Towards a framework for evaluating multitouch public displays

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Abstract

In the last few years, we have designed software applications for multitouch wall displays which provide information and/or services in different contexts, such as cultural heritage, tourism, and public events. While many of the systems proposed in the literature concentrated primarily on entertainment purposes, we are moving towards more functional applications and we are planning a set of empirical studies to evaluate their impact once used in the field. In this position paper we describe some challenges that emerged during our work and propose some initial variables which can inform the definition of an evaluation framework specific for public display applications.

Introduction

The multitouch technology is still considered as being new and "hi-tech", since it is not yet marketed to a wide consumer public. Yet, many large interactive displays have already been placed in public spaces. So far most of the applications provided on such displays have entertainment (or advertisement) purposes. For example, the multitouch displays installed in the Hard Rock Cafe allow guests to locate Hard Rock properties from around the world, explore images of both the exterior and interior of the building, etc. [9]. The application for the Microsoft Retail Store helps customers to learn about various products. CityWall is an example of multitouch display set in a public street of Helsinki 0: people can interact with images downloaded

by Flickr [5]. The Magical Mirrors are four displays installed in Berlino, which show a mirror image of the environment in front of them and apply optical effects reacting to the gestures of the audience [10].

We are developing more functional applications in contexts such as cultural heritage, tourism, and public events. In other words, the aim of such applications is to go beyond pure entertainment, offering users the possibility to retrieve information or perform tasks such as defining their own touristic itinerary,

figure 1 Young students playing with History-Puzzle.

booking a restaurant or a specific event, etc. These applications have been tested with real end users in our laboratory. We are now planning more extensive evaluation studies to understand their impact once used in the field.

Evaluation methods covering all the specific aspects of multitouch public displays are not available. In this position paper we reflect on some specific issues relevant for evaluation of public displays, like the physical space where the display is installed, its size and the specific applications provided. Such factors directly influence other behavioral and psychological variables; e.g. individual *vs.* group interaction, sharing of the interactive space, ownership of the content displayed, movements of people next to the display.

After a brief description of the applications we are working on, we propose an initial evaluation framework, whose aim is to highlight some of the main variables which can be used to understand the potential impact of large display installations in public settings.

Developed applications

On the basis of our experience in designing educational games supporting history learning while exploring archaeological parks [4], we have developed games that young students can play on large multitouch screens. Several students can collaborate to solve the challenges proposed in the games, by manipulating the displayed objects through gestures. An example is the History-Puzzle game [2]; it requires participants to complete puzzles of historical monuments by correctly identifying features of such monuments (see figure 1).

History-Puzzle has been developed according to a user-centered approach, and preliminarily evaluated with pupils at a middle school in our city. Groups of 2-5 children were involved in each evaluation session and were observed while interacting with History-Puzzle on a multitouch screen. Our preliminary studies have confirmed that users find this novel technology highly engaging. In the coming months, we are going to install the system in an elementary school of Bari and will evaluate it with pupils aged 9-11 years old.

We are also exploring the use of multitouch public displays for software applications designed to support tourists visiting our region, in Southern Italy. We have developed a system to be installed in places characterized by an intense traffic of tourists, e.g. the baggage claim at the airport, the harbor, or tourist information offices. Several features are provided: tourists can get information about interesting places,

events, accommodations, etc.; they can examine maps, define their routes, or look at and comment on photos taken by other tourists. Personalized itineraries can be composed and then sent to tourists' mailboxes or mobile phones [1]. Preliminary studies highlighted a privacy concern, which may hamper adoption of these applications as some people did not like to have others looking at their preferences, cultural interests, accommodation possibilities, etc.

We are currently designing an application for providing services to people participating to an international conference. Users can interact with an interactive conference program, which allows them to watch the video-madness of each accepted paper. Announcements, call for papers and call for position will also be shown. Real-time results of a pool for the best paper selection will also be provided. Taxi-sharing and airport shuttles reservation will be available. Finally, users can view and share conference photos. The application provides both informative and entertaining services, and one of the main issues we want to analyze is whether these applications are acceptable on large screen display. We plan to evaluate it at a conference that will be held in Italy this coming June.

Sketching an evaluation framework

The evaluation of interactive systems is usually focused on traditional measures, such as percent of completed tasks, ratio between successes and failures, time to complete a task, and user satisfaction with the available features. Regarding evaluation of public displays, much of the ongoing research is investigating social aspects. Brignull and Rogers observed that it is hard to entice people to interact with public displays and identified the social embarrassment as the key factor which determines whether people will interact in front of an audience [3]. They performed two field studies examining several variables: the flow of people around public displays; the level and types of interaction around displays; the transitions between types of interaction; factors that cause social awkwardness and embarrassment around public displays. They observed that interaction with public displays is accepted if the displays have strong physical and social affordances, which allow people to rapidly understand the purpose of the social activity to be performed at the display.

Social aspects are also the main focus of the field studies performed downtown Helsinki 0 and at the European City of Science Exhibition in Paris [8]. The aim of these studies was to observe how people approach, participate, and interact on a multitouch display in public spaces. In particular, the researchers investigated: the dynamics of approach (how people notice that there is an interactive display); the interaction at the display with others (parallel use, teamwork, and playful activities); conflict management; transitions between activities and participants (floor and turn-taking); roles and social configurations.

By taking into account related work (e.g. [6], [7]) and our own experience, we report here some first insights that can inform the definition of an evaluation framework specific for public multitouch displays. The framework aims at integrating factors of interest and at providing a systematic approach to the evaluation. Currently, the framework indicates the following factors as those which primarily influence the success of the application:

1. *Environmental Factors*, which consider, for instance, the physical location where the display is installed (e.g. city street, museum hall, fair, train station). These factors also consider how the display is

positioned in the environment, for example whether it is in a very visible location, in a place with a lot of movement, etc., because these all influence user behavior.

2. *Software factors*, like interface design and application type, e.g. if the display is used as information provider, learning tool, etc.

3. *Hardware factors*, like adopted technology, screen size, screen orientation (tabletop *vs.* wall screen).

Such factors influence a number of dependent variables, which can be used to analyze the behavior of users with multitouch large displays:

a. *Motivation and initial behavior:* how people arriving close to the display are motivated to interact and how they behave (e.g. passive observation then attempt and imitation [8]).

b. *Interaction affordances:* what type of behavior the interface stimulates on the user.

c. *Psychological reactions:* how do individual person react, e.g. engagement, fun, boredom.

d. *Individual vs. group interaction:* how people behave with the others in front of the display.

e. *Content ownership* (or content appropriation): how people share or choose not to share content during the interaction.

f. *Screen sharing:* how people share portion of screen and physical space during the interaction.

g. *Social behavior:* it considers collaboration, competition, imitation, proxemics, physical movement in the space.

h. *Appropriation:* how people incorporate large displays in their own life.

We are going to test this evaluation framework in two different public contexts: 1) an elementary school, where History-Puzzle will be available to pupils in a school hall; 2) during an international conference, where the system providing services to the participants will be installed.

Citations

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