Adaptivity in Museum Mobile Guides: the Peach experience

Cesare Rocchi[1], Oliviero Stock[1], and Massimo Zancanaro[1]

[1] ITC-Irst,
via Sommarive 18, 38050 Povo-Trento, Italy
{rocchi, stock, zancana}@itc.it

Abstract. In the framework of the PEACH project, we have designed, implemented and evaluated a series of prototypes of adaptive multimedia mobile guides. From the initial desiderata of the project to the final evaluation, we describe the steps that led to the implementation of the last prototype and the outcomes of the evaluation performed in the real scenario (Torre Aquila, Trento).

Keywords: multimedia, mobile guide, adaptivity, museum.

1 Introduction

A museum visit is a blend of education and entertainment, and visitors do not have a precise goal or a task. Often this concept is referred to as edutainment. Museums are places where people learn and amuse [7]. We started experimenting with many aspects of a mobile guide: appearance (the graphical interface), communication (the interaction paradigm and the adaptation mechanism) and the user model. During the implementation of the mobile guide we adhered to a set of principles. The first is *non-obtrusiveness*. The visitor should feel free and not carry heavy weighted tools. This is why we have chosen a standard PDA as platform to develop on. The principle applies also to the graphical interface. The interaction should not hinder the experience of the visit. This led to the development of a very simple interaction, centered on *delegation*, our second principle. Nowadays, the common interaction paradigm, favored by the web, is search based: "the user asks the machine answers". We experimented with a different approach, inspired to backchannel communication. In each face-to-face communication people, while hearing and watching, tend to give feedback to the speaker. This feedback can be made of non-linguistic signals like knotting, simpering, looking somewhere, etc. We think these are important feedbacks about the content of the communication; in the case of the museum visit, the explanation of the artwork provided by a guide to a visitor. Trying to replicate the same mechanism, we have implemented a mobile guide that allows the visitor to express positive or negative feedback (two degrees of freedom) about the content adaptively provided by the multimedia guide during the visit. The visitor can provide such a feedback by means of a graphical widget, the *like-o-meter*. At any time the visitor can *score* the

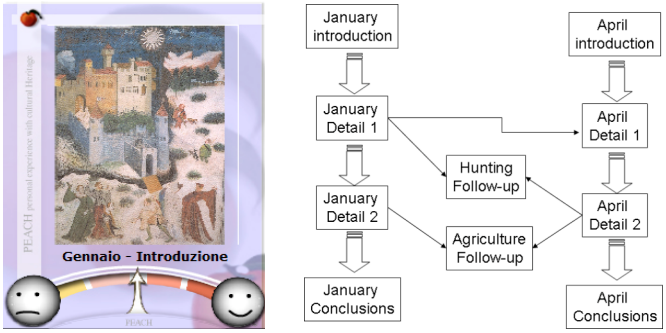
information provided by the system, which takes into account such feedback to build a profile of the visitor's preferences, the primary source which drives the adaptation mechanism process. In this paper we provide details about the design, the implementation and the evaluation conducted in the real scenario, a frescoed room in the Buon Consiglio castle (Trento, Italy).

2 Related Work

Electronic Museum Guides nowadays are very popular, as they free visitors from reading. Discovery Point is an audio-only guide, implemented on a remote control-like device that allows users to hear short stories related to the work of art; it is in use at the Carnegie Museum of Art in Pittsburgh [3]. It is equipped with special speakers, which deliver pinpointed audio that can only be heard near the work of art. GUIDE is an outdoor system [4], which supports visitors in the city of Lancaster. It adapts web-like presentations by adding information about nearby attractions that might be of interest to the visitor of a city. Another example of PDA application can be seen at Genoa's Costa Aquarium [2]. The interface's basic element is a multimedia card that corresponds to each presentation subject, such as a particular fish or a fish tank containing several fish species. Each multimedia card provides users with content and touch-screen buttons that enable them to control content presentation and navigate between tanks. Ciavarella and Paternò present an indoor mobile system, running in the Marble Museum of Carrara [5]. They particularly focus on location-awareness, surveying three technologies to detect the position: WiFi, bluetooth and infrareds.
UbiquiTO is an adaptive tourist guide, meant to act as a "companion" for visitors in the city of Turin [1]. Personalization is performed at various levels: location, device type, user profile and context (e.g. time of the interaction). An interesting work about navigation support of a mobile outdoor guide is presented in [6]. It presents and evaluates three ways of combining audio and video information to provide navigation details to the visitor.

3 The PEACH System

The application scenario of the PEACH project is Torre Aquila, a frescoed room located at the Buon Consiglio castle in Trento. When visitor stops in front of a fresco, the system shows an introductory presentation to the fresco. As said above the system is *proactive* and implements a delegation paradigm. As long as the visitor remains at the same location, the system keeps describing the fresco and its details. When the information is over the system invites the visitor to move to another location (via speech). The graphical interface, running on each PDA, is shown in Fig. 1a. The main part of the screen is used to display the player where videos, adaptively composed, are shown. At the bottom there is the *like-o-meter*, through which, during the presentation, the visitor can express her degree of interest: "I like it", by moving the needle towards the smiley face (two degrees of liking), or "I don't like it", by moving the needle to the sad face on the left, two degrees of disliking (see [10]).



(a) (b)

Fig. 1. Graphical interface running on the PDA (a). Simplified template network (b).

The *like-o-meter* implements the backchannel communication mentioned above. At any time the visitor can express her degree of liking/disliking about the content provided by the guide. Such a feedback is used by the system to build a profile of the visitor and 'tune' the choice of future information according to that profile. Preferences are modeled on top of a template network structure. A template encodes information about a fresco or one of its details. From a single template different presentations about the same topic can be instantiated. The instantiation process is influenced by the history (what the visitor has already seen), the location, and the preferences' model (more details in [9]). A template is linked to others by means of semantic relations (e.g. same topic, subtopic, part of). There are five types of templates: *introduction*, which generally describes an exhibit; *abstract*, which quickly presents a detail of an exhibit; *content* provides more information about a detail of an exhibit; *conclusion* invites the visitor to move to another exhibit; *follow-up*, which provides information about a general topic, usually shared by two or more exhibits (e.g. hunting, clothing). Each template has a value (score) associated, which ranges from -2 to +2 and defaults to 0. Visitor's interaction with the *like-o-meter* changes the value of the template from which the current presentation has been instantiated. A propagation mechanism spreads this change to all the nodes linked to the current one. A template is selected when it has a value greater than zero. The selection algorithm provides a default sequence (in case the visitor does not interact with the guide) and iteratively refines it according to the interaction through the *like-o-meter*.

4 Final Evaluation

One hundred and forty-three (143) regular visitors of Torre Aquila were invited to test the adaptive multimedia guide: 61 males and 82 females, aged from 20 to 79 years. They were recruited at the entrance of the Museum of the Buonconsiglio and received a free ticket for visiting the castle as a reward. The evaluation was meant to assess the acceptability of the interaction paradigm, which is quite different with respect to the 'search engine' paradigm (man asks machine replies) commonly adopted in classical

user interfaces. We especially wanted to check whether people felt a loss of control over the system. Two questionnaires were used in the study. The first questionnaire was aimed at assessing the dimensions of attitude toward art (4 items) and attitude toward technology (6 items). The second questionnaire was aimed at assessing their experience in using the multimedia guide along diverse dimensions. The dimensions investigated were measured on many different scales and they were then combined and factorized in the following four dimensions: *control*, obtained by combining items from perceived quality of information, perceived spatial orientation, and control with a combined reliability of 0.797; *involvement*, obtained by combining items from flow, involvement, perceived time distortion and perceived presence with a combined reliability of 0.904; e*asiness*, obtained by combining items from easiness to understand, easy of use and clarity of feedback with a combined reliability of 0.890; *intention to use*, obtained by combining items from the TAM usefulness with a combined reliability of 0.800. Additionally, two four-choice questions were used aimed at assessing the degree of understanding of the interface and the use of the *like-o-meter* ("when you are interested/not-interested in a topic presented by the guide, what did you do: a. you pressed the smiling face; b. you moved to another fresco; c. you pressed the sad face; d. you did nothing") combined in a binary measure called Correct Use, true if the users select answers a and c respectively, false otherwise (more details in [8]).

Each visitor received a short description of the system and was left free to interact with the system in Torre Aquila. Visitors were told that the system takes into account the interaction with the *like-o-meter* to organize the content of the presentations. After the visit, s/he was asked to fill the two questionnaires. S/he could then enjoy his/her free entrance to the rest of the castle. The study was conceived as an exploration on the usage of an adaptive guide: age, sex and attitude toward technology were used as factors and transformed in two-level factors. The age groups were obtained by splitting the ages according to the median value—younger visitors with age less than or equal to 47 and older visitors with age of 48 or higher. Attitude toward technology was considered positive when scored above 0.4 (on a normalized scale from 0 to 1) and negative when scored less.

All the visitors generally felt in control of the system, had good involvement, found it quite easy to use and had a propensity to use it again in the future. In particular, regarding age group, significant differences emerge with respect to involvement and intention to use and along all the four dimensions studied for attitude toward technology. We found that a positive attitude toward technology is related to a greater agreement on each dimension (control, involvement, easy to use, and intention to use in the future), meaning that probably this attitude enabled the visitors to be more open to the experience this new technology has to offer during the visit at the museum. The surprising results were that although young visitors in our sample had generally a more positive attitude toward technology than older visitors and they used the system in a correct way more often (specifically understood better the *like-o-meter*) the older visitors expressed a greater tendency toward their intention to use the guide in the future. We might speculate that being older visitors less acquainted with new technologies and less skilled to operate properly new systems, they were surprised by the good experience they've got while using it. Their tendency towards using the guide in the future is in fact a very encouraging result, indicating that museum visitors

in general can use this technology, and not just young people with technological background as might be expected.

5 Conclusion

We have described our experience in building PEACH, an adaptive multimedia mobile guide that supports the visitor in a museum. We have described the graphical interface, which implements a delegation-based interaction paradigm. We have illustrated the user modeling mechanism, the adaptation process for the selection of contents. We finally provided details about the evaluation of the final prototype in a real scenario, Torre Aquila (in Trento, Italy). Experiments testify that visitors felt in control of the guide, felt involved in the visit, found the guide quite easy to use and expressed their intention to use it. Interestingly, although young visitors had a more positive attitude toward technology than older visitors, the older visitors expressed a greater tendency toward their intention to use the guide in the future. We might speculate that they were surprised by the good experience they've got while using it.

References

1. Amendola I., Cena F., Console L., Creola A., Gena C., Goy A., Modeo S., Persero M., Torre I., Toso A.: UbiquiTO: A Multi-device Adaptive Guide. In Proceedings of Mobile HCI (2004) 409-414
2. Bellotti F., Berta R., de Gloria A., Margarone M.: User Testing a Hypermedia Tour Guide, in Pervasive Computing IEEE (2002) 1(2):33-41
3. Berkovich M., Date J., Keeler R., Louw M., O'Toole M.: Discovery Point: Enhancing the Museum Experience with Technology. In Proceedings of CHI 2003 Florida, USA (2003) 994-995
4. Cheverst K., Davies N., Mitchell K., Friday A., C. Efstratiou.: Developing a context-aware electronic tourist guide: some issues and experiences. In Proceedings of CHI 2000, Amsterdam, 17-24
5. Ciavarella C., Paternò F.: The design of handheld, location-aware guide for indoor environments. In Personal and Ubiquitous Computing (2004) 8(2): 82-91
6. Chittaro L., Burigat S.: Augmenting Audio Messages with Visual Directions in Mobile Guides: an Evaluation of Three Approaches. In Proceedings of MOBILE HCI 2005: ACM Press, New York (2005) 107-114
7. Falk, H., Dierking L.: The Museum Experience. Whalesback Books Washington (1992)
8. Goren-Bar D., Graziola I., Pianesi F., Zancanaro M., Rocchi C.: Innovative Approaches for Evaluating Adaptive Mobile Museum Guides. In Stock O., Zancanaro M. (eds.) PEACH: Intelligent Interfaces for Museum Visits, Cognitive Technologies Series, Springer, Berlin. (in press)
9. Rocchi C., Zancanaro M.: Template-based Adaptive Video Documentaries in Proceedings of Artificial Intelligence in Mobile Systems, Nottingham, UK
10. Rocchi C., Graziola I., Goren-Bar D., Stock O., Zancanaro M.: Adaptive Multimedia Guide In Stock O., Zancanaro M. (eds.) PEACH: Intelligent Interfaces for Museum Visits, Cognitive Technologies Series, Springer, Berlin. (in press)