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SEAMLESS PERSONALIZED TV-LIKE PRESENTATIONS ON MOBILE AND STATIONARY DEVICES IN A MUSEUM

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Abstract

The issue of the seamless interleaving of interaction with a mobile device and stationary devices is addressed in a typical situation of educational entertainment: the visit to a museum. Some of the salient elements of the described work are the emphasis on multimodality in the dynamic presentation and coherence throughout the visit.
The adopted metaphor is of a kind of contextualized tv-like presentation, useful for engaging (young) visitors. On the mobile device, personal video-clips are dynamically generated from personalized verbal presentations; on larger stationary screens distributed throughout the museum, further background material and additional information is provided. A virtual presenter follows the visitors in their experience and gives advice on both types of devices and on the museum itself.

Nous présentons dans cet article le problème d'un type d'arrangement fluide d'interaction avec un moyen portable et un moyen fixe dans une situation typique de divertissement éducatif : la visite au musée. Les éléments importants de ce travail sont l'emphase sur la multimodalité dans une présentation dynamique et la cohérence pendant la visite.
La métaphore que nous avons adoptée ici est une présentation « contextualisée » qui s'approche au style de la télévision, apte à entretenir les jeunes visitateurs. Des video-clips personnalisés sont dynamiquement générés à partir des présentations verbales dans le moyen portable. D'autres informations supplémentaires sont fournies par des écrans fixes plus grands distribués dans le musée. Un présentateur virtuel suit les visiteurs dans leur expérience et donne des conseils soit sur les types de moyens soit sur le musée.

Neue Interaktions-Metaphern zur gleichzeitigen, nahtlosen Interaktion mit mobilen und stationären Geräten, werden in diesem Papier im Kontext einer typischen Lernsituation betrachtet: Dem Museumsbesuch. Ein besonderer Schwerpunkt der Arbeit liegt auf der
Multimodalität der dynamischen Präsentationen, sowie der Kohärenz zwischen mobilen und stationären Präsentationen während des gesamten Museumsbesuches. Die verwendeten Metaphern der Präsentation entstammen dem Film- und Fernseh-Umfeld, und dienen dazu, die Präsentationen (vor allem für jüngere Besucher) unterhaltsam zu gestalten. Auf dem mobilen Gerät werden dazu auf den Benutzer abgestimmte Graphiken und Videos

gezeigt, die mit einer personalisierten, verbalen Präsentationen abgestimmt sind. Auf großen, stationären Displays, die im Museum an verschiedenen Orten installiert sind, werden vertiefende Hintergrundinformationen bereitgestellt. Ein virtueller Museumsführer begleitet den Besucher während seines Besuches und gibt Hinweise sowohl zur Bedienung des Informations-Systems als auch zum Inhalt der Ausstellung.

Introduction

Multimedia and multimodality have become popular concepts, and so is the theme of mobile computing. Nowadays, new challenges arise for the combination of the three areas. In this paper we mainly address the issue of the seamless interleaving of interaction with a mobile device and stationary devices, in a typical situation of educational entertainment: the visit to a museum.

There is a strong need for intelligent information presentation in the domain of cultural heritage appreciation and tourism. The way in which the cultural experience is carried on has not changed much for centuries; and especially the young seem to require novel modes of being exposed to the cultural material, so that they would engage and entertain themselves. There is a natural request for a quality shift from presentation of cultural heritage as a standard mass product, similar to supermarket goods, to a way to provide the single person with the possibility of acquiring information and understanding what interests them most, and to assist their cultural development.

We present some novel developments in an ongoing project PEACH (http://peach.itc.it), dedicated to the exploitation of cultural heritage. The projects goal is to go one step further in the development of location-aware adaptive systems similar to the multimodal approaches presented in [Stock, 2001] and [Baus et al. 2002]. In this project, some of the salient elements are the emphasis on multimodality in the dynamic presentation and the coherent and seamless transition between presentation on stationary and mobile devices.

The mobile system is intended to combine the dynamically adapted language-based output with a kind of dynamically produced visual documentary. While the first part is an improvement of well established techniques, the second is based on cinematic techniques. Underlying the whole approach is the adoption of the rhetorical structure theory and the use of repositories of material to be adapted for the specific presentation case. The input to the system comes from the locations of the visitors and observations the system itself has made about their behavior and presumed interests and what they have been exposed to and presented so far. All the material is presented coherently throughout the visit.

Museums are noncompetitive and nonevaluative environments where visitors are free to move around and learn concepts in connection to the objects exhibited. A museum visit is a personal experience encompassing both cognitive aspects (e.g., the elaboration of background and new knowledge), as well as specifically emotional aspects (e.g., satisfaction of interests, fascination for the exhibits). Therefore, object presentations have to be engaging and rich. In this paper, we go a step further. We describe work aimed at a kind of contextualized tv-like presentation, so that a young visitor is hooked. On the mobile device, personal video-clips are dynamically generated from personalized verbal presentations; on larger stationary screens distributed throughout the museum (so-called Virtual Windows), further background material and additional information is provided. A virtual presenter follows the visitors in their experience and provides advice on both types of devices and on the museum itself. In any case, our belief is still that the real objects should have the priority.

Project Overview

The PEACH project has the objective of studying and experimenting with various advanced technologies that can enhance cultural heritage appreciation. The research activity focuses on two technology mainstreams, natural interactivity (encompassing natural language processing, perception, image understanding, intelligent systems etc.) and microsensory systems. Throughout the project, synergy and integration of different research sectors is emphasized. Two general areas of research are highlighted: (i) the study of techniques for individual-oriented information presentation and (ii) the study of

techniques for multisensorial analysis and modelling of physical spaces to unobtrusively collect information about the visitors and the environment.

The scope of the project is to significantly increase the quality of cultural heritage appreciation, in such a way as to transform passive objects into active ones that can be manipulated by the observer. Extended appreciation and (inter) active objects are facets of an underlying unifying vision called Active Cultural Heritage.

The project focuses, as a case study, on a museum with beautiful frescoes. It started one year ago and it will deliver its final results in a three year period. To underline the flexibility of our approach, a second experimentation is being conducted in a cultural heritage site dedicated to iron and steel industry.

The problem of adapting content for (cultural) information presentations in physical "hypernavigation", was tackled in Hyperaudio and HIPS [Not et al. 1998, Not et al. 2000]. It shares many features with the problem of producing adaptive and dynamic hypermedia for virtual museums (e.g. M-PIRO, [Androutsopoulos et al. 2001] or dynamic encyclopedias like PEBA-II, [Milosavljevic et al. 1996]). Relevant projects focused on mobile information presentation for a cultural visit of a town are GUIDE [Cheverst et al. 2000] and DeepMap [Malaka et al. 2000].A fascinating work on wearable augmented reality systems that include localization, vision, graphics and caption overlay for a person moving in a cultural outdoor environment is described in [Feiner et al. 1997].

The situative context of the visitor

Figure 1. The system components of the mobile device

In the project there are several degrees of freedom that have to be regarded, to appropriately select and plan the personalised presentations for mobile devices and Virtual Windows. At the moment the situative context of the visitor is described as a 6-tuple (L,O,M,S,V,T):

L=Location. The location of the visitor in the museum. This location can be an absolute position regarding a well defined frame of reference (e.g. the visitor is in room A) or a relative position (e.g. the visitor is close to exhibit B).

O=Orientation. In a museum the orientation of the visitor is of utmost importance, since presentation should refer more to what the user is looking at than to information relate to where the user is located.

M=Modality. This is a list of all modalities that can be used to communicate with the visitor. Speech is the modality that is supposed to work all the time. However, the use of graphics and gestures depends on whether the visitor looks at the device or not.

S=Stereotype. The actual stereotype that is used to classify the visitor. In this moment, we. In our previous work, we have experimented with dynamic and more refined visitor models like interest models or visiting styles. In the current experimentation, we are simply using two groups: the more general or the more technically interested visitor.

V=Visiting History. This history contains all information that the system could collect from the interaction with the visitor and information on the presentations that were generated and presented to the visitor. This includes visitor requests for more information on a topic, how long the visitor looked at each exhibit, and whether the visitor interrupted certain presentation units as well as a representation of the text, the graphics and the videos that were generated during the visit.

T=Time left for visit. This helps the system to distinguish between visitors who are in a hurry and visitors who have a lot of time available. Of course, those values should depend on the size and structure of the museum.

The situative context of the system is derived from different sensors, which are connected to the mobile device. Figure 1 depicts the components of the mobile device that are used for this purpose. The position of the mobile device is determined by the use of long-life infrared beacons that are installed throughout the museum. Those senders emit a 16-bit code that can be received via the integrated infrared port of the mobile device. Several

beacons with different sending ranges, that are installed in the same location, allow to roughly distinguish the distance of the mobile device to that location.

Accelerometers provide the 3D-orientation of the device. This allows (a) to estimate the orientation of the visitor, and (b) to determine whether the user is looking at the screen of the device (the device is held within a certain range of vertical angle range). All the visitor interactions with the mobile device are recorded and send to a central server, where the visitor's situative context is constantly updated.

TV-like presentations on the mobile device

Although many research projects are exploring the new possibilities offered by Personal Digital Assistants (PDA) in a museum setting (see for example, [Grinter et al. 2002 and Cheverst et al. 2000]), usually these multimedia guides use static images, while others employ pre-recorded short video-clips about museum exhibits. In our approach, we have focused on automatically produced video-clips to be played on the small screen of the mobile device and using a life-like character either as an anchorman or a presenter.

Personalized video-clips

Previous projects, have experimented with an architecture for dynamic adaptation (taking into account the context, characteristics of the visitors and what they have already been exposed to)of existing multimedia repositories called Macronodes [Not and Zancanaro 2000]. Here, the focus was mainly on audio guides in a museum setting (see [Not et al 2000]). One of the characteristics of the Macronodes architecture is that the output is an audio commentary annotated with respect to the discourse structure. This information can be employed by other modules to enrich the presentation. In the museum project, we use it for automatically producing video-clips. At presentation time, a sequence of pictures is synchronized with the audio commentary and the transitions among them are planned according to cinematic techniques. Our hypothesis is that the use of this type of animation

to present the description of a painting allows the visitor to better identify the details introduced by the audio counterpart of the presentation. In this manner, both the efficiency and the satisfaction dimensions of the system usability are increased while also providing an enhanced learning experience for the visitor.

The language of cinematography [Metz 1974], including shot segmentation, camera movements and transition effects, is employed in order to plan the animation and to synchronize the visual and the verbal parts of the presentation. In building the animations, a set of strategies similar to those used in documentaries were thus employed. Two broad classes of strategies have been identified. The first class encompasses constraints, imposed by the grammar of cinematography, while the second deals with conventions normally used in guiding camera movements in the production of documentaries. For instance, a strategy in the first class would discourage a zoom-in immediately followed by a zoom-out, while a different strategy in the second class would recommend the use of sequential scene cuts, rather than a fade-out effect, to visually enumerate different characters in a scene. It is worth noting that in the latter strategy it is often necessary to make reference to the discourse structure of the audio part of the presentation, such as enumeration of properties, background knowledge, and elaboration of related information. In order to formally use discourse structure, we employ the Rhetorical Structure Theory [Mann and Thompson 1987].

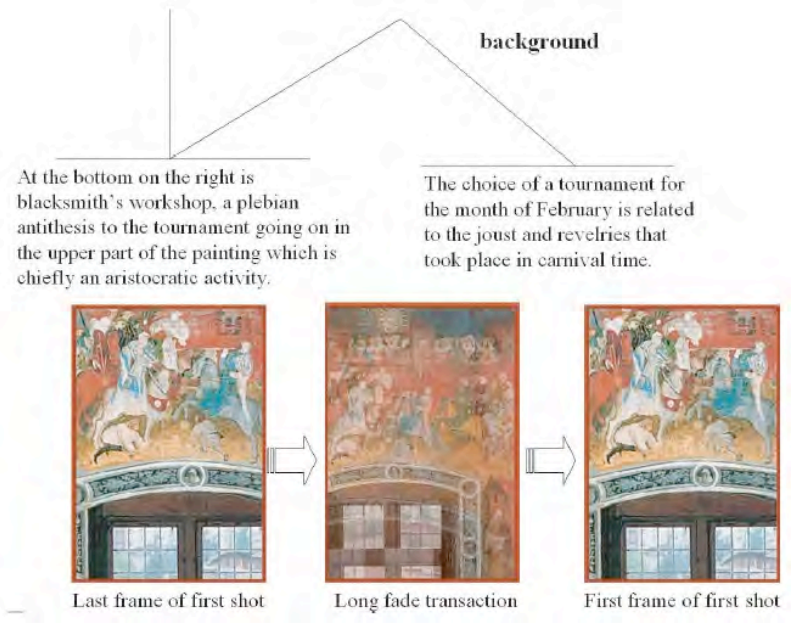

Figure 2. From audio commentary to video-clips

Video-clips are built by first searching for the sequence of details mentioned in the audio commentary, deciding the segmentation in shots, and then planning the camera movements (employing a rule-based system) in order to smoothly focus on each detail in synchrony with the verbal part.

The planning process is divided into four phases (see [Rocchi and Zancanaro 2003] for further details):
Detail association. A detail is associated to each segment of text by looking in a database of images.
Shot initialization and structure planning. A candidate structure (a sequence of shots) for the final presentation is elaborated according to the rules and the rhetorical structure of the text.
Shot completion. Camera movements between details in each shot are planned; in this phase the constraints are applied
Editing. Transitions among shots are selected according to the rhetorical tree configuration.

While the constraints are just forbidden sequences of camera movements, the conventions are expressed in terms of the rhetorical structures of the audio commentary. The example in figure 2 illustrates the strategy based on the background relation that forces segmentation of the two text spans in different shots with a long fade between them. It is worth noting, that in the example in figure 2, the shot segmentation was not necessary for the purpose of detail identification (both text spans talk about the tournament); yet the long fade quite effectively remarks the rhetorical difference between the main information provided by the first part and the background information provided by the second.

The role of the life-like character during presentations

While the dynamically arranged video-clips are a basic element of our dynamic presentation, we have also experimented with a life-like character that plays the role of an accompanying agent, ready to move on the mobile device or to jump on the Virtual

Windows, in order to provide continuous assistance and continuity to the presentation. The character helps in solving problems like how to reach a certain exhibit, and yielding explanations. User evaluations [Mulken et al. 1998] have shown that the introduction of a life-like character makes presentations more enjoyable and attractive (something that we regard as very important to keep younger visitors engaged).

Figure 3. Screen shots from a running presentation : the life-like character first presents a static graphic and then announces and starts the presentation of a video clip

The use of life-like characters on portable devices has to be carefully weighted because of the small dimension of the display. Nevertheless, there are specific roles that a properly designed character can play on a mobile device to improve the level of engagement with the presentation. In particular, following the TV metaphor, two main roles can be recognized: the presenter and the anchorman. When playing the role of the presenter, the character introduces new media assets and uses pointing gestures. When playing the role of the anchorman, the character just introduces complex presentations without interfering with them any further. Although simpler than the presenter, the role of an anchorman can help the visitor understand many different presentations, providing a context in which they all make sense. In its role of an anchorman the character also supports the seamless integration of the mobile devices' small screen and the large screen of the Virtual Window. Similar to a TV-presenter who walks around the studio to present different

content, the character is able to move between the mobile device and the Virtual Window. Besides the specific role that the character may play, it is also a metaphor for the actual interests of the visitor. By providing different characters and giving the visitor the choice between them, the different views on the exhibits are transparently conveyed and selected. For example, in our demo scenario one character represents a more general and another a more technical view.

On the mobile device we have experimented with different embodiments for the virtual character. While a full-sized character provides the most flexibility in terms of gestures and movement, it does unfortunately also cover big areas of the screen, something that is not suitable for the small displays of mobile devices. For this reason, we have decided to use an iconic representation instead, displaying only the character's head (see figure 3, left image). This choice restricts us to a limited set of character animations and gestures, i.e. small head and lip movements and simple pointing gestures, like the one shown in the left part of figure 3.

The mobile device receives the multimedia presentation from a presentation server (described below) over a wireless network. During that presentation, the visitors have several means to control the flow of the presented material, i.e. they are able to interrupt or to jump to other parts of the presentation.

When a visitor starts the tour through the museum the mobile device registers at a central presentation server. During the visit all information described in the previous section is constantly reported to that server. On the server side a multimedia database is used, to retrieve appropriate presentation content that matches best the actual situative context of the visitor. Different strategies are used to select content from the database. The result of a request is a collection of media content which takes into account the interest of the user as well as the capabilities of the device. Text that is retrieved from the database, is immediately transformed into spoken language using speech synthesizer. The collected content is then integrated into an XML-File that combines media content and assignments for the life-like character. This intermediate presentation script is used to clearly separate the representation of the content from the final presentation, allowing later on to integrate additional presentation sources.

Afterwards the script is send to the mobile device. Immediately after retrieving it, the mobile device starts the rendering of the presentation. While the media content is streamed to the mobile device, the life-like character takes over the role of a personalised presentation agent, guiding the visitor through the presentation.

Presentations on the Virtual Windows and transitions between devices

The Virtual Window is the primary medium to provide the visitors with in-depth information on interesting topics. It has enough resolution to allow the full use of graphics, animations and video-clips of all kinds. If visitors approach a Virtual Window, their personal presentation agent will transit to the Virtual Window, where it appears fully sized. The metaphor of the presentation agent as a personal guide allows the visitor to easily switch between different perspectives on the exhibits by simply taking along a different agent who stands for another view when continuing the visit.

In order to detect the visitor's relative distance to the Virtual Windows, each of the windows is equipped with two infrared beacons of different ranges. When visitors approach a Virtual Window for the first time, the presentation agent, in its role of an anchorman, proactively informs them about the Window and how to make use of it. If the visitors are close enough, the presentation agent starts to disappear from the mobile device and to reappear on the Virtual Window. The transition from one device to another is underlined by sounds and an animation. This beam-effect is used to guide the visitor’s attention towards the Virtual Window, where they find the personal presentation agent continuing the presentation. Once the presentation agent is on the Virtual Window, the visitors can continue to coherently interact both with the agent and the presentation. In the current state of the implementation this is held fairly simple, but future implementations may make more use of the capabilities of the Virtual Window, for example by providing a multimodal interface (see [Mueller 2002]). Generally, the presentation agent is playing a more active role while guiding the visitor through the presentation on a Virtual Window.

Sophisticated gestures and animations thus lead to a much more life-like appearance.

Another functionality that we make use of is the possibility for the visitors to choose a different presentation agent before leaving the Virtual Window. Since each character represents a special interest group (e.g. in our scenario a neutral character and an art historian), the newly chosen character changes the stereotype that is used to classify the visitors and hence influences the future presentations generated by the server. Finally, when leaving the Virtual Window, the presentation agent follows the visitors and after another transition automatically reappears on the mobile device.

Several projects have aimed at developing concepts for combined interaction of large and small screen devices. Two examples are the PEBBLE project [Myers:2001] that focuses on Computer Supported Collaborated Work with handhelds and a framework described in [Pham et al. 2000] for the distribution of media on different devices. However, none of those systems so far make use of a life-like character to transparently combine small and large screen devices.

Adapting presentations to the situative context of the visitor

One goal that we had in mind when designing the concepts for our project, was to transparently combine mobile and stationary output devices. In the previous section we described the role of the presentation agent, who is able to travel from one device to another and thus guides the focus of attention from the mobile device to the Virtual Window and vice versa. At the same time this presentation agent is a metaphor for a special perspective on the explored cultural heritage, representing the stereotype that is actually used to classify the visitors.

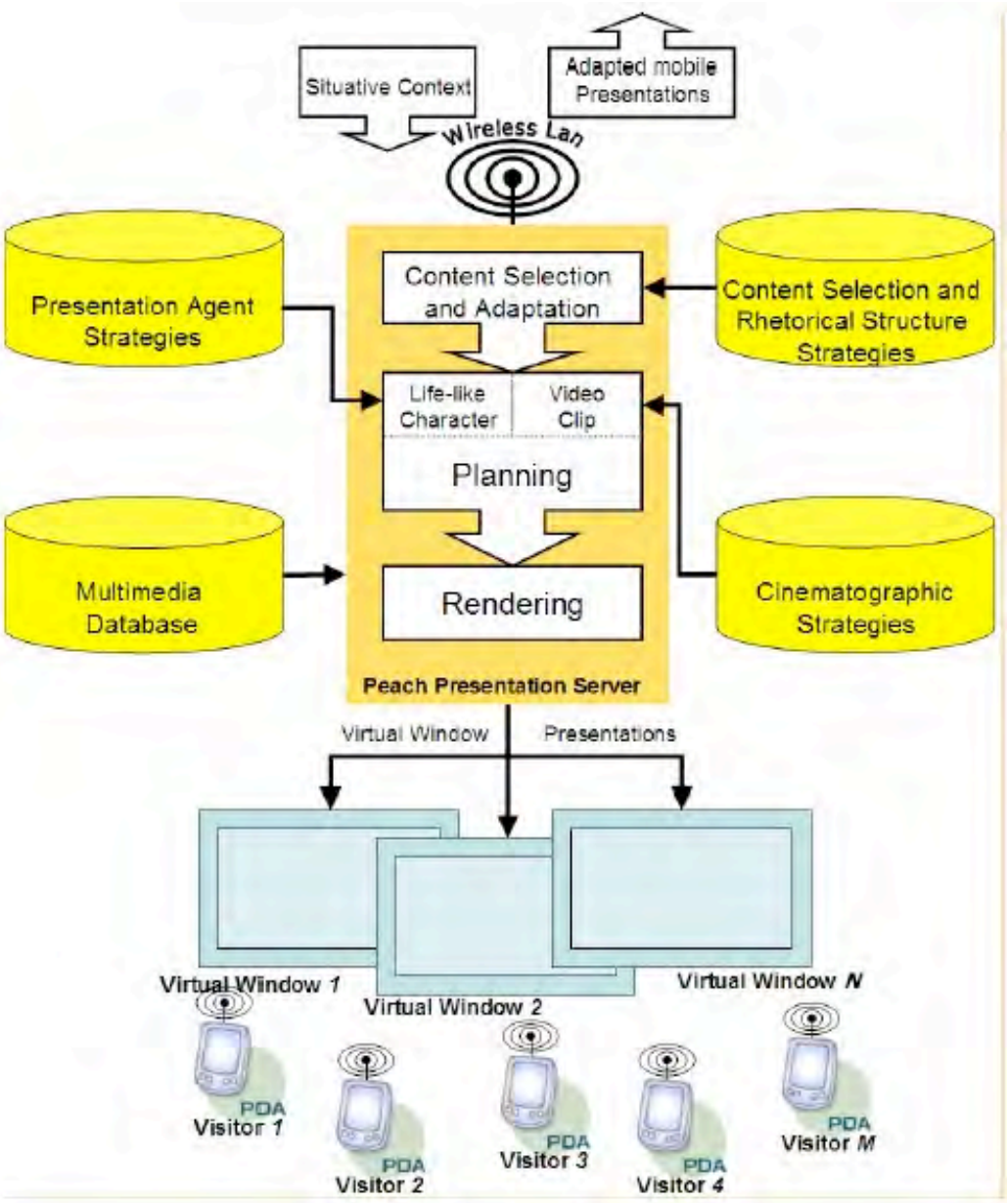

Figure 5. An overview of the project architecture

In addition, it is necessary to adapt the style and content of the presentation to the situative context of the users in order to provide a coherent presentation throughout the visit, leaving the underlying technology as unnoticed as possible and thus emphasizing the contents of the presentation. Figure 5 shows the project architecture that explains how this adaptation process was realized. It is designed as a client-server architecture, where all mobile devices and Virtual Windows have to register with a central presentation server. One of its particular features is the ability to generate presentations both for the mobile devices and the Virtual Windows simultaneously.

Given a visitor specific situative context, the presentation server first selects the appropriate content and the degree of adaptation that is necessary. For this purpose, we make use of different strategies that adapt the presentation not only to the location and the interest of the visitor but also to the available modalities. Since we are able to distinguish between users who are actually only listening to the presentation and visitors who are looking at the devices, the system can decide when to provide video-clips and when audio-only. The strategies also take into account technical resources of the output media, i.e. the screen resolution and display size.

The content for presentations at the Virtual Window is selected according to the visitor's interests during the visit. Instead of providing only additional material according to the stereotype (e.g. general vs. artistic view) the system provides further detailed information on the exhibits that were of specific interest to the visitor (according to the visiting history). Meta-strategies allow providing the visitors with information that helps to change their situative context if necessary. The system could for example advise the visitors to look at an image that is displayed on the mobile device. One specific strategy even allows the system to guide the visitors to the next Virtual Window, where the content may be presented more appropriately.

After having determined the content and structure of the presentation, the server starts to plan the behavior and role of the life-like character and where appropriate also plans the structure of a video-clip. For this purpose the server relies on the cinematographic strategies described early. The behavior of the life-like character is captured in its own set of strategies, helping the system to decide for example, which of the two roles (presentation agent or anchorman) the character should play during a piece of presentation.

Finally the server renders the overall presentation with material retrieved from a multimedia database that contains graphics and text. At this point the video-clips are generated from static graphics and the text for the character is transformed into spoken language using a speech synthesizer. The final presentations are then delivered either to the mobile devices (via wireless network) or to the Virtual Windows.

The full implementation of the architecture is still in progress. However major components were already completed. The life-like character engine from [Andre et al. 2000] was ported and adapted to run on a mobile device under Linux. The transition of the character from the mobile device to the Virtual Window is also fully implemented. At the moment we only make use of one general purpose character1, but the design of other characters has already started.

The video clip generation is implemented with Flash under PocketPC. As soon as an adequate Flash Player will be available for mobile Linux devices, we aim at merging both concepts on one device.

For the content selection and adaptation we rely on components that were developed in earlier projects.

Conclusions

In this paper we have described an intelligent interface project aimed at making a museum visit of interest to the young. The overall modality is reminiscent of the concept of mobile, personalized TV, with a presenter, that gives continuity, video-clips and verbal presentation. The main feature is that all this material is personalized and produced in a context-dependent manner.

We believe this may lead to further developments in the area of educational entertainment. There are many themes that are completely open. Perhaps the biggest challenge is concerned with keeping the attention of the users high and granting a long term memory effect. We need to be able to design presentation techniques that hook the visitors, that continuously build the necessary anticipation and release tension. The "story" (we mean the multimodal story that includes language, graphics and the visible physical

environment) must be entertaining, and, in the future, it should include mechanisms of surprise. The expectation sometimes must be contradicted and this contrast will help in keeping the attention and memorizing the situation.

Another aspect is that the users are responsible for what they do and hence for the material that is presented to them, but yet through the presentation some specific goals of the museum curator can be submitted for adoption. The way is also open to new modalities of visit, particularly important with children. A treasure hunt is an obvious example, where the external goals cause the innocent visitors to look for details and come across many different exhibits with "artificially" induced attention.

References

[André and Rist, 2000] E. Andr´e and T. Rist. Presenting Through Performing: On the Use of Multiple Lifelike Characters in Knowledge-Based Presentation. In Proceedings of the Second International Conference on Intelligent User Interfaces (IUI 2000), pages 1–8, 2000.

[Androutsopoulos et al., 2001] Androutsopoulos, J. Calder, E. Not, F. Pianesi, and M. Roussou. Multilingual personalised information objects. In Proceedings of the International Workshop on Information Presentation and Natural Multimodal Dialogue, Verona, Italy, 2001.

[Baus et al., 2002] J. Baus, A. Kr¨uger, and W. Wahlster. A Resource-Adaptive Mobile Navigation System. In IUI2002: International Conference on Intelligent User Interfaces, pages 15–22, New York, 2002. ACM Press.

[Cheverst et al., 2000] K. Cheverst, N. Davies, K. Mitchell, A. Friday, and C. Efstratiou. Developing a context-aware electronic tourist guide: Some issues and experiences. In Proceedings of CHI 2000, Amsterdam, 2000.

[Feiner et al., 1997] S. Feiner, B. MacIntyre, T. Hollerer, and A.Webster. Touring machine: Prototyping 3d mobile augmented reality systems for exploring the urban environment. In Proceedings of ISWC 97 (Int. Symp. on Wearable Computing), Cambridge,MA, 1997.

[Grinter et al., 2002] R. E. Grinter, P. M. Aoki, A. Hurst, M. H. Szymanski, J. D. Thornton, and A.Woodruff. Revisiting the visit: Understanding how technology can shape the museum visit. In Proceedings of ACM Conf. on Computer Supported Cooperative Work, New Orleans, LA, 2002.

[Malaka and Zipf, 2000] R. Malaka and A. Zipf. Deep map – challenging it research in the framework of a tourist information system.In D. Buhalis (eds) D. R. Fesenmaier, S. Klein, editor, Information and communication technologies in tourism. Springer-Verlag, Wien, New York, 2000.

[Mann and Thompson, 1987] W.C. Mann and S. Thompson. Rhetorical structure theory: A theory of text organization. In L. Polanyi (ed.), editor, The Structure of Discourse. Ablex Publishing Corporation, 1987.

[Metz, 1974] C. Metz. Film Language: a Semiotics of the Cinema. Oxford University Press, New York, 1974.

[Milosavljevic et al., 1996] M. Milosavljevic, A. Tulloch, and R. Dale. Text generation in a dynamic hypertext environment. In Proceedings of the Nineteenth Australasian Computer Science Conference, Melbourne, 1996.

[Mueller, 2002] Christian Mueller. Multimodal dialog in a mobile pedestrian navigation system. In Proceedings of the ISCA Tutorial and Research Workshop (ITRW) on Multi-Modal Dialogue in Mobile Environments. University of Southern Denmark, 2002.

[Myers, 2001] B. Myers. Using hand-held devices and pcs together. In Communications of the ACM, volume 44(11). ACM Press, 2001.

[Not and Zancanaro, 2001] E. Not and M. Zancanaro. The macronode approach: mediating between adaptive and dynamic hypermedia. In Proceedings of the International Conference on Adaptive Hypermedia and Adaptive Web-based Systems, AH'2000,Trento, Italy, 2001.

[Not et al., 1998] E. Not, D. Petrelli, M. Sarini, and O. Stock. Hypernavigation in the physical space: Adapting presentations to the user and the situational context. New Review of Hypermedia and Multimedia, 4, 1998.

[Not et al., 2000] E. Not, D. Petrelli, O. Stock, C. Strapparava, and M. Zancanaro. The environment as a medium: Location-aware generation for cultural visitors. In Proceedings of the workshop on Coherence in Generated Multimedia, held in conjunction with INLG'2000, Mitze Ramon, Israel, 2000.

[Pham et al., 2000] T.L. Pham, G. Schneider, and S. Goose. A situated computing framework for mobile and ubiquitous multimedia on Information Presentation and Natural Multimodal Dialogue. In Proc. of the ACM International Conference on Multimedia. ACM Press, 2000.

[Rocchi and Zancanaro 2003] C. Rocchi, M. Zancanaro. Generation of Video Documentaries from Discourse Structures. In Proceedings of Ninth European workshop on Natural Language Generation. Budapest. April 2003.

[Stock, 2001] O. Stock. Language-based interfaces and their application for cultural tourism. AI Magazine, 22(1):85–97, 2001.

[van Mulken et al., 1998] S. van Mulken, E. Andre, and J. Mueller. The persona effect: How substantial is it. In In Proc. Human Computer Interaction Conference, pages 53–58. Springer, 1998. Access using small screen and composite devices. In Proc. of the ACM International Conference on Multimedia. ACM Press, 2000.

