash from an ATM). If a lot of people interact with the public display it is less likely that they are logged in (e.g. the flight schedule board at the airport).

Figure 1 shows that there are only few cases where adaptations of level A (see Subsection 2.1) are suitable, but this is not surprising because we are thinking about personalized interactions with ubiquitous public displays. The level A might be restricted (depicted by (A)) when the two persons who see the display do not trust each other. But the level B and C shows that limited adaptations are reasonable for public displays.

We do not further consider cases where people interact with the display without seeing it (fields which are not gray.) This might for instance happen when people can interact indirectly or remotely with the display (e.g. they are sitting far away on a desktop PC and have access to the content on the public display).

4. Realization and Outlook

This work is done in the context of the EU-project Simplicity [7] whose key concept is the Simplicity Device (e.g. an enhanced SIM card) which stores the data and preferences of the user. This information is used to adapt content, terminals, services and networks. One prototype which is currently developed in the project is a mobile phone storing user data and preferences, and establishes connections to different terminals via Bluetooth.

We are currently working on a prototype where a person can interact through a mobile phone with a public display.

Figure 2. Generic architecture of the prototype currently under development
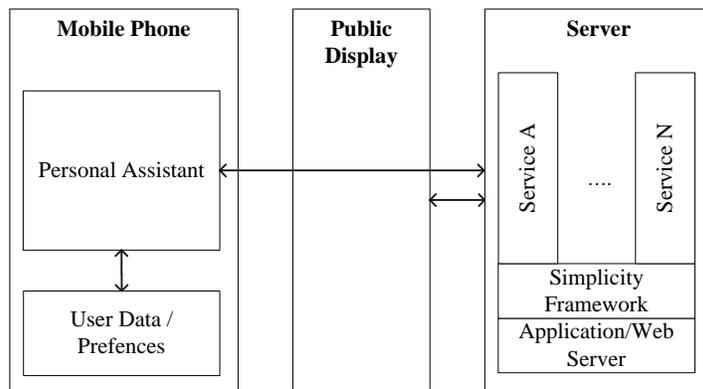
This public display will show different advertisements, which will also integrate a visual marker. On the mobile phone the data and preferences of the user will be stored. After the user has started the personal assistant (an application currently under development), the user can focus the camera of the mobile phone on the visual marker of the advertisement on the display. Based on the information represented by the marker, the personal assistant can call a special service provided by the chosen advertisement.

As a first step we will concentrate on the interactions between the user, the mobile phone, the display and the service; afterwards we will focus on personalization aspects. After reaching this, we will test the system through a user study.

5. Concluding Questions

We investigate the domain of interaction with public displays and in particular we try to give answers to the following questions:

- What are typical interaction metaphors in this context?
- Could the interaction metaphors of the mobile phone be used for the interaction with public displays?
- How is the information to be split between the public display and the display of the mobile phone? Should the person be able to use both displays? When should the displays be used in parallel and when sequential?
- When is personalization applicable in this context?
- What happens, when a person interacts with the display, but he/she has to leave the display (e.g. because he/she gets into the bus)?
- How could the personalization levels A, B and C for special services and persons be defined?

Acknowledgements

References

1. Vogl, S.: Coordination of Users and Services via Wall Interfaces. PhD Thesis. Johannes Kepler University Linz. 2002.
2. Huang, E.; Mynatt, E.: Semi-public displays for small, co-located groups. In: Proceedings of the conference on Human factors in computing systems. ISBN 1-58113-630-7, Ft. Lauderdale, Florida, USA. 2003.
3. Aizawa, K.; Kakami, K.; Nakahira, K.: Ubiquitous Displays for Cellular Phone Based Personal Information Environments. In: IEEE Pacific Rim Conference on Multimedia (PCM2002), Hsinchu, Taiwan, Advances in Multimedia Information Processing -PCM2002, Y-C Chen, L-W Chang, C-T Hsu (eds.), LNCS 2532,pp.25-32, Springer, 2002.
4. Kruppa, M.; Krüger, A.: Concepts for a combined use of Personal Digital Assistants and large remote displays. In: Proceedings of SimVis 2003, pp. 349-361, Magdeburg, March 2003.
5. Magerkurth, C.; Tandler, P.: Interactive Walls and Handheld Devices - Applications for a Smart Environment. In: Collaboration with Interactive Walls and Tables, Workshop at UbiComp'02, Göteborg, Sweden, September 29, 2002.
6. Schubert, P.; Ginsburg, M.: Virtual Communities of Transaction: The Role of Personalization in Electronic Commerce, In: Electronic Markets Journal, Vol. 10, No. 1, pp. 45-55, 2000.
7. Simplicity Project, http://www.ist-simplicity.org
8. Research Group "Embedded Interaction", http://www.hcilab.org/