Title:

A Visitor’s Guide in an Active Museum: Presentations, Communications, and Reflection

**Author:**

TSVI KUFLIK, University of Haifa, Israel OLIVIERO STOCK and MASSIMO ZANCANARO, FBK-IRST, Povo, Trento, Italy ARIEL GORFINKEL, SADEK JBARA, SHAHAR KATS, JULIA SHEIDIN, and NADAV KASHTAN, University of Haifa, Israel

**Abstract:**

Technology can play a crucial role in supporting museum visitors and enhancing their overall museum visit experiences. Visitors coming to a museum do not want to be overloaded with information, but to receive the relevant information, learn, and have an overall interesting experience. To serve this goal, a user-friendly and flexible system is needed. The design of such a system poses several challenges that need to be addressed in parallel. The user interface should be intuitive and let the visitors focus on the exhibits, not on the technology. Content and delivery must provide relevant information and at the same time allow visitors to get the level of detail and the perspectives in which they are interested. Personalization may play a key role in providing relevant information to individuals. Yet, since visitors tend to visit the museum in small groups, technology should also contribute to and facilitate during-the-visit communication or post-visit group interaction. The PIL project applied at the Hecht museum extended the research results of the PEACH project and tried to address all of these considerations. Evaluation involving users substantiated several aspects of the design.

Title:

Adaptive, intelligent presentation of information for the museum visitor in PEACH

**Author:**

Oliviero Stock · Massimo Zancanaro · Paolo Busetta ·

Charles Callaway · Antonio Krüger · Michael Kruppa ·

Tsvi Kuflik · Elena Not · Cesare Rocchi

**Abstract:**

The study of intelligent user interfaces and user modeling and adaptation is well suited for augmenting educational visits to museums. We have defined a novel integrated framework for museum visits and claim that such a framework is essential in such a vast domain that inherently implies complex interactivity. We found that it requires a significant investment in software and hardware infrastructure, design and implementation of intelligent interfaces, and a systematic and iterative evaluation of the design and functionality of user interfaces, involving actual visitors at every stage. We defined and built a suite of interactive and user-adaptive technologies for museum visitors, which was then evaluated at the Buonconsiglio Castle in Trento, Italy: (1) animated agents that help motivate visitors and focus their attention when necessary, (2) automatically generated, adaptive video documentaries on mobile devices, and (3) automatically generated post-visit summaries that reflect the individual interests of visitors as determined by their behavior and choices during their visit. These components are supported by underlying user modeling and inference mechanisms that allow for adaptivity and personalization. Novel software infrastructure allows for agent connectivity and fusion of multiple positioning data streams in the museum space. We conducted several experiments, focusing on various aspects of PEACH. In one, conducted with 110 visitors, we found evidence that even older users are comfortable interacting with a major component of the system.

Title:

Bridging the Gap between the Digital and the Physical:

Design and Evaluation of a Mobile Augmented Reality

Guide for the Museum Visit

**Author:**

Areti Damala, Pierre Cubaud

Anne Bationo, Pascal Houlier, Isabelle Marchal

**Abstract:**

Can Augmented Reality (AR) techniques inform the design and implementation of a mobile multimedia guide for the museum setting? Drawing from our experience both on previous mobile museum guides projects and in AR technology, we present a fully functional prototype of an AR-enabled mobile multimedia museum guide, designed and implemented for the Museum of Fine Arts in Rennes, France. We report on the life cycle of the prototype and the methodology employed for the AR approach as well as on the selected mixed method evaluation process; finally, the first results emerging from quantitative evaluation are discussed, supported by evidence and findings from the qualitative part of the assessment process. We conclude with lessons learned during the full circle of conception, implementation, testing and assessment of the guide.

Title:

Indoor Positioning in Cultural Heritage: Challenges and a Solution

**Author:**

Tsvi Kuflik, Joel Lanir,

Michele Corra

Massimo Zancanaro,

**Abstract:**

Museums are both appealing and challenging as an environment for research with novel mobile technology. Over the years, quite a few research projects explored the potential of novel technologies to support information delivery to museum visitors. Having an accurate visitor position and orientation is a key factor in the success for offering an interesting and personalized experience to visitors. Unlike outdoors positioning, in spite of numerous technologies experimented with, there is no prevailing indoor positioning solution. Each technology has its benefits as well as its limitations. In addition, museums have their own constraints when it comes to installation of equipment in their space. In the framework of the PIL project, a flexible “light weight” proximity based indoor positioning system was developed and deployed at the Hecht museum, at the University of Haifa. The positioning system was subject to the inherent limitations of the basic measurement technology. The implementation proposes a general framework for indoor positioning addressing these limitations by an abstract reasoning layer supported by a dialog with the user that is seamlessly integrated into a museum visitors' guide system.

Title:

Non-intrusive User Modeling for a Multimedia Museum Visitors Guide System

**Author:**

Tsvi Kuflik1, Charles Callaway2, Dina Goren-Bar2, Cesare Rocchi2,

Oliviero Stock2, and Massimo Zancanaro2

**Abstract:**

A personalized multimedia museum visitor's guide system may be a valuable tool for improving user satisfaction in a museum visit. Personalization poses challenges to user modeling in the museum environment, especially when several different applications are supported by the same user model, where it is required to operate in a non-intrusive manner. This work presents the PEACH experience of non-intrusive user modeling supporting online dynamic multimedia presentation production and additional applications such as visit summary report generation.

Title:

Personal Reporting of a Museum Visit as an Entrypoint to Future Cultural Experience

**Author:**

Charles Callaway, Tsvi Kuflik, Elena Not, Alessandra Novello, Oliviero Stock and Massimo Zancanaro

**Abstract:**

Museum visitors can continue interacting with museum exhibits even after they have left the museum. We can help them do this by creating a report that includes a basic, personalized narration of their visit, the items and relationships they found most interesting, pointers to additional related online information, and suggestions for future visits to the current and other museums. In this work we describe the automatic generation of personalized natural language reports to help create one episode in an ongoing coherent sequence of cultural activities.

Title:

Personalization in Cultural Heritage: The Road Travelled and the One Ahead

**Author:**

Liliana Ardissono1, Tsvi Kuflik2, Daniela Petrelli3

**Abstract:**

Over the last twenty years, cultural heritage has been a favored domain for personalization research. For years, researchers have experimented with the cutting edge technology of the day; now, with the convergence of internet and wireless technology, and the increasing adoption of the Web as a platform for the publication of information, the visitor is able to exploit cultural heritage material before, during and after the visit, having different goals and requirements in each phase. However, cultural heritage sites have a huge amount of information to present, which must be filtered and personalized in order to enable the individual user to easily access it. Personalization of cultural heritage information requires a system that is able to model the user (e.g., interest, knowledge and other personal characteristics), as well as contextual aspects, select the most appropriate content, and deliver it in the most suitable way. It should be noted that achieving this result is extremely challenging in the case of first-time users, such as tourists who visit a cultural heritage site for the first time (and maybe the only time in their life). In addition, as tourism is a social activity, adapting to the individual is not enough because groups and communities have to be modeled and supported as well, taking into account their mutual interests, previous mutual experience, and requirements. How to model and represent the user(s) and the context of the visit and how to reason with regard to the information that is available are the challenges faced by researchers in personalization of cultural heritage. Notwithstanding the effort invested so far, a definite solution is far from being reached, mainly because new technology and new aspects of personalization are constantly being introduced. This article surveys the research in this area. Starting from the earlier systems, which presented cultural heritage information in kiosks, it summarizes the evolution of personalization techniques in museum web sites, virtual collections and mobile guides, until recent extension of cultural heritage toward the semantic and social web. The paper concludes with current challenges and points out areas where future research is needed.

Title:

Supporting Small Groups in the Museum

by Context-Aware Communication Services

**Author:**

Tsvi Kuflik, Julia Sheidin, Sadek Jbara, Dina Goren-Bar, Pnina Soffer

Oliviero Stock, Massimo Zancanaro

**Abstract:**

Visitors often tend to visit museums in groups, mainly with family or friends, yet most of the today mobile museum guides focus on supporting the individual visitor. The technology described in this paper allows supporting groups of visitors in addition to individuals by providing contextaware services aimed at supporting the whole group. These include context-aware communication and alerting services that are provided by the museum visitor’s guide system developed in the framework of the PIL (PEACH-Israel) project, as an example case of a larger variety of possible context-aware services.

Title:

Analyzing Museum Visitor s’ Behavior Patterns

**Author:**

Massimo Zancanaro 2 , Tsvi Kuflik 1 , Zvi Boger 3 , Dina GorenBar

1 and Dan Goldwasser

**Abstract:**

Many studies have investigated personalized information presentation in the context of mobile museum guides. In order to provide such a service, information about museum visitors has to be collected and visitors have to be monitored and modelled in a nonintrusive manner. This can be done by using known museum visiting styles to classify the visiting style of visitors as they start their visit. Past research applied ethnographic observations of the behaviour of visitors and qualitative analysis (mainly site studies and interviews with staff) in several museums to define visiting styles. The current work validates past ethnographic research by applying unsupervised learning approaches to visitors classification. By providing quantitative empirical evidence for a qualitative theory we claim that, from the point of view of assessing the suitability of a qualitative theory in a given scenario, this approach is as valid as a manual annotation of museum visiting styles.

Title:

Building Virtual and Augmented Reality Museum Exhibitions

**Author:**

Rafa Wojciechowski\*, Krzysztof Walczak\*, Martin White†, Wojciech Cellary\*

**Abstract:**

A system that allows museums to build and manage Virtual and Augmented Reality exhibitions based on 3D models of artifacts is presented. Dynamic content creation based on pre-designed visualization templates allows content designers to create virtual exhibitions very efficiently. Virtual Reality exhibitions can be presented both inside museums, e.g. on touch-screen displays installed inside galleries and, at the same time, on the Internet. Additionally, the presentation based on Augmented Reality technologies allows museum visitors to interact with the content in an intuitive and exciting manner.

Title:

Storyspace: a Story-driven Approach for Creating Museum Narratives

**Author:**

Annika Wolff, Paul Mulholland, Trevor Collins

**Abstract:**

In a curated exhibition of a museum or art gallery, a selection of heritage objects and associated information is presented to a visitor for the purpose of telling a story about them. The same underlying story can be presented in a number of different ways. This paper describes techniques for creating multiple alternative narrative structures from a single underlying story, by selecting different organising principles for the events and plot structures of the story. These authorial decisions can produce different dramatic effects. Storyspace is a web interface to an ontology for describing curatorial narratives. We describe how the narrative component of the Storyspace software can produce multiple narratives from the underlying stories and plots of curated exhibitions. Based on the curator’s choice, the narrative module suggests a coherent ordering for the events of a story and its associated heritage objects. Narratives constructed through Storyspace can be tailored to suit different audiences and can be presented in different forms, such as physical exhibitions, museum tours, leaflets and catalogues, or as online experiences.

Title:

Analyzing Museum Visitors’ Behavior Patterns

**Author:**

Massimo Zancanaro2, Tsvi Kuflik1, Zvi Boger3,4, Dina Goren-Bar1, and Dan Goldwasser1

**Abstract:**

Many studies have investigated personalized information presentation in the context of mobile museum guides. In order to provide such a service, information about museum visitors has to be collected and visitors have to be monitored and modelled in a non-intrusive manner. This can be done by using known museum visiting styles to classify the visiting style of visitors as they start their visit. Past research applied ethnographic observations of the behaviour of visitors and qualitative analysis (mainly site studies and interviews with staff) in several museums to define visiting styles. The current work validates past ethnographic research by applying unsupervised learning approaches to visitors classification. By providing quantitative empirical evidence for a qualitative theory we claim that, from the point of view of assessing the suitability of a qualitative theory in a given scenario, this approach is as valid as a manual annotation of museum visiting styles.

Title:

I like it – An Affective Interface for a Multimodal Museum Guide

**Author:**

Dina Goren-Bar, Ilenia Graziola, Tsvi Kuflik, Fabio Pianesi, Cesare Rocchi, Oliviero Stock, and Massimo Zancanaro

**Abstract:**

The optimal multimedia tourist guide should support strong personalization of all the information provided in a museum in an effort to ensure that each visitor be allowed to accommodate and interpret the visit according to his own pace and interests. We claim that an interaction based on expressing affective attitude may improve usability of an interface in particular when, like in museums, the technology should not hinder the “real” experience. In this paper, we discuss an affective interface based on the explicit signal of interest to guide the amount of details presented about the museum exhibits.

We discuss an initial design, two user studies and a second design that is better understood by the user.

Title:

An Agent-Based Architecture for Museum Visitors'

Guide Systems

**Author:**

Tsvi Kuflik 1,2,Adriano Albertini1, Paolo Busetta1, Cesare Rocchi1, Oliviero Stock1,

Massimo Zancanaro1

**Abstract:**

Recent developments in museum visitors' guides focus on context awareness, personalization and multimodal and multimedia information presentation to individuals and groups of visitors. However, the modern museum is becoming an "Active Museum", which is a special example of an active environment that interacts with its inhabitants. Since recent museum visitors' guides have focused more on the application and less on the system architecture and infrastructure, much effort is now being invested in the preparation of infrastructure that will support the specific research application. This work focuses on the architecture of the "Active Museum" as demonstrated by two research projects on museum visitors' guides, and suggests a generic, layered architecture for such systems. Such architecture would facilitate research cooperation and increase its effectiveness, and also serve later as a basis for the development of museum visitors' guides.

Title:

Personalized information delivery in dynamic museum environment by implicit organizations of agents

**Author:**

Tsvi Kuflik, Paolo Busetta, Loris Penserini, Paolo Bresciani and Massimo

Zancanaro

**Abstract:**

Today’s complex distributed systems call for novel methods for modeling, design and implementation. The “active museum” being developed within the PEACH project is an example of such a system. In order to model the system, a new pattern called Implicit Organization was defined that supports the coordination requirements of the agents that compose the system. This pattern was applied within the PEACH museum’s visitor guide; its implementation is based on the “channeled multicast” capability offered by the LoudVoice infrastructure. The system analysis and design, reported in this paper, demonstrates the need and use of the Implicit Organization pattern. We discuss the planned implementation of PEACH using a general purpose environment that supports the development of such highly distributed and dynamic systems.

Title:

Preparing Personalized Multimedia Presentations for a Mobile Museum Visitors' Guide – a Methodological Approach

**Author:**

Shahar Katz, Yaacov Kahanov, Nadav Kashtan and Tsvi Kuflik. The University of Haifa, Israel. Ilenia Graziola, Cesare Rocchi, Oliviero Stock and Massimo Zancanaro.

**Abstract:**

Multimedia provides new opportunities for museums to enhance their visitors' experience. However, its use poses new challenges for presentation preparation, among which are: How to enrich the visit while not diverting the visitors' attention from the actual objects in the museum, which should remain the focus of the visit? How to provide a rich information space suitable for a wide variety of visitors? These challenges need to be addressed during planning and preparation of information presentations for mobile, multimedia museum visitors' guides. This work presents lessons learned about the preparation of multimedia presentations for museum visitors' guides in the course of the PEACH and PIL projects. While planning the presentations, the designers need to consider the exhibition as a whole, its objectives, its objects, and the information in which users may be interested. Then, in light of the resulting generic goals, elicit relevant text and images and combine them using cinematographic techniques into integrated multimedia presentations. All the above is abstracted in a nine-step multimedia presentation preparation framework, described in this paper. Keywords: Multimedia Presentations Preparation, Mobile Museum Visitors' Guide.

Title:

Examining proactiveness and choice in a location-aware mobile museum guide

**Author:**

Joel Lanira, , , Tsvi Kuflika, , Alan J. Weckera, , Oliviero Stockb, , Massimo Zancanarob,

**Abstract:**

Cultural heritage is an area that has recently drawn research attention, especially for exploring ways to harness novel mobile technologies for supporting visitors. The main benefit of these novel technologies is their ability to provide personalized, context-aware information services to their users. However, the use of context-awareness is connected to a fundamental issue of proactiveness – should the system keep the user in control all the time and only respond to user requests, or should the system take initiative and propose its services when needed? Proactiveness of mobile visitors’ guides brings with it a possibility for better service to the user at the cost of taking control out of the user’s hand. The amount of choice given to visitors is another key issue. With the vast amount of information available for each exhibit, adaptation of the amount of information by limiting the number of content items, could be warranted to filter the information according to the visitors needs. However, it is not clear how reducing choice in terms of the number of content items that are presented to the visitor affects visitor behavior and satisfaction. We examined these issues in a controlled user study conducted with actual museum visitors; comparing usage, behavior patterns, and attitudes of visitors using three versions of a location-aware mobile museum guide.

Title:

Lifelong Personalized Museum Experiences

**Author:**

Tsvi Kuflik1, Judy Kay2and Bob Kummerfeld

**Abstract:**

Previous research on the personalized museum experience has largely focused on the single visit. New and emerging mobile technologies are enablers for a longer term view, where the personalization spans multiple visits to museums and links them to other aspects of the user's life. There is a large body of research about the importance of this form of personalization. This paper reviews key literature that informs the directions that seem most promising for “lifelong” personalization of the museum experience, identifies some of the technical challenges for such personalization, in terms of the user modeling, ontologies, infrastructure and generation of personalized content. By taking this approach, technology can play a major role in supporting users in their ongoing museum experience, by modeling the visitors, “remembering” their history and recommending a plan for future visits. We explore the role of client-side personalization that makes use of a mobile phone as a lifelong user model server and a platform for both interacting with a technology rich museum environment and for delivery of personalized information.

Title:

Pathlight: Supporting navigation of small groups in the museum context

**Author:**

TSVI KUFLIK, Alan J. Wecker, Joel Lanir, Oliviero Stock

**Abstract:**

In this paper we describe the in-progress work of the Pathlight navigation system for groups and individuals. Pathlight provides indoor navigation support in the museum using a handheld projector. We describe some of the advantages the system provides, look at some background, briefly describe some system features, and posit some open questions for further investigation.

Title:

Early Detection of Museum Visitors Identities by Using a Museum Triage

**Author:**

TSVI KUFLIK, Alan J. Wecker, Joel Lanir, Oliviero Stock

**Abstract:**

The visitor to a museum may start the visit with an identity that depends on various short-term and long-term personal characteristics of the visitor, the museum itself and the visit context. Falk [2009] posits that the visitor's identity would be one of the following: explorer, attraction-seeker, professional/ hobbyist, recharger, or facilitator. Each one of the identities fits a different behavior in the museum. Early detection of a visitor's identity at the beginning of the visit would enable better adaptation to the visitor's needs, and as a result improve the museum visit experience. We present the museum triage concept and its demonstration that are focusing on achieving this goal.

Title:

**Delivering Services in Active Museums via**

**Group Communication**

**Author:**

P. Busetta, P. Bresciani, L. Penserini, S. Rossi, T. Kuflik, A. Albertini and A. Cappelletti

**Motivation:**

Active environments have some characteristics that make them substantially different from traditional computing and human–computer interfaces. For instance, multiple users may be in a single place, interacting with different applications simultaneously. The set of users changes dynamically over time. Users are unaware (and uninterested in the fact) that the environment is formed by many physically and logically distributed components. Therefore, they interact with the environment as if it was a single, monolithic system. They expect it to take note of choices, preferences, and events concerning their presence. They expect it to adapt to them silently, in other words, to be “context aware”. However, services are provided to users by set of variable components that join and leave the environment (e.g., on mobile devices or on stationary objects that may be busy or not working) or that may even be running on some remote, backend computer. Services provided by these components sometimes overlap (e.g., there may be multiple data sources, or different devices for delivering information); therefore, they need to coordinate in order to decide. An example is deciding, for instance, which component will look after a specific service request and how. These considerations lead to a multiagent system (MAS) (Wooldridge 2002) approach to the development of active environments.

PEACH aimed at creating an interactive museum where users are provided with personalized information about exhibits through a variety of information sources of different media types and delivered by several available clients. Visitor position and resource availability may impose constraints on the generation and display of information. Information, sources, and agents change rapidly over time as visitors move around. In and A. Cappelletti 96 P. Busetta et al. the background, user modelling agents should silently record histories of visitor interactions and build profiles by observing their behaviour with the goal of customizing presentations. Furthermore, future extensions of PEACH to consider might include services oriented towards groups of museum visitors (Chapter 13).

Title:

Different Reality Modalities for Museum Navigation

**Author:**

TSVI KUFLIK, Alan J. Wecker, Joel Lanir, Eyal Dim

**Abstract:**

Certain museums can be complicated places to navigate within. They may not have a clear path through the museum and may offer many alternatives. In order to facilitate navigation, we experimented with a variety of techniques and display devices on a mobile museum guide. The types of techniques examined were photo landmark navigation and maps. The display devices we used were a pico projector and handheld devices (IPad, IPod). Each combination of device and technique leads to different reality modality, such as Mixed Reality, Augmented Reality, Dual Reality and Virtual Reality. We examined the benefits and disadvantages of the various combinations, and report qualitative trends from our experience with user experiments and visitor studies. We introduce the term Quality of Reality correspondence (QoRc) to describe the differences noted.

Title:

The Influence of a Location-Aware Mobile Guide on Museum Visitors' Behavior

**Author:**

Joel Lanir1,\*, Tsvi Kuflik1, Eyal Dim1, Alan J. Wecker1 and Oliviero Stock2

**Abstract:**

Many museums offer their visitors the use of a mobile guide to enhance their visit experience. Novel mobile guides have the potential to provide personalized, context-aware, rich content to museum visitors. However, they might also affect the way visitors behave and interact. While many studies have examined novel features that these guides can provide to enhance the visit experience, few have looked into the impact that a mobile guide might have on the actual behavior of the visitors. We describe a field study conducted with 403 actual museum visitors, over a period of 10 months comparing behaviors of visitors who used a mobile multimedia location-aware guide during their visit and that of visitors who did not use any electronic aid. Results indicate that visitors' behavior was altered considerably when using a mobile guide. Visitors using a mobile guide visited the museum longer and were attracted to and spent more time at exhibits where they could get information from the guide. In addition, we provide empirical evidence of the decoupling effect that a mobile guide has on pairs of visitors. Using a mobile guide caused visitors to reduce proximity and to interact less with their fellow group members. Finally, we discuss what may be done to reduce this negative social effect.

Title:

Using Handheld Devices and Situated Displays for

Collaborative Planning of a Museum Visit

**Author:**

Inna Belinky, Joel Lanir, Tsvi Kuflik

**Abstract:**

A museum visit is often a collaborative activity with many people visiting the museum with family or friends. However, mobile museum guides often separate the group rather than enhance group interaction. As part of our efforts to support group activity in the museum we introduce a novel museum visit planning system that enables small groups of visitors to collaboratively plan their visit. After individual planning from home, a group of visitors can re-plan their visit as needed to accommodate for changes due to group preferences or environmental constraints. Visitors use a handheld device, also used as a museum visitors’ guide, to interact with a situated display located at the entrance of the museum. We describe the system and discuss some of the design challenges we had of designing a groupware system in a public space such as a museum.

Title:

Seamless Combination of Shared and Personalized Information Presentation to Groups of Visitors in Active Museums – Research Agenda

**Author:**

Jörg Bausa , Antonio Krügerb , and Tsvi Kuflikc

**Abstract:**

The goal of the proposed research is to enhance group experiences in a museum by: (1) intelligent distribution of information across several devices, allowing members of a group to follow a public presentation while their personal interests are addressed through individual annotations on a private device, and (2) navigation support of the whole group, by finding a route through the museum that maximizes the interests of all group members and helps to mutually explore and uncover most of the relevant topics related to a cultural heritage site.

Title:

An Environment to Support Multi-User Interaction and Cooperation for Improving Museum Visits through Games

**Author:**

Riccardo Dini, Fabio Paternò, Carmen Santoro

**Abstract:**

The availability of mobile and stationary devices opens up new challenges to support users in several contexts. Here we present a multi-device environment to support cooperation among museum visitors through games. In particular, we present a design and the associated implementation for using a combination of PDAs and public displays to enhance the learning experience in a museum setting by using game playing interactions. The basic assumption is to use the mobile devices for individual game play, and the situated displays for synchronized public views of shared game play; the individual game play contributes to the shared game.

Title:

A Nomadic Information System for Adaptive

Exhibition Guidance

**Author:**

R Oppermann, [M Specht](http://scholar.google.ca/citations?user=fC3dymIAAAAJ&hl=en&oi=sra)

**Abstract:**

The paper describes the electronic guide HIPS that can be used during the process of a visit in a museum, i.e., for preparation, execution and evaluation. Users can access the system via the Web to prepare a visit by receiving information about the content and organization of an exhibition and practical issues like location and opening hours. The visitor can also prepare a tour for the actual visit or define hotspots with important exhibits. The system should remind the user when on site. Once the user is in the museum he or she has two specific options to use the system: the visitor can walk around in the museum and remain standing where he or she finds an item of interest. The current location in the room identified by infrared emitters at all exhibits triggers an indicator for the information presentation. Or, the visitor can select a tour prepared by a curator, prepared by the user in advance (at home) or generated by the user ad hoc. In the museum, the information access is provided via wireless technologies. This allows the user to access information by moving in the physical space and navigating in the information space concurrently. The Web-based server approach allows for adaptive information selection and presentation based on a user model evaluating the history of the usage of the system. The user can accelerate the adaptation by specifying interests and preferences in the user model. Before the visit the user can define tours and hotspots and enter annotations that will be presented or activated by the system in the appropriate physical environment. After a visit in the museum the user can evaluate the experience at home for further own inquiries or for communication with other interested people. The before-during-after-the-visit-support of visitors via nomadic information system has been designed based on evidence from our questionnaire prestudy, which showed that visitors actually use information available in or about museums before and also after a visit.

Title:

Virtual Reality Technology and Museum Exhibit

**Author:**

Michitaka Hirose

**Abstract:**

More than 15 years have passed since the word "virtual reality" became popular in our society. Now VR technology is at the stage where realistic application should be discussed. For example, it is said that museums are now a good application field of VR technology. In this paper, recent VR technologies which can be utilized for museum exhibits are introduced. The topics include sophisticated image environments such as IPT (immersive projection technology), image-based world generation methodology, and "real world VR" supported by wearable computers.

Title:

Designing for interaction: socially-aware museum handheld guides

**Author:**

Heleen Van Loon1, Kris Gabriëls1, Daniël Teunkens1, Karel Robert1, Kris Luyten1,

Karin Coninx1 en Elke Manshoven2

**Abstract:**

We present ARCHIE, an interdisciplinary research project of the Expertise Centre for Digital Media (Hasselt University) and the Gallo-Roman Museum of Tongeren (Province of Limburg) which aims to discover how a handheld guide can be used to enhance the museum learning experience. Because we stress on the important role of social interaction as a prerequisite for intellectual, social, personal and cultural development, one of the main objectives of the ARCHIE project is to encourage and stimulate interaction with the museum, the PDA and fellow visitors. Designing for interaction however asks for a mental switch. At this point, we developed a first application: a collaborative trading game.

Title:

Opening the Frame of the Art Museum:

Technology between Art and Tool

**Author:**

Kirsten Boehner, Phoebe Sengers, Yevgeniy Medynskiy, Geri Gay

**Abstract:**

In this paper, we present our experiences in building an interactive installation, dubbed Birdscape, for an art museum. Interactive installations in museums ordinarily have one of two goals: they are either artworks to be appreciated as part of the museum’s collection, or they are tools that disseminate information about museum objects. Both possibilities tend to put visitors into the position of non-experts. Our goal was to open up the design space in the museum for new visitor roles by hybridizing these two functions: to provide an installation that was both tool-like, giving patrons information about the museum and their interactions with it, and art-like, creating opportunities for new experiences in an aesthetic and open-ended way. In the process, we ran into serious challenges in bridging the worldviews of art and human-computer interaction (HCI). In this paper, we reflect on our experiences to suggest possibilities, challenges, problems and possible solutions in leveraging ‘art’ and ‘tool’ to create something that pushes beyond the limits of each.

Title:

Treasure Transformers: Novel Interpretative

Installations for the National Palace Museum

**Author:**

Chun-Ko Hsieh1,2, I-Ling Liu1, Quo-Ping Lin1, Li-Wen Chan2, Chuan-Heng Hsiao2, and Yi-Ping Hung2

**Abstract:**

Museums have missions to increase accessibility and share cultural assets to the public. The National Palace Museum intends to be a pioneer of utilizing novel interpretative installations to reach more diverse and potential audiences, and Human-Computer Interaction (HCI) technology has been selected as the new interpretative approach. The pilot project in partnership with the National Taiwan University has successfully completed four interactive installations. To consider the different nature of collections, the four systems designed against different interpretation strategies are uPoster, i-m-Top, Magic Crystal Ball and Virtual Panel. To assess the feasibility of the project, the interactive installations were exhibited at the Taipei World Trade Center in 2008. The purpose of this paper is to present the development of the “Treasure Transformers” exhibition, design principles, and effectiveness of installations from the evaluation. It is our ambition that the contributions will propose innovative media approaches in museum settings.

Title:

Learning from Interactive Museum Installations

About Interaction Design for Public Settings

**Author:**

Eva Hornecker, Matthias Stifter

**Abstract:**

This paper reports on the evaluation of a digitally augmented exhibition on the history of modern media. We discuss visitors’ interaction with installations and corresponding interaction design issues, drawing on results from analysis of log files, interviews, and observation in the museum. We see this as an exploration into interaction design of interactive installations for public settings, using the evaluation as a case study on what makes an installation engaging and how it can provide an engaging experience for groups.

Title:

Beyond Just the Facts: Transforming

the Museum Learning Experience

**Author:**

Jennifer Thom-Santelli, Kirsten Boehner, Geri Gay, Helene Hembrooke

**Abstract:**

We present Museum Detective, a handheld system designed for use by school children to encourage guided learning through paired discovery of one object in an art museum. Initial analysis showed that children were able to use the devices cooperatively and exhibited longer-term retention of information about the artifacts in the gallery. We propose that the design of the Museum Detective interface can be refined to further encourage students to actively transform their museum learning experience.

Title:

Beyond Just the Facts: Transforming

the Museum Learning Experience

**Author:**

Jennifer Thom-Santelli, Kirsten Boehner, Geri Gay, Helene Hembrooke

**Abstract:**

We present Museum Detective, a handheld system designed for use by school children to encourage guided learning through paired discovery of one object in an art museum. Initial analysis showed that children were able to use the devices cooperatively and exhibited longer-term retention of information about the artifacts in the gallery. We propose that the design of the Museum Detective interface can be refined to further encourage students to actively transform their museum learning experience.

Title:

Satisfaction and Learnability in Edutainment: A usability study of the knowledge game 'Laser Challenge' at the Nobel e-museum

**Author:**

Charlotte Wiberg, Kalle Jegers

**Abstract:**

This paper is a report on the initial findings of a study conducted in the project FunTain with the main purpose to find general guidelines for edutainment games, in order to guide designers of such games. Usability evaluations, with users and experts, were conducted on the edutainment game in order to find usability problems. These findings were then analyzed and used as input in focus group meetings, held with joint teams consisting of game designers and HCI experts. The result was a proposal of a list of design guidelines. In this paper they are grouped in three general categories; (1) game experience, (2) balance between entertainment and education, and (3) general understanding. Findings indicate that users had problems in understanding the underlying model for the game as well as finding the knowledge related content. Experts, further, gave comments about feedback problems and different types of inconsistencies. Some of the implications from the findings, as discussed in the focus group, were guidelines for earning and loosing points, scoring and performance feedback and game object characteristics.

Title:

Semantic-based Multimedia Representations for the

Museum Experience

**Author:**

C. Rocchi, O. Stock, M. Zancanaro

**Abstract:**

We introduce a common architecture to store semantically enriched multimedia material that can be accessed by intelligent engines able to automatically assemble video clips and build text-based hypermedia. The core of the architecture is the Multimedia Database (MMDB), which stores a repository of multimedia information (i.e. text, images, speech, audio, etc.) and its annotation with respect to a shallow representation of its meaning. We present the architecture of the system, the computational framework for annotation, the applications that can access the data repository and we discuss some preliminary results of the evaluation.

Title:

The Electronic Guidebook: A study of user experiences using mobile web content in a museum setting

**Author:**

Hsi, S

**Abstract:**

A study of fifteen is reported as part of a larger research project. The Electronic Guidebook, whose aims are to understand how the introduction of wireless technologies changes and augments user experiences at the Exploratorium, an interactive science museum. The main questions being addressed in this study are: How do users respond to a mobile web resource designed to improve and transform user experiences in a hands-on museum? This paper shares results from interviews with three categories of users: teachers, staff 'explainers', and visitors. Several recurring issues and themes emerged from our analyses such as users' sense of isolation and user attempts to make a seamless experience between real-place and virtual contexts. Teachers, in particular, felt the mobile web content would be more useful as learning activities before and after museum visits. While the majority of users expressed a concern that the handheld would interfere with exhibit play, these users also reported positive feedback about the mobile web content and demonstrated new ways in which this resource motivated new ways to think and play with exhibits. Additional insights are provided regarding the role of mobile web content in mediating user interactions including a framework under development for organizing interactions with handhelds.

Title:

Digital Backpacking in the Museum with a SmartCard

Author:

Eva Hornecker, Matthias Stifter

Abstract:

This paper reports on the evaluation of a digitally augmented exhibition on the history of modern media and our experiences with the methodic approach employed. As a central element of this exhibition visitors can buy a smartcard that enables them to store collected or selfcreated data in a ‘digital backpack’, which can be accessed via internet as a personalized souvenir. We have evaluated the exhibition, visitors’ perceptions and usage of the card using a multi-method strategy complementing quantitative data-analysis with qualitative, ethnographic methods. This paper focuses on visitors’ use and the perceived utility of the smartcard, and our experiences with using automatically generated data from interaction logfiles for analyzing visitor behavior, and with the multi-method strategy.

Title:

UbiCicero: A location-aware, multi-device museum guide

Author:

Giuseppe Ghiani, Fabio Paternò \*, Carmen Santoro, Lucio Davide Spano

Abstract:

In this paper, we propose UbiCicero, a multi-device, location-aware museum guide able to opportunistically exploit large screens when users are nearby. Various types of games are included in addition to the museum and artwork descriptions. The mobile guide is equipped with an RFID reader, which detects nearby tagged artworks. By taking into account context-dependent information, including the current user position and behaviour history, as well as the type of device available, more personalised and relevant information is provided to the user, enabling a richer overall experience. We also present example applications of this solution and then discuss the results of first empirical tests performed to evaluate the usefulness and usability of the enhanced multi-device guide.

Title:

An Immersive Environment for the Vase Museum

Author:

Leonidas Deligiannidis, Robert J.K. Jacob

Abstract:

In this paper we present a new approach to displaying and browsing a digital library in Perseus that consists of a set of Greek vases. This approach is applicable to Digital Libraries in general, however. Our new design extends previous research by taking advantage of Virtual Reality to present context even while the user focuses on a single item. Using Virtual Reality, users are not limited to the physical screen of a computer monitor and in addition, they can directly interact with items in the museum naturally. Users can still focus on specific datum, a vase, while not losing reference of the entire museum.

Title:

A Multimodal Mobile Museum Guide for All

Author:

Carmen Santoro, Fabio Paternò, Giulia Ricci, Barbara Leporini

Abstract:

Museums represent a particularly suitable context in which to experiment with new interaction techniques for guiding visitors and improving their experience. This is mainly due to the large amount of digital information available, the technological resources more and more adopted in such environments, and the range of different visitors museums always receive. In this paper we present a preliminary work of a portable, multimodal museum guide also able to offer diverse accessibility options to users, so as to fit and support the needs and preferences of different users, including the visually impaired. Our work combines multiple modalities –gestures, location, graphical and voice. In particular, we will focus on how tilt gestures can be used to control and navigate the user interface in order to enhance the user experience, including the case when the users are the blind

Title:

Supporting museum co-visits using mobile devices

Author:

Yann Laurillau, Fabio Paternò

Abstract:

The goal of this work is to provide tools that promote social interactions between visitors through cooperative and educational games. In this paper, we describe how to support collaborative learning in museum visits and show an example application based on mobile palmtop systems. To this end, we have developed a system that is able to support collaborative and independent activities, and offer context-aware content.

Title:

Multimedia Systems for the Next Generation Museum

Author:

David Birchfield, Gang Qian, Hari Sundaram, Frances McMahon-Ward

Abstract:

Museums play an important role in our society by providing a forum for intellectual discourse and interaction. Despite this critical social role, museums today present artwork in a manner (accompanied by a brief text description) that has not evolved at the same pace as our digitally enabled society. In this paper we describe our work in developing a framework for the meaningful integration of digital technologies that will reshape the way in which museum visitors experience traditional artworks. We are developing an unencumbered video-based movement analysis system that allows a user to interact with the museum exhibit using natural movements and gestures. The multimedia system will respond by creating a context-aware, user centric, multimodal presentation. This project involves three facets: the development of appropriate multimedia context models, vision based interaction and analysis, and generative mechanisms for multimodal feedback in the museum context. We believe that this enriched environment will lead to a better understanding of exhibited artworks and will address the individual needs and desires of all museum visitors.

Title:

Multimedia Systems for the Next Generation Museum

Author:

David Birchfield, Gang Qian, Hari Sundaram, Frances McMahon-Ward

Abstract:

Museums play an important role in our society by providing a forum for intellectual discourse and interaction. Despite this critical social role, museums today present artwork in a manner (accompanied by a brief text description) that has not evolved at the same pace as our digitally enabled society. In this paper we describe our work in developing a framework for the meaningful integration of digital technologies that will reshape the way in which museum visitors experience traditional artworks. We are developing an unencumbered video-based movement analysis system that allows a user to interact with the museum exhibit using natural movements and gestures. The multimedia system will respond by creating a context-aware, user centric, multimodal presentation. This project involves three facets: the development of appropriate multimedia context models, vision based interaction and analysis, and generative mechanisms for multimodal feedback in the museum context. We believe that this enriched environment will lead to a better understanding of exhibited artworks and will address the individual needs and desires of all museum visitors.

Title:

The 3D Vase Museum: A New Approach to Context in a Digital Library

Author:

Horn-yeu Shiaw, Robert J.K. Jacob, Gregory R. Crane

Abstract:

We present a new approach to displaying and browsing a digital library collection, a set of Greek vases in the Perseus digital library. Our design takes advantage of three-dimensional graphics to preserve context even while the user focuses in on a single item. In a typical digital library user interface, a user can either get an overview for context or else see a single selected item, sacrificing the context view. In our 3D Vase Museum, the user can navigate seamlessly from a high level scatterplot-like plan view to a perspective overview of a subset of the collection, to a view of an individual item, to retrieval of data associated with that item, all within the same virtual room and without any mode change or special command. We present this as an example of a solution to the problem of focus-plus-context in information visualization. We developed 3D models from the 2D photographs in the collection and placed them in our 3D virtual room. We evaluated our approach by comparing it to the conventional interface in Perseus using tasks drawn from archaeology courses and found a clear improvement. Subjects who used our 3D Vase Museum performed the tasks 33% better and did so nearly three times faster.

Title:

Robots and Education in the classroom and in the museum: On the study of robots, and robots for study

Author:

Illah R. Nourbakhsh

Abstract:

The Mobile Robot Programming Lab and the Toy Robots Initiative at Carnegie Mellon’s Robotics Institute both focus on the interaction between humans and robots for the sake of education. This paper describes two specific endeavors that are representative of the work we do in robot education and human-robot interaction. The first section describes the Mobile Robot Programming Lab curriculum designed for undergraduate and graduate students with little or no mobile robotics experience. The second section describes the process by which an edutainment robot, Insect Telepresence, was designed, tested and evaluated by our group and CMU’s Human- Computer Interaction Institute.

Title:

Designing hybrid places: merging interaction design, ubiquitous technologies and geographies of the museum space

Author:

Luigina Ciolfi a & Liam J. Bannon a

Abstract:

In this paper we discuss how geographical notions of space and place can aid designers in creating meaningful interactions between end users and technologically augmented physical spaces—specifically museums. We review the literature that discusses the use of spatial concepts and metaphors within the interaction design field and discuss several examples of interactive museum installations. We then describe how we have incorporated our understanding of place and human experience into the design and development of a hybrid museum space: an interactive exhibition entitled ‘Re-Tracing the Past’ at the Hunt Museum in Limerick, Ireland.

Title:

Familial Collaborations in a Museum

Author:

Tom Hope Yoshiyuki Nakamura Toru Takahashi\* Atsushi Nobayashi†

Shota Fukuoka† Masahiro Hamasaki Takuichi Nishimura

Abstract:

Studies of interactive systems in museums have raised important design considerations, but so far have failed to address sufficiently the particularities of family interaction and co-operation. This paper introduces qualitative videobased observations of Japanese families using an interactive portable guide system in a museum. Results show how unexpected usage can occur through particularities of interaction between family members. The paper highlights the necessity to more fully consider familial relationships in HCI.

Title:

SCULPTEUR: Towards a New Paradigm for Multimedia Museum Information Handling

Author:

Matthew Addis, Mike Boniface, Simon Goodall, Paul Grimwood, Sanghee Kim, Paul Lewis, Kirk Martinez, Alison Stevenson

Abstract:

This paper describes the design and prototype implementation of a novel architecture for integrated concept, metadata and content based browsing and retrieval of museum information. The work is part of a European project involving several major galleries and the aim is to provide more versatile access to digital collections of museum artefacts, including 2-D images, 3-D models and other multimedia representations. An ontology for the museum domain, based on the CIDOC Conceptual Reference Model, is being developed as a semantic layer with references to the digital collection as instance information. A graphical concept browser is an integral component in the user interface, allowing navigation through the semantic layer, display of thumbnails, or full representations of artefacts and textual information in appropriate viewers and the invocation of conventional content based searching or combined querying. Semantic Web technologies are used in system integration to describe how tools for analysis and visualisation can be applied to different data types and sources. This supports flexible and managed formulation, execution and interpretation of the results of distributed multimedia queries. Combined searches using concepts, content and metadata can be initiated from a single user interface.

Title:

THE WELL OF INVENTIONS – LEARNING, INTERACTION AND PARTICIPATORY DESIGN IN

MUSEUM INSTALLATIONS

Author:

Gustav Taxén, Sten-Olof Hellström, Helena Tobiasson, John Bowers

Abstract:

This paper is concerned with how research on interaction principles, participatory design and museum learning can come together to inform the design of technology-intensive mixed-media museum installations. The paper has two main contributions. First, it presents a novel collaborative interaction technique and illustrates how it can be applied in a museum setting. Second, a new exhibition evaluation methodology adopted from participatory design is presented and assessed. The paper also describes how these contributions have been applied in the production and design of The Well of Inventions, a mixed reality installation co-developed by the Centre for User Oriented IT Design and the Museum of Science and Technology in Stockholm, Sweden.

Title:

The Energy Table – Augmenting the Exhibition Space at The Danish Electricity Museum

Author:

Jonas Fritsch, Christian Dindler, Peter Dalsgaard

Abstract:

This paper explores the use of digital technologies to create interactive museum experiences through a design case. Based on field studies at The Danish Electricity Museum and research into related work we present the concepts of the Energy Table. The vision of the Energy Table is to let people actively appropriate the physical exhibition space by exploring and uncovering the dynamics of electricity on a digitally augmented table. From our design case we discuss focal points in creating interactive installations for museum settings.

Title:

Museum Guide Robot Based on Sociological Interaction Analysis

Author:

Yoshinori Kuno, Kazuhisa Sadazuka, Michie Kawashima, Keiichi Yamazaki,

Akiko Yamazaki\*, Hideaki Kuzuoka\*\*

Abstract:

We are currently working on a museum guide robot with an emphasis on “friendly” human-robot interaction displayed through nonverbal behaviors. In this paper, we focus on head gestures during explanations of exhibits. The outline of our research is as follows. We first examined human head gestures through an experimental, sociological approach. From this research, we have discovered how human guides coordinate their head movement along with their talk when explaining exhibits. Second, we developed a robot system based on these findings. Third, we evaluated human-robot interaction, again using an experimental, sociological approach, and then modified the robot based on the results. Our experimental results suggest that robot head turning may lead to heightened engagement of museum visitors with the robot. Based on our preliminary findings, we will describe a museum guide robot that first works autonomously and, if necessary, can turn into remote-control mode operated by a human to engage in more complex interaction with visitors.