Proceedings of the International Workshop

“Re-Thinking Technology in Museums: towards a new understanding of people’s experience in museums”

Interaction Design Centre - University of Limerick (Ireland)
29 and 30 June 2005

Edited by:

Luigina Ciolfi, Michael Cooke, Tony Hall,
Liam J. Bannon and Serena Oliva

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This book is dedicated to the memory of John Hunt Jr.

Table of Contents

Workshop Introduction

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We are delighted to host the international workshop *Re-Thinking Technology in Museums*, made possible by the generous support of *Convivio*, the EU-sponsored Network for People-Centred Interactive Design. Over the past few years work at the Interaction Design Centre has dealt with a number of issues regarding the complex relationship between museums and galleries and interactive technologies. Whereas museums are one of the domains where the proliferation of multimedia applications has been most evident in the recent past, we felt that a number of significant issues regarding how to approach the design of museum interactives in the museum context are still open to debate and discussion. For example, how do we develop an understanding of the museum and its visitors in order to inform the design of interactives? How do we evaluate their impact? How do we ensure that the technology does not distract visitors from exploring the artefacts themselves?

The primary motivation for organising this event lies in the work that our research group has conducted in the past years regarding the design and evaluation of museum interactives and technologically-enhanced exhibits.

We have conducted feasibility studies and heuristic evaluations of more traditional museum interactives such as websites and touch-screen kiosks, showing how these latter installations can become a cause for visitor distraction when placed around exhibitis without an analysis of the spatial layout (Hertzum, 1998; Ciolfi, Bannon and Fernström, 2001).

More recently we have been involved in a major EU-funded project, SHAPE, devoted to designing and developing asssemblies of hybrid, mixed-reality artefacts in museums and exploratoria[1]. Our centre coordinated work leading to a major interactive exhibition, "Re-Tracing the Past", which took place at the Hunt Museum in Limerick during June 2003 (Ferris et al, 2004).

In this context we conducted in-depth studies of the behaviour and practices of both museum staff and visitors in the Hunt Museum (Ciolfi and Bannon, 2002). On the basis of our findings, we developed a series of *design sensitivities* to inform the development of design scenarios (Ciolfi and Bannon, 2003).

We focused particularly on analysing aspects related to the educational impact of hands-on, interactive activities within the museum in order to design the educational content of "Re-Tracing the Past" appropriately (Hall et al. 2002; 2005).

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[1] SHAPE (2001-2003) was funded by the EU IST-FET "Disappearing Computer" initiative. Partners in the SHAPE consortium were: the Royal Institute of Technology-KTH (Stockholm, Sweden), the University of Nottingham (UK), King's College London (UK) and the University of Limerick (Ireland). For more information see: http://www.shape-dc.org.

Fig 1. "Re-Tracing the Past" at the Hunt Museum

Another major concern was understanding the qualities of the museum as a place, thus gaining insights on how the activities of visitors and staff were associated with different areas of the museum and specifically of our exhibition (Ciolfi and Bannon, 2004; 2005).

Our aim in designing "Re-Tracing the Past" was to augment, rather than replace, the ethos and existing features of the Hunt Museum, so that technology would support visitors' experiences of the physical museum space rather than replace it with a virtual experience. The work on this particular project was also inspired by more theoretical reflections on how to understand the design for human experience being developed by other IDC members (Cooke and McCarthy, 2002; McCarthy, Wright and Cooke, 2004). In this context, we have developed the main themes of the workshop which we are hoping to discuss during the two days.

Workshop Themes

This workshop will focus on a specific domain of application for the introduction of interactive technologies: museums and art galleries. Existing research discussing the role and impact of interactive technologies within this domain is mainly focused on the design of information systems that provides museum visitors with large amounts of information regarding certain museum artefacts and exhibits. The technologies that have been employed for this purpose range from touch-screen kiosks, to portable digital assistants (Abowd et Al, 1997; Gabrielli, Marti and Petroni, 1999; Woodruff et al, 2002), and "ambient" technologies (Sparacino, 2002). However, this approach to designing interactive installations for museums has certain limitations. These installations can undermine people's appreciation of the exhibits, as they are often intrusive and distracting. Also, the social interaction between visitors is not supported adequately as most of these installations support single-user interaction, and these technologies might isolate people (for example in the case of audio-guides). Finally, these installations tend to replace existing informational resources such as human guides, museum docents, guidebooks and paper labels, although these "traditional" forms of visitor support are informative, engaging and unobtrusive.

As we mentioned, our experience within the SHAPE Project made us focus on how to enhance and augment, rather than replace, existing aspects of museums and exploratoria, through the design of room-sized exhibitions that incorporate ambient and ubiquitous technologies. SHAPE exhibitions such as "Re-Tracing the Past" had the goal of engaging visitors in a meaningful and rewarding experience, rather than submerging them with information and distracting them from the existing museum holdings. The overall unifying activity that characterised the exhibition had the goal of making visitors actively engage with the Hunt Museum in Limerick, encouraging them to reflect on aspects such as historical interpretation and classification of

museum artefacts, without replacing any of the existing resources the museum offers. Our design process focused on understanding *experiential qualities* of the museum – rather than simply visitors' activities or behaviours- such as the visitors' relationships with others, with the place and the artefacts they were invited to explore, and the museum staff and Docents' attitudes towards the exhibition policies, the museum holdings etc.

An increasing number of research projects dealing with the design and evaluation of interactive museum installations is being conducted with an experiential approach in mind (see for example Barrass, 2001; Heath at al., 2002; Rubegni, 2004). Existing museum education literature is also focusing on the experiential nature of the museum visit in order to provide recommendations for exhibit and workshop design (Falk and Dierking, 1992). In this workshop we hope to discuss in further detail how the design of interactive, non-desktop technologies can be aided by studying in depth a variety of issues related to visitors and staff's experience of the museum. Installations of this sort would augment specific features of the museum in order to provide engaging and educational activities for visitors. The workshop would be beneficial for discussing different approaches to studying the experiential qualities of museum visits (such as social interaction, development of a sense of place, learning and critical reflection), both in terms of conceptual and methodological tools.

The participants will discuss novel ways of conceptually approaching the problem of designing interactive installations within this domain, as well as examining current methodologies adopted for the study of people's experience of museums within several disciplines. Practitioners and academic researchers participating in the workshop bring together a variety of perspectives and sensibilities regarding this domain. We feel the domain of museums and art galleries is an important one when studying how novel technologies could impact on people's appreciation of and engagement with cultural heritage and material culture. From our past experience in international research projects on this topic, we feel there is a strong need for extending current approaches to the design of museum interactives, both from a conceptual and a methodological point of view. The papers presented at the workshop discuss the new directions that research in this area will take in the near future.

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Many thanks to Serena Oliva for all her work on preparing the proceedings, and to Anne Murphy and Deborah Tudge for their help with the practical organisation of this event.

We also acknowledge the support of Science Foundation Ireland for the *Shared Worlds* research project which has also contributed to make this event possible.

Finally, we wish to thank Ms. Patricia Hunt for granting us permission to republish John Hunt Jr.'s 1998 paper "Museums of the Future" in this book of proceedings, which is dedicated to him. We are grateful to Patricia for allowing us to pay a tribute to John's memory.

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Museums of the Future

John Hunt

Originally presented at the "Museum of the Future" Symposium, University of Limerick, June 2nd 1998.

We are often told that the future of Museums lies with the use of new technology. I don't know for sure but I suspect it is a bit of a red herring. It is a bit like hearing the one that the future of museums is purely dependant on more money being made available. For me the appropriate question is the simple one: "What will museums be like in the future?" It is only after this question has been posed that we can go on to ask questions about the role of technology within that future. But we must also ask questions about the national responsibility to its heritage, security, audiences and, indeed, entertainment.

Museums have always been concerned with technology. They exist to display manifestations of technology throughout the ages. A bronze-age axe, like a second generation computer, is designed to do the same job as its predecessor: however its improved technology means it does the job better.

Museums have always used technology, and have always sought to improve and develop those technologies that make their lives easier in many areas such as security, admissions control, environmental control and conservation.

The big issue, therefore, is how do we use modern technology to maximum effect so that our museum becomes a better museum? Technology is, after all, only a tool and should never become its own justification.

Imagination

Einstein said that "*Imagination is more important than knowledge*". In many ways this could be declared the unofficial motto of The Hunt Museum. Take, for example, the Museum's approach to labeling objects in the collection.

The earliest museums had no labels at all. They were cabinets of curiosity which served as starting points for scholarly discussion. Because those who either owned or had access to such collections were well educated there was little need for instructive labels. Labels for individual objects really only came in with the Victorians. The idea being that the uneducated masses could receive some information and instruction about what they were looking at. Ever since then things have got out of hand as far as object labeling is concerned. We have now got to the stage where some museum visitors spend more time looking at the label than at the object itself. And I wouldn't be at all surprised that the same holds true in some museums where computer terminals are available.

In The Hunt we deliberately decided to have a certain number of rooms which would be label-free zones. We saw it as a way of challenging the visitor to look more closely at the object in an attempt to figure out what it might be. And if the visitor does want information they can always approach one of the Museum docents. In a little over a year these areas of the museum have proved immensely popular.

Informal feedback would suggest that visitors find that the absence of a label helps remove a feeling that they should learn while they are in a museum, and that it enables a more relaxed approach to looking at individual objects. It has certainly lead to an increase in noise levels in those rooms, as visitors do less reading and more discussing about the material in front of them. By removing the feeling to acquire Knowledge, we have enabled the Imagination to run riot!

Expectations

My father worked on the excavations of a Neolithic site at Loch Gur, Co. Limerick, during the 1940's.

Every few weeks the Director of the National Museum would come down to inspect the excavation's progress and to monitor the finds. As an exercise in studying the pottery making process, my father and some of the archaeology students had made a replica Neolithic pot which they then broke to see how Museums of the Future University of Limerick they would manage to reconstruct the shards. When they heard that the Director of the National Museum was about to visit the site, the opportunity for a bit of mischief was too good and the broken pot was placed on the table alongside the real finds for his inspection. Although he was one of the most respected archaeologists of his generation, the Director of the National Museum was taken in by the fake pot and proceeded to lecture the students about how this discovery gave the site much more importance than it had enjoyed so far.

The point I am making is that, in this case Imagination was more eagerly applied than Knowledge! The gentleman justified what he saw to fulfill his expectations. Which is why the display in The Hunt Museum deliberately seeks to be non-museum in style. There is no heed paid to chronology. No particular story is told. Objects are placed side-by-side in an apparently random manner. And all with the deliberate intention of subverting and challenging the visitors' expectations.

Money

Money will never be the solution to figuring out what the museum of the future should be like. Like the application of technology, money is only a tool that can be used if you have figured out in what direction you are going.

The Custom House was refurbished and made ready for the Hunt Collection for roughly IR3 million, whereas some IR30 million was required for the refurbishment of Collins Barracks for the National Museum. Though some have tried to 'wind me up' over this apparent disparity, I have yet to rise to the bait. As far as I am concerned the National Museum should be getting something closer to IR300 million. And besides, extra cash would not necessarily have made The Hunt a better museum. What makes The Hunt work as a museum is that we knew the character of the museum we wanted long before we started to talk about budgets. A case of Imagination being more important than Cash.

The Museum of the Future

The Museum of the Future will need to be different and to have its own character. It will also need to know what exactly it is trying to achieve... in the context of its own unique collection. Only then can they begin to figure out what technology may or may

not be appropriate to support that vision.

The Hunt Museum

I believe that the reason The Hunt works as a modern Museum is that it has defined its own identity which, though different to most museums, is appropriate to the Collection it houses. The Hunt Collection is not a National Collection: it therefore has none of the baggage that normally goes with national responsibility. It is a finite collection of some 2,000 pieces assembled by two individuals: in this sense it is more an accumulation than a collection. There is no pressure on the Museum to tell a chronological story or fill 'gaps' in its collection. The Museum is held in trust for the people of Ireland.

And therefore accepts a responsibility to its ownership. The display is different in that it seeks to convey a domestic ambience rather than that of a public building. Hence there is much emphasis on daylight, carpets and 'furniture-style' display cases and drawers.

The Hunt is different from most museums in Ireland in that it charges admission. This was a conscious decision in that the museum is not there to offer the ultimate solution to leisure time: instead we are merely offering another option. In this regard we are deliberate in avoiding the message that 'This museum is good for you and will improve your mind'.

Conclusion

And that is the key to it all: that the Museum of the Future does not necessarily have to be good for you.

And this is the danger with technology in museums. All too often technology has been installed in museums in an effort to win back those of us who were put off culture for life thanks to forced museum visits when at school. The real way to win back the museum audience is to provide a well thought out Museums of the Future University of Limerick experience that is relevant to and respectful of an audience that is much better educated and that has much higher expectations than those of a previous generation.

As I said above, technology only becomes relevant when a museum knows exactly what it is trying to achieve. Once its vision is clear technology is a wonderful tool that is only beginning to be exploited to its potential. In the overall scheme of things technology in the Museum of the Future should enhance Knowledge and stimulate the Imagination.

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Things and Technology: the Fate of Museums as Hybrid Institutions of the 21st century

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Museums have built their identities around collections of tangible objects, but many are now responding to the challenges of a multi-media age by attempting to become serious multi-media players in their own right. What are the implications of this shift for the identity of museums as grounded in material culture? To what extent can a museum shift its core role away from objects without becoming indistinguishable from other forms of heritage experience that are not dependent on collections of physical things? What are the positive and negative implications of attempting to merge the tangible and intangible dimensions of heritage in exhibitions by means of multi-media technology?

The philosophical challenge of these and related questions will be at the heart of the opening address.

Keynote Speaker: Pat Cooke is currently Chairman of the Irish Museums Association. He manages two historic properties in Dublin, the Pearse Museum and Kilmainham Gaol. In 2003 he was a research fellow at Trinity College Dublin and produced a policy paper entitled "The Containment of Heritage: Setting limits to the growth of heritage in Ireland". In 2004 he completed an MBA degree at University College Dublin.

ÄÄNIJÄLKI
Opening Dialogues for Visually Impaired Inclusion in Museums

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Abstract
This paper describes the project: Äänijälki, keskustelun avaus (Sound-trace, Opening the dialogue). The project is used as a case study for analysing visitor experience enhanced through active participation in museum exhibitions. While walking through an exhibition, visitors have access to the message from the museum. The experience is more engaging when visitors go to an exhibition with a friend that knows about the subject exhibited. The whole practice refreshes when someone tells the visitor something that connects her own life with the exhibition in an informal language with personal opinions. The idea of the project is to open this dialogue with other, possibly anonymous, visitors in order to augment users' experience.
The way this idea takes shape is creating a social tool for exchanging comments about the experience of going to and being in an exhibition, leaving audio traces in the process. These traces allow a dialogue within visitors that are not necessarily present at the same time in the exhibition.

Äänijälki is a service for visually impaired people and their related community for exchanging advises about exhibitions. Äänijälki is an instrument for enhancing accessibility and the experience in the context of Finnish museums. At the same time, it is a platform for collaborative sound gathering created mainly by visually impaired people. Despite that, our aim is that every visitor can listen Äänijälkiä (sound-traces).

The visitor participates in creating knowledge in the exhibition, and in exchanging it with other future visitors. All visitors have something in mind while in the exhibition, and they are inspired or provoked. Äänijälki is a tool for sharing these thoughts. Visitors and pieces in the exhibition will open their existing dialogue, by making it audible.

This service has two main elements: a PDA (Personal Digital Assistant) device with texture touchable screen (for using in the Museum) and a WWW portal (for remote use). The visually impaired person will leave audio traces in the exhibition by using a PDA device and/or the website. All the information addresses to visually impaired people in Museum pages is in the WWW portal, as well as the traces left in the museum connected to the exhibition as a whole.

Keywords: museum, inclusion, user centred, visually impaired, assistive technology, social tool.

1. Introduction

After our observations, we found out that visually impaired people are interested in going to museums and exhibitions in general, but they do not have the information they would need in order to enjoy a visit. This information is related to accessibility issues as well as about opportunities for them to enjoy the exhibition. They are an excluded community not fully taken into consideration while designing exhibitions (e.g., there is no a feedback board where they could exchange comments about exhibitions).
On the other side, we wanted to know how do visually impaired people "visualize" and bring visually impaired people's world closer to the sighted people's world by providing descriptions and comments. Thus, we create a tool for visually impaired people and their related community (e.g. friends, family and workmates), for them to use for exchanging advices about exhibitions.

> *"How can a blind person from birth form in his mind the idea of figures? I think that the movement of his body, the successive existence of his hand in different places, the non-interruptive sensation of a body passing through his fingers, give him the notion of direction."* (1)[2]

Äänijälki is a project about creating a service that Finnish museums could offer to visually impaired people and their related community. This first phase of the project is done in collaboration with Ateneum Museum[3], The Finnish National Art Gallery, in Helsinki**.**

Äänijälki will be used for sharing hints about the experience of going to and being in an exhibition. The goal is to motivate visually impaired people to visit museums by providing a tool to get information about museum spaces and exhibitions, with their "comments".

Äänijälki consists of creating a platform for collaborative audio gathering of people's comments related to the museum exhibition.

This service has two main elements: a PDA (Personal Digital Assistant) device with texture touchable screen (for using in the Museum) and a WWW portal (for remote use). The visually impaired person will leave audio traces in the exhibition by using a PDA device and/or the website. They can also access other visitors' comments, and museum's experts through earphones from the PDA.

All the information addressed to visually impaired people in museum pages, is in the WWW portal, as well as the traces left in the museum connected to the exhibition as a whole and to accessibility issues.

Äänijälki is a multi-user system that has a simple interface and requires no training. People coming in groups to the museum can record a part of their conversation, and share the listening of traces left by others.

2. Background

This initiative was born after coordinating a usability test study in the context of the Museum of Cultures in Helsinki for improving the interface of the Digital Facsimile of the Map of Mexico 1550. Many visitors had very interesting comments about the Map. Some of them were Mexicans and had comments related to the city and the places where they have been. One expert in the Map came and had a lot to tell about the history of the document. A researcher in our team had a lot to add about how they took the photographs and how the map is conserved in the Museum in Uppsala. Others were anthropologists and had other points of views. The Map was alive while listening to them, their impressions, stories, and reactions!

An exhibition is a unique opportunity to collect data about the items, personal stories, questions, jokes, recommendations, etc. This is why the content of *Äänijälki* are visitors' comments.

3. Process

In the beginning of the development of this project we decided to make accessible the exhibition's information in the Museum, and remotely (e.g. from home or workplace). The idea behind this was to make available all necessary details about an exhibition

[2] Mariana Salgado did the free translation from French to English.

[3] Ateneum; www.ateneum.fi

beforehand, since visually impaired visitors need information about accessibility issues, and the museum experience before the visit. In one visit to a museum with a visually impaired person, she noticed that she would not have gone to the museum we proposed because she didn't know there were so much hands-on experiences in it.
It was important for us to make Äänijälki available for all blind and visually impaired persons. This is why we never experiment with Braille based applications. In this way, people that have only recently lost their sight can use this tool.

The metaphor of a compass helps to visualize directions for different implementations and technology involved. We analysed these options during the process of defining this project. A key issue in our discussions was how to make the data gathered accessible. Some ideas about managing the traces that visitors leave in the museums are in Figure 1.

Defining this project implied several testing periods. Our design approach was user-centred and used a number of methodologies.

We experimented with a touchable-screen with texture for a desk terminal when considering the possibility to install a computer in an isolated place *inside the museums.*
Tests of the prototype were done in the Media Lab, with sighted people that had their eyes covered. The prototype only worked by having someone behind-the-scenes who is pulling the levers and flipping the switches, in our case copying the testers behaviour in the computer. This allowed testing of an interface concept before the system was fully working. This type of technique is called the Wizard of Oz (2).
Everybody could easily understand and use the prototype. Although the test was successful, we considered that the idea of a separate place inside the museum is not a right concept while considering inclusion. Moreover, we thought that it is beneficial for our concept to have a mobile device in order to enhance accessibility, and comments related to specific items.
During this test we realized that the content was important for the participants. The fact of having only two comments was a bit frustrating.

In order to clarify our goals, we used scenario-based methods. Scenarios are stories. They are stories about people and their activities. They are widely used in the field of software design for arrive to a common understanding of what are the user's activities, tasks and behaviours (3). In these scenarios, we described different visitors situations, analyzing pros and cons of the tool.

Ateneum Museum gives permission to touch certain sculptures only to visually impaired persons. We went with visually impaired persons and a museum guide to create the content for our PDA device. The descriptions, we gathered from the visually impaired visitors, in order to produce the content for the prototype, are surprisingly visual.
In the case of these sculptures in Ateneum Museum, sighted people can enjoy the traces that visually impaired people left in certain sculptures, after touching them. See figures 2-3-4.

For managing the information, in this phase of the project, we decided to do a time-line, that combines in a chronological order comments related to the building, the

exhibition, and the pieces. The comments come in alteration from the visitors and from the museum guide.
The aim is to produce a tool that is user-centred and an example of both of Assistive technology and Universal design. Universal Design is the concept of designing products that are usable by all people, including people with disabilities. When applying Universal design, the aim is to improve the usability making the product suitable for people with disabilities (4).

The next phase is to test the demo PDA application in Ateneum Museum and the WWW Portal. The testing will include in-depth interviews, semi structured interviews, and behavioural observation with visually impaired persons. The interviews will be held in Ateneum Museum and in people's houses when evaluating the WWW Portal.

4. Content

The visually impaired people will be the co-authors together with the museums' experts of the content for both the PDA application and the web portal, leaving audio tracks during the visit. The content of these inputs relates to the exhibition, to the building, or to accessibility issues. The tracks could be "attached" to a certain piece, space or to the exhibition as a whole. That means that the comments will be reachable from certain places, and will relate to them. In the case of the remote dialogue, the comments are managed in the same way as inside the exhibition, making explicit the link between a comment and the referred item.
The content of Äänijälki is divided in two:
a) SHARE: content connected to experience of being in an exhibition that people like to share because it is nice to be "heard" and to give a comment.
b) ORIENTATION: content connected to the place, the real building of the museum and the accessibility. It has details that visual impaired people need for navigating and orientating inside the building and on their way to the museum.

Äänijälki in Ateneum Museum allows the following actions: a) listen and record the directions for arriving to a certain sculpture, toilet, cloakroom b) listen and record stories related to the sculptures, the building and the exhibition in general.
Äänijälki uses speech, because the goal is to present it as a natural component to visually impaired people, as Ubiquitous Computing where the aim is to make the technology invisible to the user. Also, speech is essential to enable systems to be used by disabled people and so is important for Universal Design (4).

Technical resolutions have been explored for the device to use in the museum, using both mobile phones and PDA devices. We decided that a PDA is the appropriate solution. The current prototype uses the Hewlett-Packard iPAQ h5450.
The technical functionality consists from server and client side elements. Server side consists of database, server software and hardware. The client side of this service consists of a PDA and the client software in it. The client software contains necessary interfaces and hardware support to use the service and to communicate with the server. The main line of communication will be Wireless LAN. User positioning and recognition will be implemented using Bluetooth. Bluetooth stations are essential for each piece or room in the exhibition, so each area in the museum can be recognized as its own space, and can be identified through visitors' PDA (positioning).

The product is demonstrated by using Apache server, MySQL Database, PHP-programming (server-side) and simple Flash-application in the Client side.

5. Dialogues

The traces allow a dialogue within visitors that are not necessarily present at the same time in the exhibition. It is an exchange of ideas between future, past and present visitors to museums. Future visitors get to know about Äänijälki and even enter questions before the visit. Present visitors leave a comment in the moment of the visit. Past visitors can remember something and add it later, or they can even check for some information that was added after. One visitor is able to reach the message left by his friend that was in the exhibition some time ago, or to listen to anonymous comments. Äänijälki provides information about exhibitions, information that is not coming from journalist or expert discourses.
Simultaneously, visitors and pieces in the exhibition open their already existing dialogue by making it audible. Visitors have something in mind in the exhibition, are inspired or provoked by the exhibition. This is why Äänijälki is a social tool that contemplates the human necessity of commenting, criticizing and recommending.
Äänijälki facilitates the communication between the museum, as an institution, and the visitors. Many museums are looking for more visitor-focused ways of approaching their audiences (5).
The museum institution sends a particular message to visitors using Äänijälki. Visitors can reply leaving feedback to the museum. The message of the institution (which is the message of an expert, with formal language) is complemented with the fresh messages coming from the visitors. Once Äänijälki is implemented, visitors and the museum institution will generate a new understanding of their respective roles.

As Äänijälki allows a dialogue between visitors that are not necessarily present at the same time in the museum, visually impaired persons that normally have problems in meeting by chance (or recognizing that they meet) in a public space could "meet" inside the museum or in the web portal.

Wakary and Evernden, while analysing a case study of an Ambient Intelligent Museum Guide, saw the chance to give form to the intellectual knowledge of the museum staff in addition to the embodied knowledge of the artifacts. They wanted to catch the informal and yet engaging delivery of specialized knowledge on behalf of the museum researchers (6). The difference is that Äänijälki includes all other visitors beside the researchers.
It was evident to Wakary and Evernden that once the artifacts were connected to people, the understanding of these artifacts became deeply connected to all aspects of the museum ecology. The comments from museum researchers came out in the form of storytelling that covered activities related to the artifact, conservation, storage, research and display technologies, meaning and values associated with the artifacts-all situated in specific contexts of time and place (6).

It has been compared with Wikipedia,[4] because the content is open, and users can modify it. In the case of Äänijälki the content relates to exhibitions, to physical places, or to pieces inside exhibitions. The object themselves, the exhibition and the building by their presences in a certain place affects visitor's comments.

[4] Wikipedia: http://www.wikipedia.org/

6. Conclusions

There is a need to change museum experiences and convert them to more participative ones, connecting people's comments to the exhibition. The visitors participate creating knowledge in the exhibition and exchanging it with other future visitors. We think that in this way the visit is more active, communicative and engaging.

The feedback we are gathering in our interviews in museums, while making the content with visually impaired people and in the test sessions, is encouraging.
Äänijälki is a project in the beginning of its development, but we believe that in the future, it can influence the visitors' experience positively.

Opening the dialogue to the visually impaired people is a good way of making the exhibitions more inclusive and engaging by exchanging opinions about the exhibition. In the path of working for this project, we understood the need from the museums to communicate with the visually impaired community, and the need of visually impaired persons to get information about museums.

Silvia and Victor Margolin highlight that the foremost intend of social design is the satisfaction of human needs. Äänijälki tries to enhance quality of life, directed to a specific vulnerable population and can thus be framed into social design (7).

We share the belief with Ciolfi and Bannon that understanding the concepts of space and place can be beneficial in a project about physical spaces enhanced by technology. Places offer cultural, structural, and social clues that shape the actions of the visitors (8). Our experience in the Ateneum Museum, a historic and respectful building showing art from the 1750s to the 1960s, might be different from designing for other museums involved in the service. Analysis of this comparison is one of our research concerns while developing Äänijälki.
The main question in Äänijälki is how the insights that people leave in the museum change the experience of being in a museum, enhance the accessibility, and generate a manageable amount of data for remote use.
Other important issues are:

- How could these comments improve visitor's learning about the exhibition? How does Äänijälki generate education added value to the exhibition? How can the museum collect information about the exhibition's theme with Äänijälki?
- In which way Äänijälki influences interactions within visitors in the context of a museum visit? For example: Will the talk of the visitors be organized around the listening activity, or the other way around?
- How to evaluate, classify and perhaps select the content that visitors are leaving in the exhibitions?
- In the case of opening this service to all visitors. How can editing the gathered data be adapted to the practices and processes of museums?
- How effective is Äänijälki for collecting feedback from the visitors?

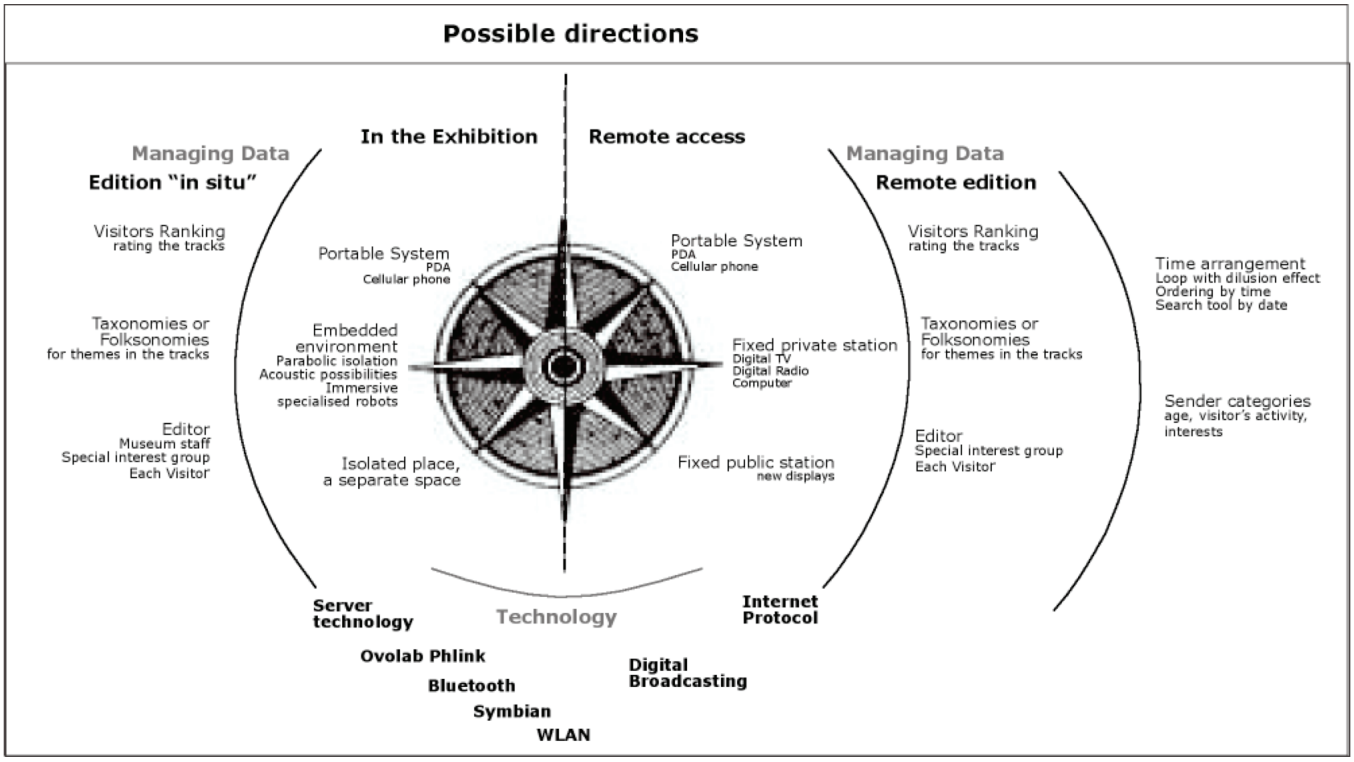

Fig 1. Possible directions analyzed in the process

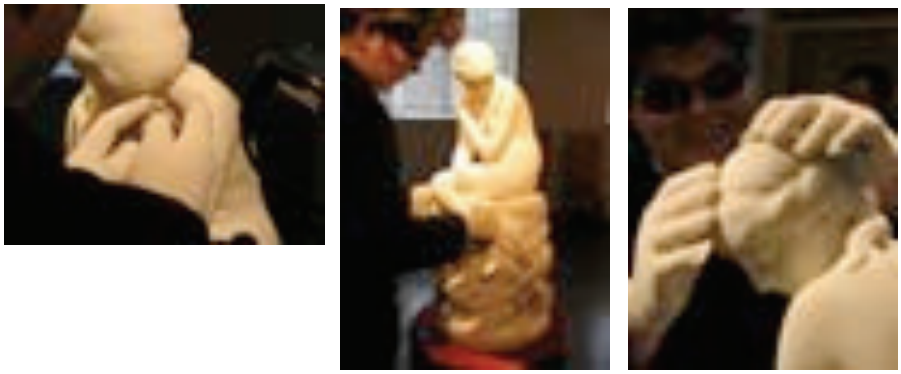

Fig 2,3,4. Touching the sculptures in Ateneum

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Surprise and Illusion: Design strategies for Interactive Museum Exhibits

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Abstract
Experimental prototypes, informed by an understanding of cognitive and child psychology are being created for museums with the aim of producing surprises, children's excitement, retaining their attention, encouraging physical activity and increasing their knowledge and understanding. We will argue that this approach can create exhibits that enhance the learning experience through interaction.
This paper, describes a simple prototype showing that both surprise and attention can be generated and maintained through the adaptation of an old and familiar toy: thereby utilizing an existing skill set, to control a more advanced activity. Here, an interactive digital LED system is embedded within a child's skipping rope, and by exploiting our persistence of vision, it creates an illusion of an animated character correspondingly jumping in the air on an invisible/ephemeral screen (provided by the movement of the skipping rope), thus combining the experience of skipping with image display.

1. Introduction

With the emergence of new technologies and new media, museums have been attempting to further develop the form and content of their exhibits and installations to meet the visitor's evermore demanding requirements. From my research the change of emphasis may be characterized as follows:

1) The focus is shifting from curation to education.

Museums have provided leisure, fun, learning environments and information resources to assist formal education; facilitating the teaching of difficult subjects e.g. science, history and inspiring students in art and design. However, historically the emphasis has been on curation, i.e. the protection of sensitive exhibits and the cataloguing of material.

2) Exhibition presentation, from static to dynamic.

Museums have moved away from traditional, static displays to the provision of interactive, dynamic, edutainment exhibits and installations that actively encourage visitors to explore and gain further insight into the exhibits and the information they contain (Barnard 2001).

3) New technologies and new media are spreading throughout the museum environment.

Interactive multimedia is being increasingly utilized: typical museums representing this trend are 'the Science Museum, the Natural History Museum in London, the National Space Centre in Leicester: they have evolved to exploit discovery and self-learning. Museums have become sophisticated computer-based worlds using networking, telecommunications, 3D image processing technology, virtual reality technology (CAVE) and sensor hardware, for the purposes of interactive

communication. Interactive devices have a central role to play in the communication process.

4) Target group – the young generation.
The museum of the future will specialize in the creative use of new technology: it engages the next generation of visitors (especially young visitors) and has a wider range of educational properties, enabling active learning and demonstrating the application of knowledge to different, but recognizable domains (Dussek 2002). In many interactive exhibitions, children have been encouraged to learn from play and exploration.

2. Hands-On Interactive Experience to 'Hearts-On' Interactive Experience

Although current museum exhibitions have been enhanced by the incorporation of advanced interactive technologies, the children may not see beyond the physical interaction to read and digest the material that is presented to them. Andy King, the curator of industrial and maritime history at Bristol's museum service, notices that the visitors (especially children) seem to be only interested in twiddling buttons of interactive works. 'He even has thought of bringing out a load of buttons and setting them up because kids would love it, even though the buttons would not actually do anything.'
In this paper, we are exploring a new way of communication that intuitively encourages the visitor to search for information and engage in a rewarding experience through an interactive dialogue/negotiation with an exhibit or installation. "To create such exhibits designers need to draw on visitor research, ergonomics, sociology, developmental psychology and educational theory to ensure that the interactive exhibits prove to be educational as well as entertaining" (Macdonald, 1998). In order to become better communicators, we recognise the essential value of psychological research in our design practice. In other words, a 'heart-on' interactive experience needs to be promoted and explored: this is a model for a more empathetic design process.
According to Perry (1987), six components have been identified to make learning fun, satisfying, and successful for visitors. They are curiosity, confidence, challenge, control, play and communication. Many museums like the Science museum, National Space Center in the UK are providing dynamic interactive settings and engaging fun learning experiences. However, visitors are tending to loose the excitement of experiencing surprises from exhibits in these environments that are full of interactions, artificial reconstructions and computer simulations. Advanced digital technology and computer hardware is not yet fulfilling its initial promise to maintain and promote the element of surprise and novelty. Paradoxically, exhibits that are technologically sophisticated and information rich may in practice overwhelm and distract visitors as they move around a museum environment.

3. Psychology Research – Surprise as 'Basic' Emotion

The creation and manipulation of surprise is an experimental design strategy central to this research: its aim is to provoke the visitor's excitement and retain their interest. We have identified the component of surprise – sometimes regarded as 'basic' human emotion (Reisenzein, 1998, 1999) - in this interaction process as most salient, drawing people's attention, sustaining interest and effectively dealing with the ensuing processes e.g. questioning, exploring, analyzing and "schema updating". We studied

and developed a model of surprise from the original model proposed by Meyer (1995, 1997) as showed in Figure 1:

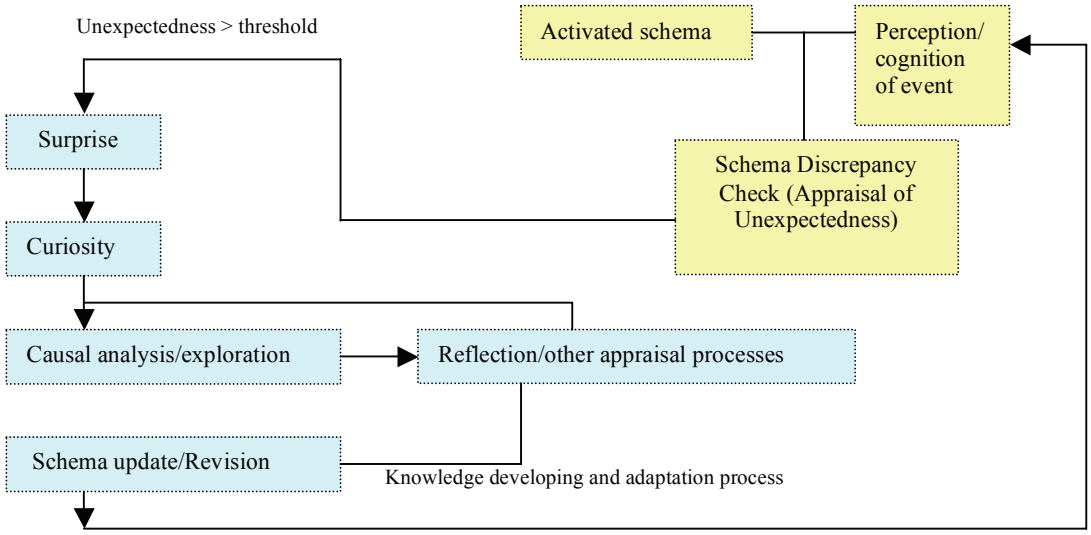

Fig 1. The cycle of surprise to adaptation

The surprise mechanism enables and provides an initial motivational impetus for the ensuing processes of event analysis and schema update. Therefore, the active and motivation consequences derived from a surprise lead to immediate adaptive actions to the surprise event: the adaptation process is an active learning process.
In this project, we are experimenting with how to stimulate the visitor to 'play' through creating the schema discrepancy, and to extended duration of the interactive activity by maintaining the schema discrepancy and curiosity drive. We are also looking at how to enhance the experience of sharing surprises and adaptation action among children through the interactive artifact they use in their 'play'.

4. Discovering Surprise by Inspiration from Magicians and Illusionists to Enhance the Interactive Experience

The study of the tricks used by magicians and illusionists provides a wealth of material that can be used to generate surprises, and could perhaps be usefully applied in promoting new design concepts. Through exploring and experimenting with perceptual illusion, we can see that it is a powerful tool to create amusement and surprise. By incorporating these devices for creating the element of surprise, we can not only manipulate the spectator's perception creatively through contextual displacement and schema discrepancy -modifying their experience of the familiar in unexpected ways- but also explore more intuitive interfaces by utilising the participants existing set skills. Learning becomes more effective when it builds on children's existing knowledge and understanding. It is one of the challenges for new media artists/designers to develop illusionary phenomena and deliver further surprises to children through exploring the possibilities of new technology.

A new interactive experience is in the ascendancy and at its centre is the humanisation of the interface. This will include the assimilation and accommodation of the interface into the object - a tangible interface. It is hypothesized that physical manipulation of the interface can engender intimacy and encourage play. By using the viewer's

existing skill set to facilitate a more immediate interaction, a rapid access to different worlds may be achieved, offering more possibilities for interpretation of exhibits, whilst also expanding imagination and nurturing their creativity.

Through experimenting with a rotating cord and projector we began to realise that the effect we observed - a persistence of vision/afterimage phenomenon - could be developed in conjunction with 'the skipping rope' - a simple outdoor toy, which is still widely used in playgrounds as an outside activity - to produce a hybrid child's toy. The rope would form the interface onto which images could be projected or – as in this case, with the use of embedded LED's - could appear from within: different manipulations of the rope could produce different images.
According to the psychological model of surprise, when an old/existing experience or perception set/'schema' is in conflict with a new experience, the user is pushed into a state of schema discrepancy (unexpectedness) and therefore experiences surprise.

In the exhibit, children will be encouraged to pick up the rope and rotate it (as in playground games) to produce a screen in the air. Depending on the rate of rotation, an image will appear as if on an illusionary screen. Hence, this piece provides a vehicle for the learning of a new skill, e.g. how to produce the persistence of vision effect.
The interaction is not merely something that provides you with information but is actually informative in itself. Therefore, the interactive process becomes part of the learning process. Thus, in this process, the skipping rope intuitively bridges the relationship between object and viewer. The rope itself is an object that is familiar to most children and is a source of pleasure and fond memories (as evidenced by the reminiscences on websites of childhood memories). This therefore seems a suitable object to bridge the emotive gap.

5. The Design: Initial Aims and Objectives

- To create and manipulate surprise, provoking the viewer's excitement and retaining their interest.
- To enhance the learning experience through the process of interaction- learning through interaction.
- To encourage visitors to intuitively engage with, and respond to, the enhanced hybrid object/artifact for a more stimulating interactive experience.
- To establish an effective communication bridge between objects and users.
- To provide engaging and educational activities for visitors.
- To improve the social interaction during the interaction with the artifact.

The designed polarization between a simple child's toy and the embedded wireless microprocessor controlled LED ephemeral array screen technology, is considered wide enough to promote a high level of surprise and attention in the participant, and serves as an elegant design proposition that is consistent with the notion of hybridity.

6. The Design Features of the Exhibit Include:

1) My research with the moving rope has shown that the very surface from which the image is produced, can in itself mediate the interaction: liberating us from fixed screen interactivity, using a modified ephemeral screen, based on an optical illusion.

2) In this project, the skipping rope can be characterized as a traditional game/activity with low-tech design features combined with high-tech embedded local microprocessor technology to provide a new interactive experience for children - simple known features combined with embedded computing/display hardware and contextual displacement to produce new surprises, without compromising the original toys functionality.
3) Use the children's existing activity skill set to deliver new knowledge/content intuitively. The surprise event is produced by the discrepancy between the participant's expectations of a familiar object/activity combined with a new experience created by the persistence of vision phenomenon activated by the embedded computer technology, i.e. an image is produced on the virtual screen created by the swinging of the skipping rope. This stimulates the learning process: new knowledge will be acquired through an active learning experience, i.e. children can learn and understand the phenomenon of persistence of vision, animation, and film etc. as they are simply playing with the skipping rope.
4) Social interaction with others will be promoted through the skipping rope play activity: it can provide children with the benefits of improving their co-ordination and socialization skills. Furthermore, the skipping rope encourages the visitor(s) to become a participant in a physical interactive process and importantly through their play they become the object itself to new onlookers/additional participants. Thus the children can engage with the rope either individually (swinging or skipping in the rope, or in pairs (rotating the rope), or through three people (two swinging and one jumping through it) (see figures 2a and 2b), with spectators also experiencing the illusion. Additionally, utilizing wireless synchronization, groups or single users can be linked together wherever their location may be.

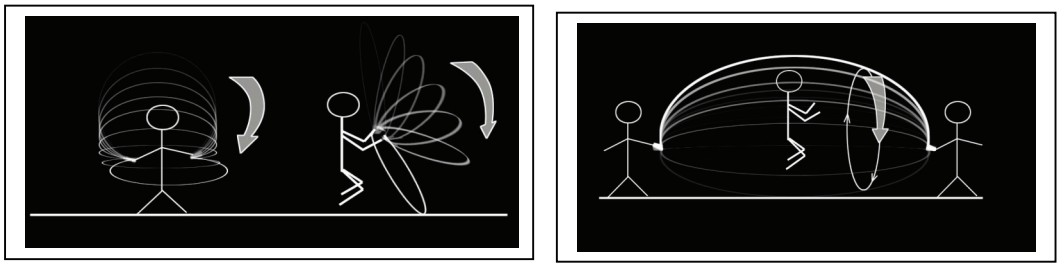

Fig 2 and 3. Skipping actions and field of vision for one and three users

7. Prototype Development

The initial prototype was constructed by embedding seven high intensity LED's in a transparent cord (see Figure 3). The rate and sequence of flashing of the LED's is controlled by a microprocessor. The seven LED lights within the skipping rope flash at different times to produce a jumping figure when the rope is rotated at a certain speed. What the player can see when skipping is a jumping figure moving at the same speed as the player. This is shown schematically in Figures 4a, 4b, and 4c. As the player skips, a different still image is refreshed at each cycle of the rope. The succession of still patterns that appear in the air will result in the illusion of an animated jumping figure. Figure 5 shows initial prototype evaluation trials.

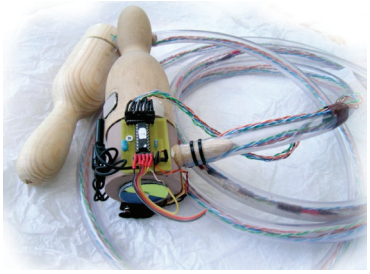

Fig 3 and 3a. Electro-mechanical testing

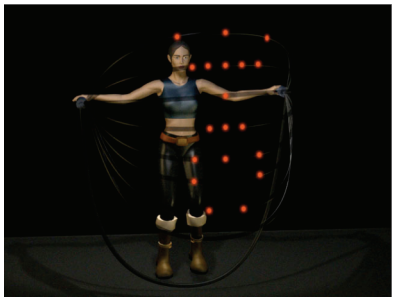

Fig 4a. standing *Fig 4b. jumping*

Fig 4c. whole sequence of LED's

Fig 5. Programming and initial prototype evaluation

The smoothness of the animation of the jumping figure is dependent on how fast you are skipping. In other words, the player and the jumping figure are synchronised. Part of the game is to understand this relationship and control it.

By interacting with the skipping rope, the players are encouraged to explore new visual effects and new ways of interaction.

The immediacy of the interactive experience based on existing general competencies facilitates the physical activities, leaving higher level meta-cognitive processing freely available to guide and regulate the learning experience.

8. Conclusion

At the moment a wireless microprocessor controlled LED rope prototype has just been produced. However, we haven't conducted the intended series of usability trials with children to see if it meets with our initial aims and objectives.

In summary, this paper reports on the emergence of new applied embedded digital technology in museum environments. It will change the system of communication and relationships between both visitors and exhibits, between the visitors themselves and the visitor and artist/designer. It is informed by psychological research into the nature and structure of surprise, which is being applied to create and manipulate surprise in an educational artefact. The paper outlines the reasoning that has been applied in creating a prototype to support an active learning experience.

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Handbags and Baggage: the Visitors' board, audience assumptions and Women in Thatcher's Britain

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Abstract
This paper examines the use of a visitors board in the exhibition Women in Thatcher's Britain at the Women's Library October 2004 – April 2005. Visitors to the exhibition came with polarised views about Mrs Thatcher and Britain during the 1980s. A simple device, a comments wall, collected their opinions during the exhibition. What kind of categories did their comments fall in and what did they tell us about how visitors had reacted to the exhibition? How did the visitors wall act as a place for debate for visitors and what did it contribute to the exhibition's content?
The paper concludes by asking how this kind of device can be used to build visitor participation and how it can be developed as part of evaluation structures.

1. Introduction

1.1 The Women's Library at London Metropolitan University is the largest collection of women's history in Britain. It is a cross-domain collection consisting of archive, library and museum collections. Our mission is to:

1.1.1 "To document and explore women's lives in Britain, in the past, now and in the future. It aims to inspire learning and debate on issues that concern women for the benefit of all".

1.2 Our exhibition programme is a key means of developing the museum's role as a centre for debate around more contemporary issues, a function particularly suited to a university museum.

1.3 This paper will focus on our most recent exhibition "Iron Ladies, Women in Thatcher's Britain"(1) and in particular the role played by the comments wall. We have used web based participative components in the past: how effective is the comments wall in comparison? What did we learn from our visitors, how useful is it as an unstructured form of evaluation and how will we use the information?

2. Iron Ladies: Women in Thatcher's Britain

2.1 It is 25 years since Mrs Thatcher came to power in Britain. The Women's Library holds a good deal of material from the 1980s, particularly from women's organisations who were active campaigning against Thatcherism, such as Women Against Pit Closures, lesbian organisations which campaigned against Clause 28 and records and objects connected with Greenham Common and the peace movement. We were also aware that the 1980s saw the first (and only) female prime minister in Britain. What kind of effect did that have on women's role in public life? Our

collections also have material relating to employment issues in the 1980s, what happened to the glass ceiling?

2.2 We teamed up with the Thatcher Archive at Churchill College Cambridge, which holds material that gives another perspective on the same story from Mrs Thatcher's personal papers.

2.3 As we put the exhibition together we were aware that Mrs Thatcher and Thatcherism inspired very polarised opinions in many people. They either loved her or hated her. For example, one of the items we loaned from the exhibition was one of her handbags. This is owned by an ardent admirer who had paid £100,000 for it in a charity auction, which, he felt, represented her significance and worth. At the other extreme was a Greenham web, a symbol of the peace camp there, which endured protesting against Thatcherite foreign policy for near on 20 years.

2.4 How would people look back from the perspective of 2005? Undoubtedly the 1980s had changed the landscape in Britain, how did people perceive them now?

2.5 Dr Harriet Jones, the curator, was keen to challenge some assumptions. For example she put together a case on 'Victorian Values', a phrase very much associated with the moral values of the right at the time. The case included material about the Charles and Diana marriage with photographs of William as a baby exemplifying family values and material from the Stop the Sexist Ads campaign at the Greater London Council, arguing the case for censorship in advertising and a leaflet for a black lesbian meeting boldly stating 'no SM/fascist gear'. Moral purity, Harriet Jones argued, belonged to the left as well as the right in the 1980s, both sides were equally censorious. This kind of ambiguity was present in other aspects of the exhibition; was it Thatcher or Greenham which ended the nuclear threat, did a female prime minister promote women in public life or did she do little to help them?

3. Collecting Visitor Views

3.1 Given that we had designed the exhibition to illustrate corresponding polarised views about the period we wanted to find a way to collect visitor opinion to see what kind of views visitors really did have, and possibly, to get some feedback on whether they had reassessed them. As one of the tenets of the exhibition was to use as much of our collections (as well as those from the Thatcher Archive) as possible, we were also conscious that there might be areas of discussion and debate that went beyond what could be illustrated by our collections. As part of our mission is to inspire debate we also wanted a device which would allow visitors to participate in and add to a view of the 1980s.

3.2 Some of this function was answered in a talks and events programme. But inside the exhibition hall we used a low budget (through necessity initially) and simple option – a comments wall. We made sure it was in a prominent central place and of a size to compete equally with other elements of the exhibition. We asked one question: "What do the 1980s mean to you?" so that people could answer who did not have direct experience of the 1980s themselves as The Women's Library has a high proportion of young visitors.

4. What Did the Comments Wall tell Us?

4.1 The comments wall collected around 300 responses, interestingly about the same rate as a questionnaire would have, although it quickly ran out of space. (We filed responses in a book below the wall, but this had limitations). It grew considerably over the period of the exhibition and operated as another point of display and later even a central focus to the exhibition. It was included as a point of discussion by tour guides. Importantly, its construction (non linear, entirely open and available to view until we ran out of space) encouraged its role as a point for debate, visitors were not only responding with their own point of view but to each other. In two previous exhibitions we had operated web based participative devices. Visitors had been asked to write comments which had been collected on a website. However, though there was a site in the hall, it was less prominent. Virtual users also contributed and so the comments reflected less engagement with the exhibition, though it did give us information about the types of visitors. There was les sense of visitors reacting to each other. The space was used as private rather than public space. Handwriting made a difference, comments on the wall belonged to real people, providing a more open invitation to respond. The eye can move around the board, return to particular comments and decide in what company to place a comment. This gave the wall the capacity to develop discussion between visitor and a debate soon developed.

5. Who Were the Visitors?

5.1 Our target audiences were as follows:
People who had been involved in political activism during the 1980s
People who are interested in politics (both right and left)
Students
Researchers
People interested in women's history
People interested in women in politics
People who remembered the 1980s

5.2 The visitors' breakdown for the exhibition is as follows:
Gender: Female: 84%, Male: 16%

Age: 60+29%, 45-59 20%, 35-44 22%, 25-34 17%, 16-24 12%

5.3 Thus a significant proportion (nearly 30%) had not been alive during the 1980s or had been children. It is impossible to analyse responses according to age, but they were received across the age range suggesting it was equally accessible to all age groups.

6. What Did the Board Tell Us?

6.1 I have divided them into six different categories, although in many cases these overlap. The categories are only useful because they illustrate some of the different ways visitors reacted to the exhibition subject and content. The categories that seemed most apparent were:

- I wasn't there
- Cultural icons and memory stories
- Slogans and positions

- Women's lives
- The Additional curator
- In retrospect

7. I Wasn't There

7.1 The Women's Library is part of a university so it has a high proportion of student visitors. Our student population classifies itself as 59% non-white and we have a large number of international students. Thus for many of our visitors there is a gap between our collections, built from mainly white middle class British campaigning women, and their own points of reference.

7.2 For some this gap meant disengagement:

7.2.1 "Wasn't born, no comment, younger than all of you. "Ha, Ha, Ha" or "Can't remember them" or comments that replaced the visitor reflectively in the centre

7.2.2 "I was born in 1984 so it is the best decade ever!"

7.3 These kind of comments gave us useful information, not only that we were failing to engage some visitors at all, but the lack of engagement had made them openly challenging to the rest of the material.

7.4 The board taught us not to generalise visitors. One young visitor demonstrated an extraordinary amount of related memory, which added a real feel of the period to the exhibition:

7.4.1 "Born in 1981, among my first works "Maggie, Maggie, Maggie, out, out, out". Spending every Saturday it seemed on a demonstration – miners, CND, abortion rights, trade union rights…organising my own first petition and poster campaign/badge making at the age of 6, in protest against school dinners. Growing up in Hackney everyone at school wanted Nike or FILA trainers but we could afford only the NICKS or those Jordan ones with double glitter…"

7.5 Another young visitor commented:

7.5.1 "I was born in 1988 so I didn't see much of the 1980s, but I like this exhibition and I like the idea of a woman museum. Press through Ladies. Olivia France, 16" as though she had been caught by the spirit of the comments of the women who were there.

8. Cultural Icons and Memory Stories

8.1 These responses related to nostalgic reactions to the material, particularly through association with familiar objects. Many of these objects were not themselves part of the exhibition, but the material and the subject matter had summoned them from memory. The responses illustrate the pleasure of personal memory and the importance of material culture as a way of summoning them. There was whole batch of comment from people listing iconic objects that represented the period. For example the comment from Students@Richmond read:

8.1.1 "Carebears, My Little Pony, Fraggle Rocks, Smirffs, Puffalumps, Cabbage Patch Kinds, Pound Puppies, Sir-ups and jellies, leggings, Ninja Turtles, Batman, Brite, Regan (sic) Us pres"

8.1.2 Most of these objects (save President Reagan) did not appear in the exhibition, but they added a texture to the content (though not as trustworthy as a label?) which was echoed by other visitors:

8.1.3 "Born in 82, Childhood, Cooby Show, legwarmers, shell suits, milk@school, My Little Pony, Cabbage Patch dolls, Thatcher, Paying 20p for the bus fare, Hair clips and high socks"

8.2 Sometimes the memories were more specifically attached to parts of the exhibition. One section had used material from Women Against Pit Closures and had dealt with the Miner's Strike. This comment directly enriched the interpretation:

8.2.1 "I lived in a pit village. When I was 7/8/9 my friends at school stopped having birthday parties because there was no money for striking miners"

8.3 By looking at this kind of evidence we have gained more knowledge about how our visitors respond to objects, which we could use to plan content in further exhibitions. This was not the original purpose of the comments wall, but it suggests that a comments board might have a greater role to play than a less complex evaluation/feedback form particularly if built into an evaluative process initially.

9. Women's Lives

9.1 Another set of visitors responded very much as women and made their own lives representative of the changes of the 1980s. Interestingly the similar experience could induce entirely different opinion, as apparent in these two corresponding pieces, which were placed near each other on the board:

9.1.1 "Divorce 1984, Death Mum 1983, Dad 1985,BOYsterous youth, sons = 15 and 16 in 1985, Crisis of funds as no alimony 1985,Undergrad degree 1985, Postgrad qualification 1986, First read career job 1987, Continuation of wonderful life, GOD BLESS MARGARET"

9.1.2 "I had a baby in 1984 at the age of 17, I did not do so 'to jump the housing queue (M Thatcher). I lived in a privately rented house then local authority – not I won my own and am a full time teachers. FUCK OFF MAGGIE THATCHER – YOU DESTROYED OUR SOCIETY"

9.2 The board also developed quite a debate as to whether the 1980s had helped women – another sub theme of the exhibition. From the role model:

9.2.1"Being born into a world with e female as the PM! What a great role model"

9.2.2 To "looking back now as an adult the 80s remind me that feminist progress isn't a given (even if a woman is running the country)" and others used their lives to illustrate some of the complexity around the issues:

9.2.3 "Fighting the battle being a large anima females yet buying my first house, getting married, buying into a partnership, buying my partner out, employing staff (mainly woman) learning to see both sides of the pregnancy debate – the employer and the employee."

10. The Additional Curator

10.1 Some visitors thought about how they would have told the story, identifying gaps. Some of these gaps may have been there because our own material did not reflect the issue, but there were also comments about perceived interpretative approaches from visitors who took a curatorial approach. We were pleased that the wall provided the space to introduce some of the issues that we had not been able to include for one reason or another, and that it gave visitors the space to operate on similar terms to the curator. We were keen that this was not guarded territory and it is important for staff in museums that the visitors' voices are present (even when they have left the room) and that they get a sense of how people have responded to their work. That sense of engagement should be highly motivating for staff in museums.

10.2 One person commented:

10.2.1 "Why no Poll Tax" and another "Why nothing here on councillors including women leaders of local councils – like Hackney – who defied Thatcher" and another visitor did not like what she perceived as the emphasis of the exhibition and wanted to correct it:

10.2.2 "Things other than lesbians and 'anti' establishment/organisation happened. It was a great time to be young and a more easy and positive time to be female than you suggest."

11. In Retrospect

11.1 This final category of response takes us back to our initial objective – how would people re-evaluate the period 25 years on?

11.2 Interestingly a sense of re-evaluating things came through in several responses, and not always people who had come with strong pre conceived opinions. All three of the following comments want to introduce comparison or perspective:

11.2.1 "Its interesting to know what happened in the 80s. But it could have been put in relation to what happened before and what happened afterwards. Everything within a historical context."

11.2.2 "Acid drenched hatred of all things Thatcherite, dreams of a better world, potent and live, if naïve in the extreme."

11.2.3 "In retrospect I miss feminism. I'm jealous of women older than I am who got to enjoy the period where the F word wasn't a swear word. Whilst a lot of the 2nd wave stuff presented here is outdated or dubious or of no relevance to most women, at least feminism actually meant something back then!"

12. Conclusion

12.1 I hope that I have illustrated that a simple device such as a comments wall can inspire a huge amount of interaction with an exhibition's audience. It is because it is open, accessible to all and centrally placed within the exhibition rather than in a separate electronic space that it can form part of the display and inform the exhibition over it life. It illustrates that we inspired debate as we had set out to do.

12.2 I hope that I have also shown that the comments wall was a useful, if unstructured way, of telling us more about how our visitor's responded. Staff must listen to a comments wall and respond to it. We now need to think about how we can do this. Is writing on a wall enough of a way of participating? Is it a dead rather than a live dialogue? How do we use a device like a wall to measure identified learning outcomes for our visitors? Integrating the wall into evaluation of the exhibition in a more structured way is the next step. We have small resources but we also need to find other ways to talk to our audiences, the value of which the comments wall as clearly shown us.

12.3 Finally though I am arguing here that for the small museum a low-tech device can be highly participative, there were members of the audience who expected a more mixed media content that we had been able to provide. We better listen to their requests!

12.3.1 "Margaret Thatcher was a typical white woman that's why she had authority. This museum lacks liveliness, they need videos, music etc. Williams 14 years."

Aknowledgements

All quotes from the exhibition visitors' board. Original spellings are preserved.

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Iron Ladies: Women in Tatcher's Britain curated by Dr Harriet Jones, The Women's Library, October 2004 – April 2005

WONDER OBJECTS
Magic and Interactive Storytelling

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Abstract
This paper presents a part of my Masters Thesis Research undertaken at the Interaction Design Institute Ivrea, Italy, in 2004 titled, 'WUNDERDINGE {Wonder Objects}: Familiar objects as interactive storytellers in a museum space' in assistance with Britta Boland and Alberto Iacovoni.
'Wonder Objects' is inspired by the notion of *cabinets of curiosities*, the forerunners of the museum as we know it today. Initially known as 'Wunderkammern' (literally, Wonder Rooms) and 'Wunderkabinette' (Wonder Cabinets), these collections of curiosities, both natural and man-made, offered their viewers a glimpse of the world they had not experienced until then. This project aims to recreate that experience of learning through a sense of discovery and wonder.
It explores interaction design in the context of intuitive and interactive storytelling interfaces, in a museum space, more specifically a 'Museum of Information Technology', displaying some of the famous writing and calculation machines developed by the Olivetti company of Italy during its most productive period.
These interactive storytellers are familiar objects from our everyday world, which we recognize easily, yet they possess an additional hidden layer of information to invoke a feeling of the extraordinary or the magical.
Museums often struggle with the effort of creating an engaging display of their collection of historic objects. This project explores ways in which such dormant inactive entities can be imbued with an animate quality, encouraging the viewer to discover the various hidden layers of information. Through this notion of discovery, and playing on the element of surprise, it seeks to provide a more engaging experience to the museum audience, combining the act of learning with play.

1. Introduction

As computers get smaller, more diverse, and are embedded in the environment around us more frequently than ever, is it possible to extend the inherent language of familiar objects that we instinctively relate to, or know how to interact with at an intuitive level, as a conduit between this physical world that we easily recognize and understand, and the virtual one which is more abstract and ever expanding? Can we create a complimentary relationship between the two by combining the multi-sensory and tangible richness of the former with the dynamic quality of the latter? By adding a layer of digital functionality to these familiar tangible objects, can we bestow upon them a quality of being 'alive' and animate, enriching them even further?
These were some of the questions I asked myself at the very beginning of my study and have frequently touched upon in the course of the development of this project. In this paper I present a set of interactive tools that are designed to provide information about a group of objects on display in a museum setting.
Having always been fascinated by magical objects and the fantastic, the design of these interactive information artifacts carry forward this enthusiasm by exploring the relationship between familiar physical artifacts from our everyday world and the hidden digital layers embedded within, which when revealed, could inspire feelings of surprise and wonder.
When placed within the context of a museum these artifacts function like tangible physical icons of the stories they contain or represent. Together they create an

atmosphere, which imparts upon the space and the objects on display, an animate quality of the living, making the museum a space for wonder and discovery.
As more museums all over the world begin to embrace interactive technologies in a variety of different ways to present their collections, this area offers new opportunities and challenges in re-looking at the museum as a living theatre of memories or a modern day cabinet of curiosities.
Keeping the above in mind, I began my research strongly inspired by the theme of 'magic' and the enthusiasm to explore how notions of magic relate to interaction design in general and interactive objects in particular. I set out to look at those qualities in an interactive artifact that drew parallels with an *object of magic*. When I say an object of magic I refer to the depiction of magical objects and devices as written about in folklore, popular literature, fantasy stories for children and as depicted in films, among other similar sources of inspiration. Objects like the magic wand, the crystal ball, magical instruments of various kinds, talismans and pendants, magical orbs and containers, ornaments and magical clothing, magic mirrors and magical books being a few examples of what one may call 'magical objects.'

Fig 1. Magic objects from "HarryPpotter" film series

Fig 2. Magic objects from "Lord of the Rings" film trilogy

2. Background Research

My background research touched upon two key areas. The first being the field of 'tangible computing', with a strong emphasis on some of the work that has been done by the Tangible Media Group at the MIT Media Laboratory, USA. Examples of some of the works that I found inspiration in are cited below.
The second area of research dealt with understanding the idea of a museum. Understanding how the first museums of the world came into being, and what they offered their audience in terms of knowledge and the experience of learning, and how that compares with museums today.
The endeavor was to provide myself with a broad overview and understanding of context within which to place the interaction design solutions I would propose.

2.1 Tangible Interfaces

The Tangible Media Group, founded by Prof. Hiroshi Ishii in 1995, have done a number of projects which seek to give physical form to digital information providing us with digital information that integrates more seamlessly with the physicality of our work and home environments, identifying new physically grounded approaches for interacting with computer mediated information.
Among the many projects done by the Tangible Media Group the first related work

that comes to mind is titled the ambientROOM. The ambientROOM explored the theme of peripheral awareness for external activity, using the expression of "ambient media"–ambient light, sound, airflow, water, movement and physical motion as peripheral displays at the background of the user's attention, combined with the idea of physical objects as tokens and containers, and as information faucets/outlets for information.

For instance, by bringing an object to an information display or information sink, an "ambient" display of that information could be accessed. In one example, by bringing a toy car close to the speaker, ambient sounds reflecting the level of activity of a car web page could be heard. Each hit to the website was translated into the sound of a raindrop, the more the raindrops the greater the number of hits. Another ambient display synthesized the shifting sounds of birds and rainfall and modulations of ambient room lighting, simulating ambient displays reflecting e-mail arrivals and other computer related network activity.
What interests me in this project is the use of ambient cues and tangible physical tokens to access and 'display' information. Also the notion of an information display not always being constrained to the conventional graphical display of information on a screen, but using the qualities of ambient sound and light as information 'displays' as well.
The approach of embodying virtual functionalities into tangible real world objects is reflected in another project by the Tangible Media Group, called the 'metaDESK'. In this project the language of physical real world objects was used to depict GUI representations of ideas like windows, icons and handles, as tangible user interfaces. These graspable 'physical icons' or 'phicons' as they are called, were used to control and manipulate the display of virtual information on the metaDESK.
The metaDESK itself was inspired by an earlier work called, 'The Digital Desk'. This interactive piece by Pierre Wellner (Xerox EuroPARC, 1991), seeked to combine the electronic world of the workstation with the physical and material attributes of an actual, real world desk top.
Another project which this piece of work finds inspiration in, is Durrell Bishop's 'Marble Answering Machine' (Royal College of Art, London, 1992), which deals with the notion of embodying digital information into simple physical objects, thereby giving this digital information a tangible tactile quality.
The metaDESK and Marble Answering Machine projects give us a glimpse at how physical objects can function as containers and enablers of digital information. What interests me about these two projects is the attempt at giving digital information a real world physical and tactile quality.

Another project that explored this notion of empowering familiar physical objects as containers of virtual content is the 'WebStickers' system. This system, developed by L.E. Holmquist, J. Redstrom and P. Ljungstrand, empowered users to connect physical objects to data on the World Wide Web using bar coded stickers and a barcode scanner connected to a computer terminal.
The above mentioned projects provide an insight into the attempt at making computers recede into the periphery of our world, while at the same time, empowering us to remain in control of the technology and interacting with it in a more natural and intuitive manner, through tangible objects that we recognize and relate to instinctively-familiar shells from our everyday world.

2.2 Understanding Museums

In the second part of my background research I tried to broaden my understanding of the domain within which I would place my work – the museum space.
I began by looking at how the first museums of the world came about, what was so unique about them and the experience they offered the viewer?

2.2.1 The History

The earliest museums, dating back to the sixteenth and seventeenth centuries, were what we have come to refer to as *'cabinets of curiosities'*.
In their catalog 'Devices of Wonder', for an exhibition of the same name held at the J. Paul Getty Museum in November 2001, Barbara Maria Strafford and Frances Terpak discuss the origins and significance of these cabinets of curiosities. According to them these collections of objects, which comprised of both natural as well as man-made curiosities, ranged in size from entire rooms (Wunderkammern), to tabletop cabinets (Wunderkabinette), depending on the interests and financial resources of the individual collectors.
Natural objects as objects of study and wonder played an integral part in the intellectual life of early modern Europe, from the sixteenth century through the nineteenth century. The acquisition, examination, and display of such items produced a community of collectors who visited one another, met at learned societies, and exchanged ideas, objects, letters and publications.
At the heart of this enterprise in Europe was the port of Amsterdam, where ships laden with curiosities and natural wonders ranging from exotic plants, animals, insects, marine specimens and minerals, to a variety of man-made wonders, arrived from all over the world, most notably the East and West Indies, Malabar, Ceylon, South Africa, and North America.
While most of these collections were intended for the private viewing and pleasures of a select few, one of the first of such collections to become a museum, as we know it today - a collection for public viewing was the Tradescant Collection.

During the 1600s the Tradescants – John the Elder (died 1638) and John the Younger (1608-62), built up a famous collection of curiosities in their home, known as 'The Ark', in Lambeth, on the South Bank in London. Both, father and son, were primarily gardeners and botanists, and had served as Keepers of His Majesty, the King of England's Gardens. In the course of collecting exotic plant specimens from Europe, North Africa and especially the New World (the Americas), they had also acquired a collection of curiosities in the nature of artifacts, relics, rarities, specimens and other enigmas.
This collection, started by the father, was further expanded by the son. Gradually this collection grew to be an enormous one and was eventually opened to the curious public, for a fee.
In 1659, this collection passed into the hands of one Elias Ashmole (1617-92). Elias Ashmole, in turn, presented the collection to the University of Oxford, where he had briefly studied. Here the Tradescant collection was sorted, catalogued and winnowed out, and this randomly acquired cabinet of curiosities became the modern museum. Thus came into being the 'Ashmolean Museum' – the oldest museum in England, and predecessor to the museum, as we know it today.

2.2.2 The Experience

These cabinets themselves were arranged in such a manner that natural and man-made

objects jostled for the viewers' attention together. They were, moreover, organized according to pre-scientific criteria, arranged in most cases to suggest a microcosm, a model of a much larger world. They offered their viewers a glimpse of a world they were unaware of, and provided them information through a process of juxtaposition and superimposition, amazement and wonder.
This project aims to recreate this experience of learning through a similar spirit of discovery and wonder. In these cabinets the viewers often found their attention shifting between boundaries of the natural and artificial, the real and the unreal, in a process of learning through active participation. These cabinets encouraged the viewers to move from the position of an audience in an auditorium, onto the stage themselves. Modern interactive technologies offer us a similar potential to create a more engaging learning experience within a museum, by creating an intriguing relationship between the actual material objects, and immaterial virtual layerings, in an attempt to enhance the overall experience of the object.

2.2.3 Mathematica

In 1961, Charles and Ray Eames (Eames Office), considered by many as two of the most important and influential designers of the twentieth century, set the precedent for the 'interactive exhibition' with *Mathematica: A World of Numbers and Beyond*. *Mathematica* is considered to be the direct ancestor of the modern museum exhibition. Sponsored by the IBM Corporation, for the California Museum of Science and Industry, the basic idea behind this exhibition was to present mathematical concepts of varying complexity, in a pleasurable and fun manner. Something, as Charles Eames put it, "should be of interest to a bright student and not embarrass the most knowledgeable."
For the design of *Mathematica*, the Eameses fused their ideas about learning, illusion, toys, mathematics, science, technology, and new ways of seeing to produce an exhibition that offered some of the *"magic and glamour"* of ancient entertainment along with the earnestness of nineteenth century learning.

3. Prototypes

Presented below is a brief description of four prototypes that were developed keeping in mind the concept of 'magical interfaces' as interactive storytellers. A detailed descriptive account of these prototypes shall be provided at the presentation of 'Wonder Objects' at "Re-Thinking Technology in Museums", in Limerick (29-30 June '05).

3.1 MagicMirror

Most often information about objects in museums is provided via textual panels and similar static displays. This piece seeks out other alternative means by which to provide such information in a more intriguing manner. Based on the idea of a 'magic mirror', this solution provides information to the viewer by playing on the elements of surprise and entertainment. This 'magic mirror' acts as a dynamic information display surface by providing audio and visual information to the viewer according to his/her proximity to it (Fig 3).

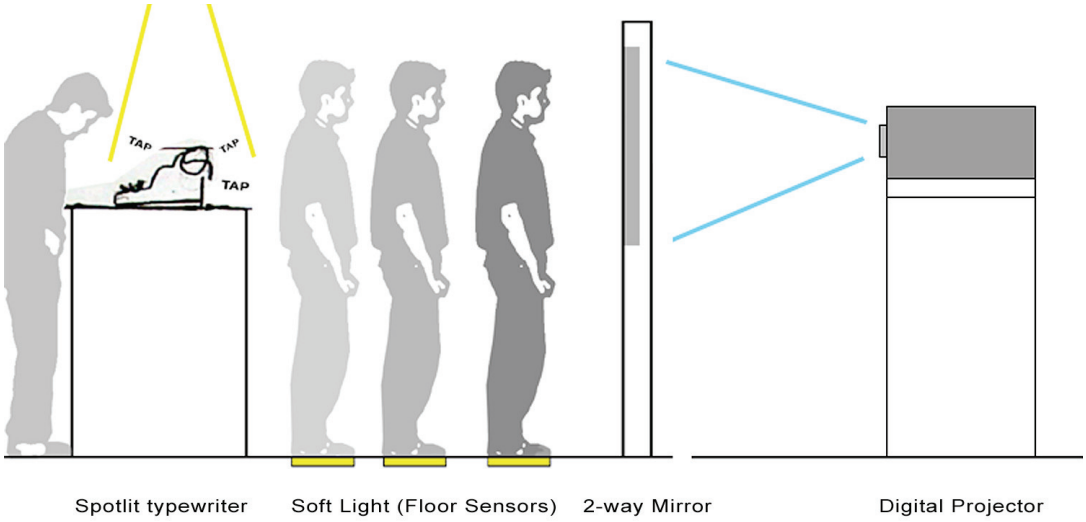

Fig 3. The key object on display, the floor sensors that measure the proximity of the viewer, and the 'MagicMirror' display.

3.2 WhisperingTable

The second idea, which explores notion of providing information by inviting the viewer to interact with an object to discover its hidden layers of information, is the 'WhisperingTable'. Inspired by the notion of wonder cabinets and *shadow boxes*, the 'WhisperingTable' is, quite literally, a 'table of content'.

The 'WhisperingTable' is a table with small peepholes on its surface and a viewing lens. These peepholes function as windows to the individual compartments below. Some compartments house artifacts (i.e. a photograph, a newspaper clipping, a miniature typewriter, a mechanical part of a typewriter and other similar objects) and others small digital screens. When triggered by the viewer peeping into them (using the viewing lens), these compartments launch the contextual audio / video content. In its idle state, the viewer can see a flicker of lights and hear a murmur of sounds emanating from the table, to entice the viewer to approach it. As the viewer approaches, the flickering stops as do the sounds as if the table were 'alive' and aware of the viewer's presence.

For the sake of demonstration, a quick idea sketch was developed using cardboard boxes and keyboard buttons as the pressure sensor triggers (Fig 4).

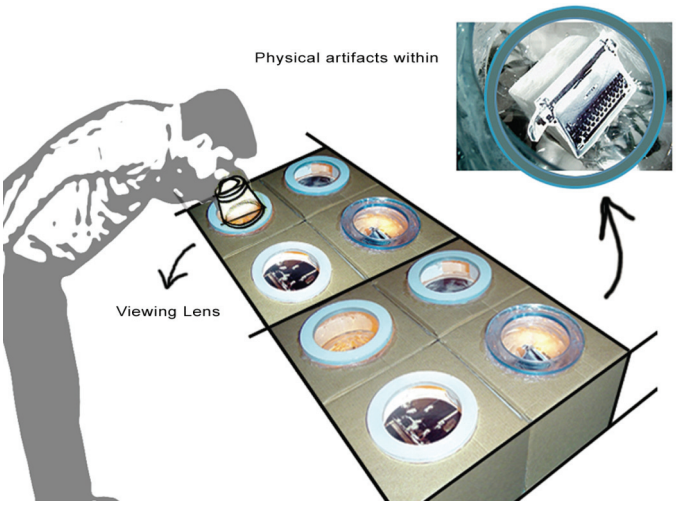

Fig 4. The 'WhisperingTable' prototype

3.3 InteractiveBook and WallCabinets

This installation has two key components:
a) InteractiveBook (plus fragmented/distributed projections)
b) WallCabinets

a) **InteractiveBook**

A book is an object symbolic of information. We have a tacit understanding of how to use it. We know, that to access the information within, we have to open it and flip through its pages. Based on an earlier prototype called 'The Book of Answers' done by Aparna Rao, a colleague of mine at IDII, the 'InteractiveBook' explores this notion of our intuitive interactions with an ordinary book, to generate content in a not so ordinary manner.

At the first level, its pages provide textual information and printed imagery, as does a conventional book. But at a second level, certain pages once flipped by the viewer, launch contextual video projections onto sheets of paper suspended from the ceiling, making the 'InteractiveBook' a simple, intuitive, tangible and seemingly magical interface to access information (Fig 5).

Fig 5. "Interactive Book"

b) **WallCabinets**

Carrying forward the inspiration from *Wunderkabinette* (Wonder Cabinets) and building upon the idea of the 'WhisperingTable' is the concept of the 'WallCabinets' - the wall as an interactive space.

The walls surrounding the key display are embedded with a matrix of small windows/compartments, each displaying an image or artifact placed within. Some of these compartments have doors with handles (simple interface cues), which the viewer can open to reveal a hidden layer of information, in the form of audio or video content, transforming the entire wall into a large interactive wonder cabinet. The images and artifacts displayed within these compartments are arranged in context to the key object on display (in this case the Olivetti Lettera 22 typewriter), to give the viewer a broader sense of the times i.e. events, design directions and popular culture that existed, when this object was designed and produced.

While 'InteractiveBook' provides a micro view of the key object, the 'WallCabinets', like the *Wunderkammer* (Wonder Room), provide the viewer with a macro view - a glimpse at its larger context.

3.4 WonderObjects

In this fourth display, set up to present information about Olivetti's first portable typewriter, the MP 1, the viewer finds a table with the typewriter placed upon it. Video content is projected from above onto the surface of the typewriter, and the surface of the table itself.

In its idle state the visitor sees and hears hands typing on the machine's keyboard. The video has been created in such a fashion that there is a precise one is to one layering of the virtual image upon the actual physical object, transforming the static object into a surreal animate entity (Fig.6).

As the viewer comes closer (via proximity sensing), he triggers another video, and the hands begin to type out a set of instructions which appear on a sheet of blank paper that is inserted in the machine. These are an index to certain 'hotkeys' on the typewriter's keyboard that when pressed, trigger contextual video content which animates the object on display (Fig.7).

Here as in the other prototypes mentioned above, interactive technologies have been used in a manner that complement and contribute towards transforming these ordinary objects into a 'wonder objects'. Objects that seem to pulse with a life of their own haunted by immaterial ghosts that enable them to tell their stories to us.

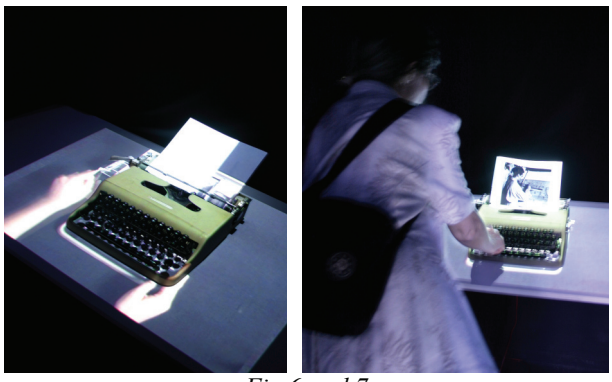

Fig 6 and 7

4. Conclusion

By presenting the examples mentioned above, this paper illustrates ways in which an ordinary artifact in a museum space may be made more interesting to the viewer, by encouraging learning through an active interaction between the viewer and the objects on display in the museum. The interaction process has been designed with a strong focus on the elements of surprise and discovery, to make the viewer's learning experience a little more akin to the Wonder Rooms and Wonder Cabinets of the 16th and 17th centuries - an experience of learning by wondering at and wondering about the object on display.

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Devising Educational Workshops and Programmes that Generate a More Meaningful Engagement with the Public

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Abstract
This paper outlines ways in which museums and galleries engage with the public through workshops and education programmes and takes as examples two case studies, the Lewis Glucksman Gallery, University College Cork and the Hunt Museum, Limerick (author was Education Officer from 2000-04).

1. Educational Remit of Museums and Galleries

The didactic function of the museum dates to its birth in the eighteenth century, with an increased emphasis on educating the general public in the nineteenth century. Today this educational focus permeates the museum, affecting curatorial decisions on the arrangement of exhibits and the way in which information concerning the displays should be mediated to the public. The key objective of museum and gallery education is to stimulate and engage with the visitor, an objective, it would seem, that is shared by those working within the field of interactive technology design.

2. The Museum and Gallery

When examining how museums and galleries engage with the public it is useful to begin by considering the origins of the specific museum/gallery space. The Lewis Glucksman Gallery, on the campus of University College Cork, is a custom-built art gallery that opened to the public in October 2004. Designed by the architects O'Donnell + Tuomey (ODT) the gallery consists of two large gallery spaces and two smaller environmentally controlled white cube galleries, one of which is an intimate space for viewing a small number of artworks. The Glucksman hosts curated research-led temporary exhibitions. Recently named Best Public Building by the Royal Institute of Architects in Ireland (RIAI) it was described by the judges as 'a limestone pier and a timber treasure-house in the trees: dreamy and poetic, which repositions the viewer at the centre of the experience of art.'

It is worthwhile comparing this contemporary purpose-built gallery with the elegant eighteenth century Palladian-style Custom House that is home to the Hunt Collection. The Hunt Museum in Limerick consists for the most part of Medieval and archaeological material. Due to the object-based nature of the collection most of the artefacts are behind glass. Before John and Gertrude Hunt donated their collection to the people of Ireland, the Hunts lived with and enjoyed the objects now on display in the Museum. A simple way in which the Museum evokes the informality of the Hunts' home and encourages visitors to interact with museum objects is through the non-ordered display in drawers and curiosity cabinets of various items from the

collection, many of which are without information captions. It is the presence of drawers, inciting curiosity and exploration, that visitors to the Museum recall with the most intensity.

3. Workshops as a Means to Engage the Visitor

It is the role of the museum educator to create a meaningful and enduring learning experience. The Education Departments of both the Hunt Museum and Glucksman offer, though workshops, a number of entry points to different audiences to the work on display. These workshops focus on a particular aspect of the collection or exhibition and explore it in some depth. In the case of the Hunt Museum these workshops are delivered by volunteers who participate in the Museum's long established 'docent' programme, whereas the Glucksman Gallery employs art facilitators.

Workshops are designed to:

- provide a focus for the museum/gallery visit
- bring about a greater understanding of the museum/gallery and its displays
- stimulate an interest in the exhibits
- provide direction and an environment conducive to an uninhibited exploration of the displays
- promote critical thinking and an active learning in which the visitor is involved
- allow for a personal engagement with and an individual response to the displays

4. Case Studies of Workshops

4.1 The Hunt Museum

There are numerous workshops on offer to groups visiting the Hunt Museum. These generally tend to be organised under different themes and focus on evoking the original context of the objects in the Hunt Collection.

The Hunt Museum's Time Travel workshop, designed specifically for primary school children, attempts to recreate the original context of objects from the Museum's archaeological collection. This is a four-part workshop consisting of :

1) a video presentation of travelling in time
2) a Bronze Age drama re-enactment
3) a quiz in the galleries
4) an object study

Children are brought on a journey of discovery in a time machine, constructed in the Education Wing of the Museum. Through the use of a video presentation, which acts as a window to the outside world, children travel backwards in time. The video, produced by the Museum's education department, was shot predominantly in the Irish National Heritage Park in Ferrycarrig. There is no voice-over. A facilitator guides their discovery, interprets what they are witnessing and encourages the children to employ role-play to take an active part in the discovery process. The video takes the children on a journey from the present day to the Bronze Age, Iron Age, Early and Late Medieval Period and ends once again with contemporary scenes.

After having witnessed a re-enactment of ceremonies at a Bronze Age fulacht fiadh in the video, the children recreate a burial and feast. They dress up in hessian garments

and participate in mime. They become hunters. They grind corn on a saddle quern. They prepare the fulacht fiadh and mourn their chief.

The third part of the workshop, a quiz, which can be a very effective means of provoking critical thought, is based on material from the Hunt Collection and reinforces what they have thus far learnt.

The object study allows children to handle reproduction axe-heads and thus to experience objects similar to those on display in the Museum in a new way. Handling sessions draw attention to the physical attributes and aesthetic value of the objects rather than concentrating on their historic significance. Unless a school group specifically requests access to the Museum's handling collection of genuine artefacts, generally reserved for adult groups, children handle reproduction objects. In a similar vein the Museum's costume workshop, which is suitable for all ages, introduces participants to reproduction costume from the middle ages to the 1920s to evoke the context of many of the decorative arts from the Hunt Collection.

While the emphasis in these examples is on the evocation of the original context of the objects, in workshops relating to paintings and two-dimensional artworks the focus tends to lie more with the inherent artistic qualities of the exhibits. To accompany the Hunt Museum's 2004 exhibition programme a resource pack was designed for teachers entitled 'Reading 20th Century Irish Art'. The resource pack was intended as a reference for teachers, to be adapted to the needs of each class, and for people with an interest in the visual arts. The pack encourages users to explore, interpret and evaluate paintings in the Museum's temporary exhibitions but also takes the museum exhibitions beyond the museum and into the classroom.

4.2 Lewis Glucksman Gallery

Workshops in the Glucksman are generally two-part. During the first half of the workshop participants are encouraged to spend time looking at and making observations about exhibits. This requires a very direct relationship with the artworks. In this light labels and interactives could be regarded as a distraction. However, one could equally argue that the art facilitator is obstructive to a true engagement with the artwork. It is essential that the art facilitator strikes a balance between the information given and that which emerges through discussion among the participants. The latter half of the workshop involves a creative response to the artworks, either through art, drama, dance or music. It is perhaps more in responding to the artworks that interactive technology might be employed and in studying the works in an artistic or social context.

In the contemporary art gallery certain art projects rely on interactive technology to engage with the public. In a recent performance piece in the Glucksman the German artist Dirk Fleishmann used the popular format of the game show to raise questions about society and established economic structures. STOPSHOW copies well-known models of the entertainment industry and, apart from questioning economical and societal structures STOPSHOW blurs and questions the lines between art and non-art projects.

As a university gallery the Glucksman is eager to foster links with academic departments. In April-June 2005 the Glucksman hosted *Visual Practices across the*

University, an interdisciplinary exhibition, curated by Professor James Elkins, which studied the university's image-making protocols with examples from twenty-five university departments. This reflects the Glucksman's policy of looking at novel ways of appreciating and understanding artistic practice from the perspective of different academic disciplines and offers visitors unusual references and entry points to the exhibits.

5. Technology and Museum Education

If interaction is at the heart of museum and gallery education it is appropriate for cultural institutions to collaborate with interactive design centres in the development of educational programmes and exhibitions. This section is written in the format of questions and challenges.

5.1 Display of exhibits

Labels or no labels? While visitors require information about exhibits, if there are no information captions visitors can look and respond with a more open mind. How can one enjoy exhibits without being distracted by labels, but at the same time have the information required at ones fingertips if desired?

5.2 Workshops and tours

Workshops or tours by their very nature are aimed at those visiting the gallery in groups, but how does one create a unique and tailored experience for the individual visitor?
Can the visitor be involved in designing his/her own tour (length, time per object, specific interests, while also taking into consideration the background, preferred learning style and prior knowledge of the visitor)? Through the use of technology can the visitor be offered a tour designed to meet their specific needs? Falk and Dierking contemplate the possibilities of designing 'a learning experience for a mass market that simultaneously accommodates the unique prior experiences and interests of all potential users' (Falk and Dierking, p.182). Could interactive technology provide the solution?

When an object is placed in a museum it is alienated from its original setting. Interactives could be used to evoke the object's origins, to give contextual information and to approach the object from unusual perspectives. Technology could also create new contexts for the exploration and juxtaposition of objects.

Exposure to objects in a museum setting is not enough to guarantee that the visitor will experience them. In the case of functional objects in particular we learn though use to understand and value them. Could interactive technology be employed to recreate this experience of using objects?

Workshops are designed to create memorable experiences for participants and to develop personal connections with museum/gallery exhibits. Design technology likewise should not divert attention away from the original artworks but enhance the museum visit and mediate information in a meaningful and engaging way.

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MoMo: Enabling Social Multimedia Experiences in Hybrid Museums

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Abstract
Museums are playing a more active role in modern societies beyond preserving a society's cultural heritage. They have become an important learning environment and some of them even a tourist attraction. Traditional storytelling aid for museums consisting of texts and labels may not be personalized to fit each individual personal taste and are static sources of information. This paper introduces the notion of Hybrid Museum (HM) in which wireless personal digital assistants (PDAs) are used to tailor content to the visitor to enrich both the learning and entertaining experience.

1. Introduction

In the last few years, museum technology is experiencing a revolution with the arrival of handheld devices, which are capable of enhancing visitors' experiences by introducing multimedia content. This issue has been the focus of a great number of studies and projects, e.g., iTour [5], the Multimedia Tour [8], GettyGuide [6], MultiMuseum [1], and Renwick [4] among others. All these projects have evolved from the traditional storytelling for adults to other types of visits targeting audiences like children, teenagers, and art specialists. However, despite these efforts, there is still a lot of work to be done to obtain some kind of social interaction among museum visitors and both highly customizable visits in a dynamic way and simple mechanisms to explore large collections of related data. In this paper we will present the MoMo project, an example of Hybrid Museum as defined in [2]. The MoMo project includes a mechanism for browsing large collections of explanatory items on PDAs, a system to provide social interaction within museums and two different techniques to obtain dynamic and customizable itineraries.

2. Exploring Very Large Data Sets on PDAs

By definition, the User Interface is the meeting point between the user and the program. Our aim is to design the user interface for a multimedia navigation client on the PocketPC platform to guide the user while browsing a vast amount of information, avoiding him getting overwhelmed. Therefore, the fundamental issue to be faced is how information must be displayed so that it is perceived and assimilated by the user in the most adequate way. The main requirements that have to be fulfilled by a multimedia content browser are:

- Functionality: usefulness should be the main goal at every moment. Graphical designers should try to minimize their interface's learning curves. By doing so, we contribute to relieve users' efforts when interacting with a software system and make their experience more gratifying.
- Simplicity: the information provided to the user must be synthesized, categorized and, if possible, multimedia in nature. Therefore, in this kind of applications, the

solution that is designed must be intuitive enough so that every person is able to use it regardless of his background knowledge.

At the present time it is still difficult to find solutions for Museums running on mobile devices. Nevertheless, for the few existing ones we have found them to be excessively based on PC solutions. Form-based interfaces are usually obtained and, as a result, information appears to be compressed in an insufficient space. In the best case, we find web based designs that instead of improving considerably the appearance of those austere interfaces we have just mentioned, they forget completely about supplying an easy and useful navigation mechanism. In our opinion, assuming that some sort of classification is needed, this must not be just limited to a physical arrangement of files, but extended to cope with more complex classification schemas, so that associations may be expressed in several ways as it happens in Data Bases.
It must be remarked that we should not forget that we are designing a content navigation tool and, therefore, the main issue are the contents themselves. If we incurred in too complicated or badly designed interfaces, the user would be distracted excessively by paying attention to the interface, getting disoriented, rather than being concentrated on the displayed contents. We believe it is possible to design complete solutions by extensively using hierarchical content navigation, setting a clear way for the user to know how information is organized.

2.1. Information's nature and organization

The information that is supported in the current version consists of Macromedia Flash movies and any other multimedia format supported by Microsoft Windows Media Player including video movies. All these formats must be totally integrated within the application interface in such a way that it becomes transparent to the user.

In terms of organization of the information we used a graph topology, so that it is possible to establish relationships between any two arbitrary elements. The terminology we used in our project names *dissemination* to the basic data packet associated to an artwork. Disseminations are associated among them by using ranked relationships called *collections.* This kind of associative arrangement allows different clustering levels of information that the user may navigate. Our final goal is to give the user just the information in which he may be interested in adapting the navigation to his characteristics without limiting the ways he may want explore. In order to achieve this adaptation capability without crowding the PDA with disseminations, our project makes use of a kind of prediction engine [3] to foresee which collections the user is more interested in. By doing so, we ensure a short service time (the time needed to send to the user the information he requested) and a greater availability of disseminations on the collections he is more interested in.

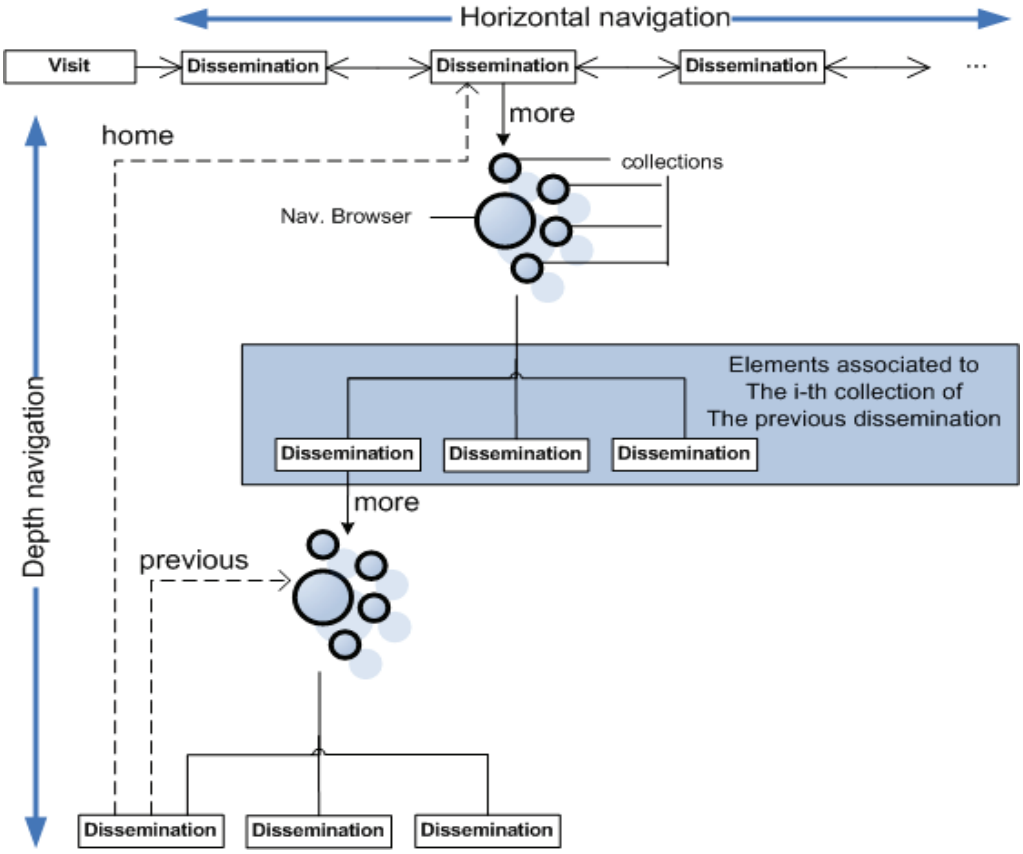

Fig 1. Types of navigation

2.2. Content navigation

In order to support content navigation, a hybrid scheme supporting both, fully guided visits and free navigation was created. The user may navigate in a fully guided manner by exploring sequentially a set of proposed disseminations (Horizontal Navigation). These sequential disseminations may either be statically preset or generated dynamically by some type of intelligent infrastructure. As stated in [3] and formally described in [7], the MoMo project makes use of an Ant Colony System to generate automatically guided visits taking into account the user available time. The generated visits are automatically rebuilt when needed in order to warrant the visit fits on the remaining time. All this process is completely transparent to the user.

At any time during the visit, including automatically generated visits, if the user feels he wants to know more about a particular dissemination he may invoke the Navigation Browser (see Fig.1). This browser is populated by clustering information in terms of collections by analysing the graph of available associations for the particular dissemination he is currently observing. In our current implementation, the potential visited collections are “Details about the artwork”, “Same historical context artworks”, “Previous artworks” (which inspired the present one), and “Miscellany”. Entering a specific collection to know more about a particular dissemination triggers a different mode of navigation known as Depth Navigation, which allows the user to explore associations between disseminations at any level of nesting. Therefore, the user is not limited to follow the initial, fully guided, sequential disseminations but rather can browse the graph in a straightforward manner because information is clustered in terms of collections.

3. The Interface and the Navigation Browser:

One of our main goals while designing MoMo was to keep it simple. The provided interface keeps the number of elements down to a minimum in order to simplify the use of the application, letting the user to focus on the contents rather than the container.

On Fig.2 we can observe the main elements of the user interface. There is a small navigation bar (A) to support Horizontal Navigation located in the lower left corner, emulating the functionality offered in most Web browsers that are familiar to an average user, since it provides with the basic *forward/backward* mechanism that allows the user to explore the visit contents in a proposed order. In case of being immersed in a Depth Navigation, the *home* button, represented as a little red house, can be used to return to the root dissemination where it was originated, which belongs to the visit the user was navigating in Horizontal Navigation.

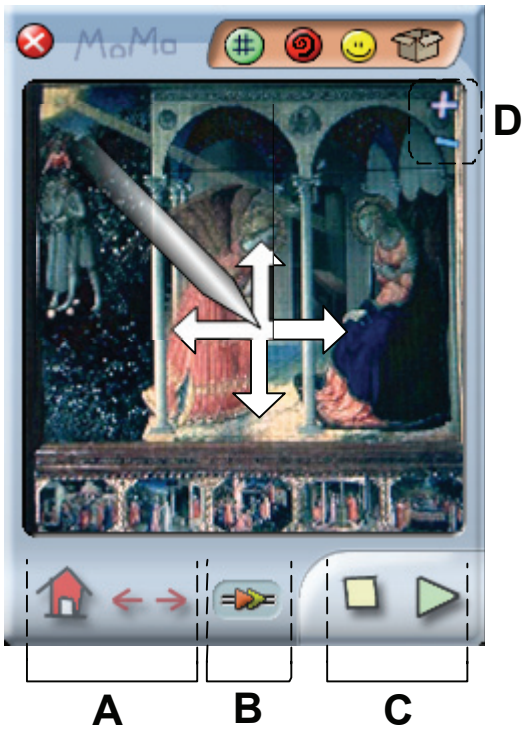

Fig 2. MoMo's main interface

If there are many items in a proposed visit, or the user wants to skip some of them in order to reach to a certain point or just peeking, a *fast* scroll control (B) is included next to the standard navigation controls.

In any dissemination, the contents are displayed in the central part of the interface, having a playback controller for them (C). Moreover, in case of Flash movies the client area responds to dragging and zooming (D), controlled by the PocketPC stick, enabling the user to pay especial attention to the artwork details.

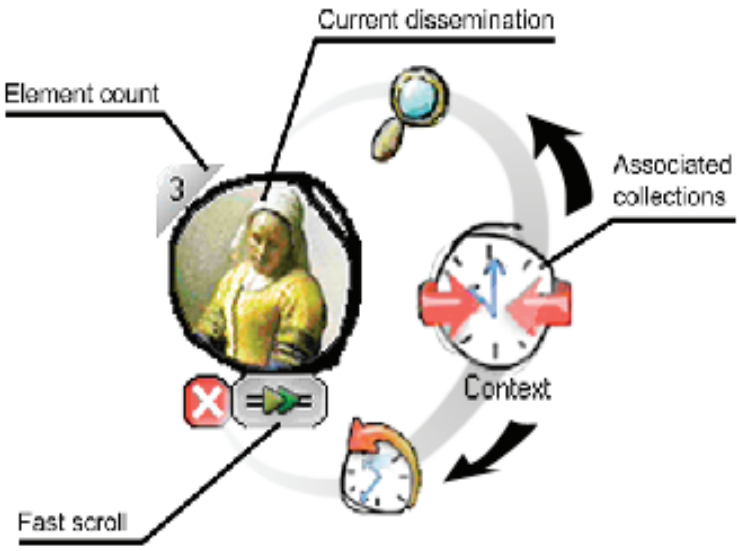

Fig 3. The Navigation Browser

As wrote previously, in order to perform a Depth Navigation the user may invoke the Navigation Browser (*Fig*). The design of this control was especially important; the main goal was to create a versatile enough control that could be reused in any arbitrary PocketPc application. In fact, using the appropriate skin, the Navigation Browser is also used in the Social Interaction subsystem to display additional functionalities.

The control is formed by a central element, which comprises an image representing the current dissemination. Surrounding it, the icons corresponding to the available associated collections are arranged in radial disposition. Only a subset of the available options is simultaneously shown, the user can navigate these options rotating them around the central element.

Fig 4. Random navigation pad

The main benefit of using this control is immediate: the high degree of reusability of this control accelerates notably the learning curve for new users who just need to learn one control.

In addition, as the visit goes by, if the user feels interested in some piece not included in his visit then he may use a special pad (Fig.4) to request any arbitrary multimedia element. Automatically the application will display the dissemination related to the requested item, attaching it as any other Depth Navigation item, so it gets naturally linked to the user's browsed contents.

4. Social Interaction in Museums

Generally, to visit a museum is an activity carried out individually or in pairs and seldom visitors communicate with other visitors during their visits. Even when visitors are part of a group, the amount of information exchanged is very low and the chances to lose the track of the group are high.

In order to solve those situations the MoMo project features a Social Interaction subsystem that allows visitors to send messages to other visitors, to create groups of visitors (to share similar interests or in order to keep in touch more easily) and to see the previous visitors of an artwork. The messaging feature is the main point of the social interaction because it allows visitors to communicate and to interact with the rest of the museum visitors, whether sending messages individually or by sending the same message to all the members of a group, becoming extremely easy to share ideas, opinions or just to keep in touch. Due to space limitations a more detailed description of this subsystem is not possible.

5. Conclusions and Future Research

In this paper we have presented MoMo, a Hybrid Museum infrastructure that illustrates and extends exhibits using Personal Digital Assistants. We have claimed that existing infrastructures lack of flexibility to accommodate content to the visitor's taste and that both, the special characteristics of PDAs, and the information's nature and organization are often not taken into account when designing application user interfaces. In order to tackle these points we presented: a graph topology to organize the information; a navigation browser that allows the user to manage a certain amount of information; and a user interface designed to be simple and functional that reuses some very well known metaphors to ease the interaction and to reduce significantly the learning curve. Our approach also features a social interaction subsystem to let museum visitors freely communicate each other opinions, suggestions or

appointments. As future work we will include into this project *synchronized visits*, that is, a museum curator with a PDA leading a group of visitors with PDAs. The curator's PDA will behave as described in this paper and the visitors' PDAs will act as mirrors of the curator's one.

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The Chawton House Experience – Augmenting the Grounds of a Historic Manor House

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Abstract
Museum research is a burgeoning area of research where ubiquitous computing has already made an impact in enhancing user experiences. The goal of the Chawton House project is to extend this work by introducing Ubiquitous Computing not to a museum as such, but a historic English manor house and its grounds. This presents a number of novel challenges relating to the kinds of visitors, the nature of visits, the specific character of the estate, the creation of a persistent and evolving system, and the process of developing it together with Chawton House staff.

1. Introduction

Ubiquitous computing has been employed to enhance the museum experience (Aoki et al 2002, Benelli et al 1999, Brown et al, 2003, Fraser et al 2003). The aim of our project is to develop engaging experiences for visitors to an historic English country estate, Chawton House, which blend into its specific atmosphere and 'natural' experience. Our aim is to produce a ubiquitous computing system that enables visitors to explore the gardens of the estate on their own, while tapping into the knowledge about the estate held by curators. These experiences are to be co-designed with Chawton House curators who are eager to tell visitors more about the grounds and to attract further visitors, but lack time to give tours in parts of the estate other than the house. The projects' long-term aim is a persistent infrastructure for long-term use and adaptation by various groups with an interest in 'using' Chawton House, for example coach parties, school children and scholars. The project builds on past work using embedded technologies in outdoor environments for explorative learning activities with schoolchildren (Rogers et al 2005). A key milestone of this project will be an evaluation of a demonstrator system in July that will deliver two experiences: one for visitors to the house, and one an educational experience for schoolchildren.

An essential part of our work is acquiring an understanding of the specific nature of this place and of the work of curators that we seek to support and extend. Before laying these challenges out in detail, we give some background on the house. Then we describe what kinds of experiences we have started to design, how we went about this and what we have learned so far from workshops with our collaborators.

2. Chawton House

Chawton House Library, half an hour from Southampton near Alton in Hampshire, is a charitable organisation that has restored and refurbished Chawton Manor House, gardens and park to operate as a centre for the study of early English women's writing. The library's core activities are the study of the collection (attracting scholars) as well as seminars, day conferences and cultural events. Where appropriate, the landscape has been returned to its early 19th century design, and a stated goal is to 'to preserve the peace and beauty of the estate while sharing this heritage with visitors'. The landscape reflects the open landscape ideals of the late 19th century, so signage and visible technology in the grounds detract from the desired impression. The Manor has been in the Knight family since the late 16th Century and at one point was inhabited by Jane Austen's brother Edward Knight. Jane Austen lived in a cottage in the village and was a frequent visitor. This is a part of the house's history and many visitors have a specific interest in this aspect. The grounds include a church and churchyard where most of the Knight family are buried.

Fig 1. Chawton Manor House, built 1580 to 1660 by John Knight (side view) and the old library, hosting hundreds of novels and women's writings from the 17th and 18th century (in the cellar there is another, modern library room)

Chawton House is primarily a study centre. This differentiates it from most museums (cp. Taxén 2004) and many other historic houses. All furniture may be used and in fact is used. Curators emphasize that seeing the house used and inhabited gives visitors a sense of how such a house 'might have worked'. Visits need to be arranged on appointment basis and only groups of certain sizes are accepted. On average one or two coach tours per week are accepted, as giving tours takes time away from staffs' other duties and interferes with the function of a library used by scholars. On the other hand group visits provide an additional source of funding for preservation and reconstruction. The curators thus keep a delicate balance between these conflicting interests.

Building and grounds of Chawton House themselves are of interest to visitors, and artefacts within them are part of the space, rather than merely placed within it. They are therefore not labelled or showcased. Artefacts are not 'on exhibit' – there is no

exhibition, the house is considered and arranged as a whole entity, in which the placement of objects is rather part of a mosaic and placement itself is part of the story. One could say that the entire house is the exhibit, rather than the incidental site for exhibits and exhibitions. Chawton House is not only a house, but an estate with extensive grounds, which have been redesigned by the successive generations of the Knight family. Curators enjoy giving tours of the house, but lack the resources to give tours of the grounds on a regular basis. This provides an opportunity for technology support.

Historic houses differ in several aspects from museums. As said before, curators of historic houses tend to be hesitant of labelling artefacts in order to show the house as it looked like when inhabited. The building itself and the stories about its history are what visitors want to see and know about. "The lived-in character and the varied life of historic buildings are often of great interest to visitors" (Waterfield 2004). These buildings have multiple layers of history, being extended and changed by owners, and can be described from the vantage point of any of these layers or of any person living or working there. For example over time, the gardens were designed in diverse landscaping styles and family members experienced the house in different ways to servants and staff. For these reasons curators of historic houses talk about *interpreting* such heritage sites (http://www.heritageinterpretation.org.uk, Waterfield 2004). Despite of these differences, historic house are like a museum in being of aesthetic, cultural and historical interest. In making historic houses open to the public and giving tours, curators aim to foster visitors understanding of the past. Many houses cooperate with schools and local communities on offering educational activities (Waterfield 2004).

2.1 Types of Visitors

A wide variety of visitors to the house can be identified. Just looking at the grounds, we might identify:

- Academics studying at the Centre who wish to take a stroll through the grounds as a break from their studies.
- Coach parties (such as the Jane Austen Society of America), who might want to gain a sense of the environment in which she was creating her fiction and that her heroines were situated in.
- Groups (such as the Farnham Floral Society) interested in the botany of the gardens, which are created using 19th century techniques and reflect the available flora of the period.
- Groups of schoolchildren using the grounds for a number of possible curriculum based experiences.
- Visitors interested in landscape architecture (the garden providing features from the English open landscape movement, the late 19th Century, from Lime avenues to Arts and Crafts designs by Lutyens).

Visitors using the library stay for several days or weeks, living in the village, while other visitor groups stay for a few hours only. Visitors need to plan for an appointment and thus usually have a dedicated interest, unless colleges tour several literary sites or manor houses.

2.2 Chawton House Curators

As the main function of the Library is a study centre, no-one has the official role of curator, but the staff between them hold much of the information that visitors might wish for. Of the overall 15 members of staff (plus part-timers and volunteers) several persons give tours besides of other responsibilities. The various staff who play a role include:

- The Acting Director – Has general knowledge about the overall goals of the Centre along with some specific knowledge of the history of the house.
- The Estate Manager – Has specific knowledge of the landscape and architecture through managing the restoration for over 10 years, and occasionally gives tours of the grounds.
- The Public Relations Officer – Is in charge of giving tours of the house and has more targeted experience of visitor groups.
- The Assistant Librarian – Is primarily in charge of novels held on site, but carries responsibility for giving tours and has specific knowledge of the period and Jane Austen's connection to the house.
- The Gardener – Has specific knowledge of the plants and planting schemes of the gardens and might at some point start giving tours of the garden for botanically interested visitors.

These curators complement each other but none would claim to be able to give the 'definitive' tour to all potential visitors. How to explore and integrate the different stories that they can tell for re-use in a guide system for visitors, augmenting the grounds and using UbiComp technologies, is one of the key challenges of the project.

3. Aims and Challenges

The curators are interested in being able to offer new kinds of experience to their visitors. We aim to find out what types they would like to offer, and to help create them. There is thus a need for 'extensible infrastructure' based on a basic persistent infrastructure that supports the creation and delivery of a variety of content. The extensions can be of two kinds (often in parallel): technology and content. The infrastructure can be extended to provide different, more specialized experiences for specific user groups e.g. for 'standard' visitors, schools, history societies, Jane Austen enthusiasts etc. We envisage a hierarchy of users with Chawton creating generic experiences, and other 'users', for examples schools, clubs, etc. tweaking and extending these to offer the results to students, club members etc. The concept is that Chawton takes ownership of infrastructure and content and provides tools to their end users which then author their own experiences, with experience designers (us as researchers) taking a facilitating role.

A number of questions arise:

- How can we enable curators to create a variety of new experiences that attract and engage different kinds of visitors, both individuals and groups?
- How do we engage curators in co-design of these experiences?
- How can curators without computer science backgrounds contribute to the authoring of content for the system?
- How do we create an extensible and persistent infrastructure; one that can be extended in terms of devices, content and types of experience?

The Chawton House project, then, involves understanding and engaging with curators' practice in ways which can inform the design of UbiComp systems that are

persistent in terms of technology but also of value. The system will only be appropriated and taken ownership of by curators if we from the very start engage in co-design with them, enthuse them about the project and make sure it provides value to them.

3.1 Embodied Skills Of Curators And Layers Of Knowledge

One of the key issues for the project is that the visitors' experience of the house and its grounds is actively created in personalized tours by curators. House and grounds are interconnected in a variety of ways, e.g. by members of the family rebuilding the house and gardens or being buried in the churchyard. Thus artefacts or areas cannot be considered in isolation. A story is not so much about the artefacts itself, rather about how it came to be here and what is its relationship to other objects. There are many stories to be told and different perspectives from which they can be told, and these stories often overlap with others. We have further come to understand that there is seldom a 'true story', as curators describe parts of their research to be almost like 'detective work'. Thus information exists in several layers. In addition, pieces of information, for example about a particular location like the 'walled garden', can be hard to interpret in isolation from information about other parts of the estate – there is a complex web of linked information.

Running tours is labour intensive at a time when Chawton House wants to attract more visitors. So there is a real need to create experiences for visitors based on computing technology as well as the human resources already there. The first major issue, then, is how to produce something appropriate for Chawton House. This first central issue generates some key challenges.

Curators 'live the house' both in the sense that it is their life and passion but also that they want to make it 'come alive' for visitors. The experiences offered by Chawton House are intrinsically interpersonal – they are the result of curators interacting with visitors. Giving tours is a skilled, dynamic, situated and responsive activity: no two tours are the same, and depend on what the audience is interested in. They are forms of improvisation constructed in the moment and triggered in various ways by locations, artefacts and questions. Part of a good tour is what curators call 'enthusing' the visitors and 'responding' to them. They do not consciously categorize visitors, but attend to subtle cues in body language and engage in conversations. The information they give is not a formalized body of knowledge that could be made immediate use of for digitally augmented tours. Information is of many types – factual, speculative, anecdotal; it is embedded in the house and grounds and situationally constructed. In being given tours and observing tours for other visitors we furthermore found that stories about the work of managing and restoring the estate itself as well as the multitudes of decisions involved in doing so are an essential part of engaging experiences and find high interest in visitors. Past and present become tightly interlinked in these stories.

Basic issues for us are 1) how to preserve the human agency and skill that is intrinsic to current experiences of the house; and 2) how to abstract these things and make them work digitally, in ways that don't 'put us out of a job' (one curator's concern) or create sterile experiences for visitors.

3.2 Creating A Persistent And Extensible System

A second key challenge is more technical. UbiComp projects that 'instrument' public spaces are often heavyweight research efforts that are one-offs, depending on a team of skilled developers. Any maintenance or change has to be carried out by this team. This means that persistence is a crucial issue; there need to be ways that technology can remain in situ, at least partly maintained or changed by its users. The specific issue to be addressed by the Chawton House project is how curators can be encouraged to engage in 'co-authoring', working with developers to create visitor experiences.

We also conceive of 'persistence' in a second sense: continuous use of the system, because it is meaningful and valuable to its users (the curators and their visitors). We are therefore exploring how we might enable curators to continue authoring tours and furthermore, to hand over authoring to other stakeholders to create specialized experiences and activities for specific visitors. Further we envision visitors to contribute, telling their own stories and sharing their knowledge with future visitors. In the rest of the paper we describe how we are going about addressing these issues.

4. Designing Experiences

In July 2005 a demonstrator system will deliver experiences for visitors, and a specially designed educational experience for schoolchildren. We have started with co-design workshops both with curators and teachers.

4.1 Designing Visitor Experiences

First we are working with curators to develop a range of tours of the grounds. Visitors may decide on themes they are interested in and either follow a given trail or wander about freely. Information will be contextualized, based on location, stated interests, and visitors' trails through physical and information space. Visitors then experience different locations, e.g. the 'wilderness' – a small (managed) forest with several intricate paths and a romantic clearing. Here, women of Jane Austen's time could imagine being in a wild place, without any danger of getting lost or meeting strangers. Devices that provides information on the grounds and on demand give directions could enhance the experience significantly and make available curators' knowledge in a way not possible today.

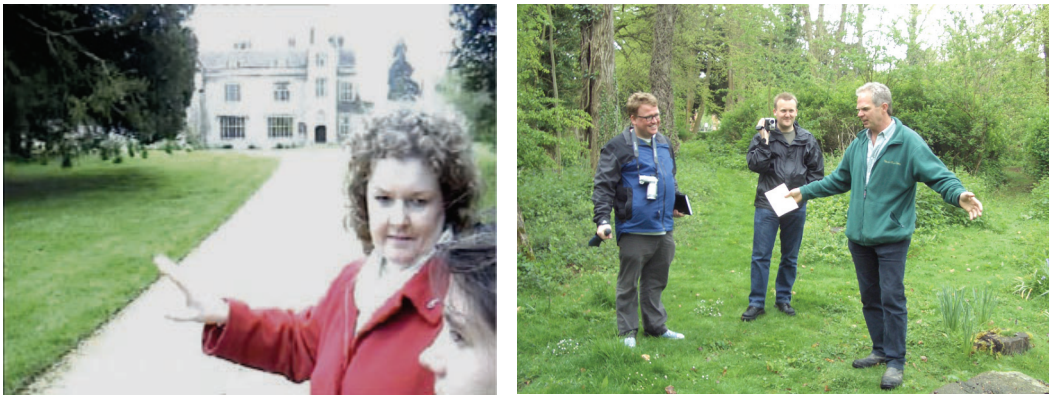

Fig 2. Second curator workshop: touring the grounds and taping these tours to collect audio stories

The functionality of the devices will mostly consist of providing contextualized audio information and also visual information if this provides added value, for examples paintings showing the house with the formal garden preceding the current open

landscape. The devices should accommodate groups and individuals, as visits are usually social events and are shaped by social interaction (Ciolfi 2004, Aoki et al 2002) in which the devices themselves might come to play a role. With the small number of visitors simultaneously present, distributed around the large grounds, typical issues of 'audio clutter' relevant for Museum audio guides are much less relevant in our case.

We imagine extending the scenario to allow visitor annotations – particularly as some have more knowledge on specific issues than curators. This can be literary societies meeting on the estate or people that used to work as servants in the early 20th century on the estate (e.g. a woman visiting on an Open Day, telling she had been a parlour maid in the 1930s). These annotations then add further layers of information, historic knowledge and contextual stories about life on the estate that curators are keen to collect and preserve for future generations.

4.1.1 Types of Tours

We envision enabling different kinds of tours for visitors in terms of directedness and contextualization. Unguided (Random Access) tours allow exploring the grounds in any location order. The provision of information may be based on location only or on previously provided information. Guided tours start from one location and direct visitors on a given tour. They give certain cuts through physical space. Here contextualization is produced implicitly by tour authors who construct a storyline. Semi-guided tours ('the hidden story') allow visitors to wander about and drop in and out of (partial) authored paths, so they can join, leave or even toggle between multiple storyline. They are at most given only suggestions where to go next. Contextualisation can result in visitors hearing different stories about a place or being offered more detailed information when revisiting it. Visiting locations in a different order might also result in different experiences, as information is selected differently.

4.2 Designing School Fieldtrips

A second avenue addresses a different group of visitors and introduces a second level of users. A primary school in Southampton is interested in using Chawton House for fieldtrips with children for literacy education and creative writing (for an earlier project see Rogers et al 2005). The rich atmosphere and history of the house and landscape is valued as inspiring and providing context for children. We are cooperating with these teachers to design a first fieldtrip. Teachers could browse available content provided by the curators and include it, while also adding more specific content. Children will explore the grounds and construct narratives around what they discover. For this type of experience the functionality of the device will be expanded significantly. Children will be able to save information they found while wandering the grounds and to record audio or make photos. The teachers want them to e.g. describe places, imagine being a specific person, or to role-play and record this. After wandering about in small groups the children when convening together should also be able to show each other what they collected and to swap content. After touring the grounds, the children will reflect on their findings and start creative writing in the house.

5. Workshops With Curators and Teachers

Up to the writing the initial version of this paper, we conducted two workshops with curators, and one with teachers. Furthermore we were initially given tours of house and grounds. As significant parts of the fieldtrip design have changed since, we will here describe the fieldtrip design as it currently is decided upon (two more meetings with teachers having taken place).

In the first curator workshop we aimed to have curators generate stories about the grounds, which could be digitized for later use in the system, and to identify themes. We printed a large map and populated it with 3D models of core buildings (Figure 3). The map was to provide a shared reference for discussions, to trigger stories (represented with post-its on the map) and reflection on the practice of giving tours. We also hoped that the map would provide an anchor for talking about possible types of tours. The workshop gave us insight into what different curators like to talk about, and sparked their imagination on what the devised system might do for them. We found, consistent with the notion of a 'web' of information that stories were partial, overlapping and hard to categorize. This raises issues of knowledge elicitation and clear information 'streams' or chunks that can be put into a digital guide system.

Fig 3 and 4. First curator workshop: telling and placing stories around a map.
Teachers developing a rough concept for the fieldtrip (papers on the map stand for potential activities)

With the curators we agreed that a potential way of collecting stories that addresses these issues would be to have them tell stories in-situ. In the second curator workshop we were taken on separate guided tours and taped these. In early May we went off with three curators who had decided on a loosely defined set of themes to be addressed (the landscape, Jane Austen, the Knight family). We videotaped these tours to select stories for reuse in audio tours (Figure 2). We ourselves attempted to ask questions to trigger desired stories and turn this into a natural situation, but to refrain from interruptions. This delivered a wide range of stories in different voices from different points of view that were richer and more detailed than those generated by the first workshop.

The aim of the first teacher workshop was to give us insight into how teachers go about designing fieldtrips. We asked the two teachers to design a structure for the actual fieldtrip in July. We also discussed the value of fieldtrips, usual practices in organizing these and other questions. The large map that we reused focussed discussion about the fieldtrip's overall structure, how different groups of children might be distributed around the estate, and which paths to take. We here describe the

end result of the three meetings during which the teachers, working with us, refined and redesigned the initial fieldtrip design.

Because the Chawton fieldtrip will focus on creative writing, the teachers want the experience to be open-ended, the house providing atmosphere and context. The initial idea was to meet characters (from the house) in the grounds, who tell the children about their lives. After reviewing the stories told by curators we all agreed that these are not fit for children, being focused too much on architecture and landscaping. Yet, many non-character-based stories were found to be inspiring, e.g. about the church burning down or 18th century ladies imagining the wilderness as a risky place. These atmospheric stories in combination with the rich scenery should be sufficient to spark children's creative imagination.

After a tour of the house, the children will be introduced to the devices. In small groups they tour the grounds. In this first phase the children should visit most locations to get an overview. They are presented with small information snippets and hear introductory descriptions of locations, triggering their interest and imagination. Furthermore they are given small exercises that ask them to observe closely, to find something, to attend to sensory perception, to record sounds (with the device), describe a location or interesting object, to engage in a short role play or to imagine how people in the past experienced the location. They might also use the device to record questions that they want to ask curators in the house. After this first phase of about an hour they meet at the house and share their experiences. Groups then decide on up to three locations they are most interested in, decide on characters that they want to construct their story around and go on a second tour of these selected locations, engaging in creating descriptions and story elements. To review their collection and design a story, they return to the house for creative writing.

5.1 Some Issues Learned From the First Workshops

Eliciting content from curators is most naturally and effortlessly done in-situ. Our use of a map in the first workshop nevertheless may have triggered somewhat different content, showing e.g. structures that have by now been removed and encouraging more general discussions of e.g. how far visitors usually walk without a human guide. We learned that curators do not think of visitors in categories and then decide on what type of tour to give; they rather react to subtle cues and engage in conversation, an ability that no system will be able to imitate. An ongoing issue will be that curators do not think of content in terms of categories, yet visitors should be able to specify their interests. Thus we will need to review the content we sampled from curators and attempt to roughly relate it to keywords or potential interests of visitors.

The fieldtrips are less demanding than anticipated in terms of categorization or relations between different content. They are structured on a different level, having two phases of different intensity and structure. The main demands concern less contextual relations in-between snippets of information, but the timing, sequencing and staggering of provided information, tasks and procedural requests. This is to ensure that the children visit most locations and engage in a variety of activities, reminding them to finish activities and to move on after a while. Some information might even be withheld for a while, asking children first to imagine what the function of a wilderness might have been. It might furthermore be valuable to ensure that not all groups engage in exactly the same activities or are provided identical information.

6. Reflections and Conclusions

There are lots of different stories, but also different characters. These are not only characters from history, but also Chawton House staff as characters who are enthusiastic about the house and want to transfer this enthusiasm to visitors. Listening to them is much more lively and interesting than listening to professionally spoken, but often somehow sterile and dull audio tapes sometimes found in museums and galleries.

Contextualisation and personalization may thus not only refer to tailoring content for visitors. We do not wish to substitute curators, but have decided to actually re-present them as the person that told the stories in audio tours. If we use snippets from real tours by curators, other visitors may share this experience. They might hear the birds, the wind, and people walking on gravel. Instead of seeing this as an impediment to the 'perfect tour', we feel that this is a quality, providing a sense of intimacy, authenticity, and an 'unofficial' feel. And curators can only authentically tell stories when giving tours and walking the grounds; these stories are their creations and should be represented rather than replaced. Visitors will thus 'meet' staff that are not present at the day of their visit – or years after, might listen to people that no longer work here.

Taking content from actual tours and not transcribing and having it redone by professional speakers has a second advantage. If curators are to take ownership and to extend the content, we must enable them to do so. The simplest and most natural way for them is taping tours they might give in person once in a while or by walking to a specific location that they want to add a story about, using this as a situational resource, later on selecting sections. This means that curators could be directly involved in co-authoring content for the system, overseeing its creation and selection, and building an oral archive of knowledge for their own and visitors' use.

There are now many contextualized multimedia and audio guides for museums delivering information based on location and visitor interests. An early example is (Bederson, 1995), newer examples include (Aoki et al 2002, Benelli et al 1999, Fleck et al 2002, Oppermann and Specht 1999). Some audio guides used interviews with 'real' people or authentic sounds to enliven historic places (see Ciolfi 2004). With re-presenting the curators, using recordings from actual tours and handing over the ongoing creation of 'content' to curators and other user groups, we aim to go beyond this. In allowing other types of experiences, e.g. school fieldtrips, the system comes to be more than just an audio guide, but allows creative interaction with the information space, the creation of new content, or complex activities such as treasure hunts as realized e.g. in Nottingham castle museum (Fraser et al 2003).

6.1 Authoring and Co-Design

Our research so far has revealed that curators' activity of showing the estate to their visitors is a situated, embodied practice that is constructed in the moment, drawing on rich knowledge of individuals. The co-design process involves understanding this in detail, and also honouring rather than replacing this practice.

This has implications for co-authoring. Our research suggests that curators themselves could review and select material from recordings. They can also sort them into themes and topics, so that the system can cater for people with different broad interests, for

example landscape, flora and fauna, or how Jane Austen's writing reflects the environment. This necessitates a learning process, which must build on existing practices and over time develops new practices based on experience and reflection.

We see this kind of ubiquitous experience as one based on information. This means we can create a persistent infrastructure that allows for the creation of information applications on top of it. By abstracting the 'experience design' level from the underlying technology we can begin to focus on the needs of domain users, and look at ways at empowering them to create their own experiences. We believe that the same ubiquitous information system can deliver different experiences to different groups of visitors, including: local guided tours, authored by curators; field trips, authored by trip organisers such as school teachers; and an annotated, situated visitor space, co-authored by visitors to the house (cp. the visitor annotations to mysterious and unidentified objects in the Hunt museum (Ciolfi 2004)). A major challenge is to make this power available to domain experts who may be non-technical, and allow them to focus on the experience, rather than the system.

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The Language of Contextualism and Essentialism in Museum Education

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Abstract
This paper proposes that studies of social interaction as situated activity may shed light on processes of meaning making in contemporary art museums and inform the development of new museum technologies. It is argued that a sociocultural perspective on the pervasive 'meaning culture' in museums makes apparent the interplay between situated discourses and the ideological constructs that guide them. Such insight into the workings of embodied interaction may be useful for the development of technology that supports, mediates and creates the effects of immediacy and the move toward a 'presence culture'.

1. Introduction

Art museum research frequently revolves around problems related to traditional distinctions in aesthetics, between what may be call essentialist and contextualist positions. Briefly stated, essentialists argue that contextual information, in principle, distracts from and undermines unmediated somatic knowledge that is crucial to the aesthetic encounter: a non-linguistic, intuitive response to the sensual characteristics of artworks. In the development of digital mediating devices, such concern with aesthetic effects is expressed in the concept of embodied interaction (Dourish 2001) and a theoretical focus that Gumbrecht calls 'presence culture' (Gumbrecht 2004). Contextualism, on the other hand, has to do with hermeneutics and art history: a concern with language systems that mediate this disciplinary knowledge in order to construct meaning. The contextualist tradition, or 'meaning culture,' is today not so concerned with ‘what does it mean’ in the classical hermeneutic sense as with ‘how does it mean.’ Ultimately, tensions between contextualist and essentialist positions may perhaps explain why the concept of learning in art museums operates mostly a vague construct (Knutson 2002).

In this paper, I will focus on 'meaning culture' in museum education at the level of social interaction. I propose that microlevel studies of situated, social interaction not only shed light on processes of meaning making, but may also be useful for developing concepts in museum technology that aim to support and create 'presence' through mobile, location sensitive devices, among other means. Interaction analysis is suggested as a methodology to address issues of context that are central to questions being posed in this workshop; specifically, which methodological and conceptual approaches are useful in studying the experiential qualities of museum visits?

2. A Sociocultural Perspective

In advocating situated activity as unit of analysis, my perspective relates to a growing body of museum research developed within a sociocultural perspective that has identified physical orientation and conversation as units of analysis (vom Lehn, Heath, & Hindmarsh 2001, Leinhardt & Knutson 2004). A sociocultural perspective,

based on Vygotsky, understands the mind as socially developed through interaction with others and mediated by tools and signs such as language, particularly human speech (Wertsch 1991). In contrast to methods developed to identify change in individual cognition, this research explores processes of meaning making based on observations of visitor orientation and talk as they move through exhibitions.

Contrary to some claims (Packer & Ballantyne 2005), this methodology is not based on the premise that learning is more effective in shared rather than solitary encounters with museum objects. Rather, it asserts that meaning is constructed through human activity, which is always socially situated (Vygotsky 1978). Furthermore, human activity often assumes the form of discourse, as language is essential to processes of meaning making. From a sociocultural perspective, the analytical act can never be a direct relation between subject and object - the mediating instrument of language is present whether the subject is conscious of it or not (Engeström, 1987). Discourse is understood as something that people *do*, and as such it is activity accessible to scrutiny by the researcher.

3. Do and Say in Practice

Curators in contemporary art museums tend to operate with a 'show and tell' metaphor as their discursive mode. Here, the selection and mounting of works are seen as creating a contextual narrative that will ideally allow the viewer to construct a meaningful encounter. In contrast, museum educators have 'do and say' as a primary focus. In broad terms, educators are mediators between curatorial idea and viewer, and are concerned with concrete tasks of devising materials, technologies, workshops, and discursive strategies that will create meaningful encounters for diverse groups of users. Moreover, educators are aware that museum visitors bring with them a rich sense of identity, or 'entrance' narrative, which may or may not align with the narratives of curators and educators (Leinhardt and Knutson 2004).

Given this awareness, then, it is perhaps all the more noteworthy the extent to which contemporary art museum education research is also framed by reductionist notions of contextualism and essentialism, often couched in terms 'formal' and 'informal' learning. On the one hand, museum educators are criticized for prioritizing information over the sense of personal discovery and aesthetic experience that characterizes the museum as a free-choice, informal learning environment. On the other hand, museum educators are charged with the task of conveying specialized knowledge that may enrich perspectives and provide insight via face-to-face encounters, websites, and increasingly wireless mobile devices. As I have argued elsewhere, dispensing with such generalizations opens up predetermined categories and coding schemes that may narrow researchers' perceptions and limit the explorative nature of the analytic process (Pierroux *in review*).

4. Contrasting Methods

One approach in contemporary art museum education that adheres to the view that personal discovery should take place unimpeded by contextual information is the inquiry-based program Visual Thinking Strategy (VTS). Researcher Abigail Housen and museum educator Philip Yenawine argue that concepts in art history and aesthetics, particularly in modern and contemporary art, are typically beyond what Vygotsky called the learner's "zone of proximal development (Vygotsky 1978)." That is, concepts are introduced that are too abstract or 'scientific' in relation to the

viewer's everyday knowledge to become meaningful. Housen and Yenawine instead propose that young viewers be taught how to develop their perceptual and reasoning skills over time, empowering them as viewers to construct personal meaning based solely on previous knowledge and what they see. This method was employed at the Museum of Modern Art for many years, and has since become increasingly popular with art museum educators. Yenawine explains the approach:

> It begins with asking people to look in silence at the work, and I follow a period of examination with questions. What's going on here? What do you see that makes you say that, and (…) what more can you find? I paraphrase what people say. And I link answers that relate one way or another. I also point to what people mention as they talk (Yenawine and Rice 1999).

Objections to this approach generally follow along the lines voiced by Associate Director of Education Danielle Rice at the Philadelphia Museum of Art. Rice is concerned that viewers may walk away with misunderstandings and wrong answers without contextual information. Rice maintains that specialized disciplinary knowledge is expertise that viewers seek from contemporary art museums, and educators are obliged to share this information in a manner that enriches encounters with art. She argues:

> I think *listening* is really important…but I do also believe that it's very important to get them inspired and motivated to want to go out to learn more and…to figure out how to interpret objects by bringing their own responses to bear and the responses of historians, artists, critics, etc. (Yenawine and Rice 1999, my italics).

Rice and Yenawine have demonstrated and documented their respective approaches to guided tours with high school students and contemporary art in a video entitled *Contrasting Practices III* (1999). In this video, two different classes from the same high school were invited to discuss the work titled *Tori* (1969) by artist Eva Hesse, one class with Yenawine and one with Rice. Video recordings of interaction and discourse is considered optimal data in interaction analysis, because it offers the advantage of capturing participants' talk and orientation - to each other, to artworks, and to other artifacts - at a detailed level, as well as the opportunity for repeated playback and scrutiny. Although a full account of my analysis of the interaction is not possible in this paper, the following discourse types are apparent as common to both approaches: *describing* works based on formal characteristics, *analyzing* processes of making, *arguing* for causal explanations of material appearances, and *making associations*. In short, throughout the two encounters, there is an oscillating between what could be called presence effects, 'it makes me feel,' and meaning effects, 'it makes me think.'

The students' comments enter into and become framed by a kind of narrative-making activity that is supported by both museum educators in the manner in which interpretations are picked up, elaborated upon, or rejected. In Yenawine's

demonstration, the themes of life, death, rebirth, and aftermath are related to the artwork based on what the students see, that is, its formal characteristics, and through the content and structure of the talk; no contextual information was provided. In Rice's demonstration, the introduction of biographical information and art concepts raises these very same themes. In addition to supplementing students' own associations with information about the artist and the work, Rice also asks students to reflect upon the information they are given (do you feel differently about the piece now?), to relate it to the artwork (does it seem more serious?), and to make judgments based on what they have discussed (do you like the piece more or less now?). Based on analysis of these two demonstrations, I nonetheless assert that it is difficult to distinguish a qualitative difference in the meanings constructed using the respective methods.

5. Discussion

These contrasting approaches were developed to support purportedly different aims; a focus on learning about the disciplinary domains of art history and aesthetics on the one hand, and processes of 'visual thinking' on the other. For Yenawine, meaning constructed through the act of looking is valued most highly. Contemporary art education, particularly for beginning viewers, should be concerned with "a process of thinking, not arriving at the right or wrong answer (Yenawine & Rice 1999)." By limiting questions to 'what do you see,' 'what do you see that makes you say that,' and 'what more do you see,' students will be trained to look carefully at the work for evidence to support their claims and develop a sense of empowerment in encounters with contemporary art. Far from operating with a non-linguistic, somatic concept of aesthetic experience that focuses on the perception of sensual characteristics, however, talk is essential to the visual thinking strategy – not listening as Rice claims above. By scaffolding responses in a specifically structured type of discourse that guides the meaning making process, Yenawine supports a rich kind of exploratory talk (Mercer 1995).

For Rice, meaning should be directed based on what she calls "interesting and worthwhile" contextual information (1999). This is because Rice distinguishes between good associations, that is, meaning constructed through contextual information, and those made based on students' previous knowledge and what they see. While the latter are valued for contributing to "a sense of confidence in their abilities to look carefully at an object," the former are valued more highly for also engaging in the external discourse of art history scholarship (1999). Importantly, despite Rice's emphasis on the kind of qualitative distinctions that value concepts of formal learning over informal learning in museums, what is apparent in her demonstration is the same creative, joint activity of meaning making witnessed in Yenawine's teaching. In other words, while there is a difference between the aims of the two approaches in terms of the incorporation of contextual information, analysis of the talk and interaction suggests that it is the way in which discourse is guided and supported that is most significant for meaning making activity.

It is proposed that close analysis of guided discourse and situated activity may inform the design of narrative structures, interfaces, and content that aim to navigate between the meaning and presence cultures in museums. Studying social interaction provides insight into meaning making processes at more than the ontogenetic level; the concern is not to determine or analyze what visitors feel and think or how they behave. Rather,

a sociocultural approach is able to describe and make apparent tensions between the institutional, cultural, and historical languages of contextualism, essentialism - even 'visual thinking' - and actual art encounters. A better understanding of the voices *in play* at the microlevel of meaning making - curator, educator, and visitor - and *at play* at the macrolevel of cultural historical ideologies may prove useful as educational narratives are developed for new technologies in museums.

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Magic Land: a 3D Human Capture Mixed Reality System for Museum Experiences

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Abstract
Magic Land is an application of mixed reality in art and entertainment. This system includes a special recording room where visitors can have themselves captured and a mixed reality environment where the 3D avatars of those visitors and 3D computer generated virtual characters can form an interactive story and play with each other. Magic Land has been exhibited at Singapore Science Center since December 2004 and it has proved its ability in enhancing museum visitors' experience by integrating both virtual and real environments in the same environment and by including more social and tangible interactions.

1. Introduction

Following the footsteps of the internet, wireless and mobile communications, Mixed Reality (MR) and 3D Live technologies will change the world once again.
Mixed Reality involves the overlay of virtual graphics on reality (see [1], [2] for reviews). The user views the world through a head mounted display (HMD) that overlays graphics on video of the surrounding environment. With this special HMD, people can access information at anywhere and anytime. Doctors could see ultrasound information on their patients. We can see 3D Greek mythical figures on the pages of our real books, and watch a football match on our table in 3D. MR Technology will change all aspects of our lives.

MR, with 3D Live technology [3], will create the next breakthrough in human communication and entertainment. Users can not only conference from any location, but also see their distant friends in the real environment. They can see the 3D holographic form of the remote participants in their hands with 3D Live technology. MR - 3D Live technology not only connects people all over the world, but also really brings them close together.
As an application of MR - 3D Live Technology, our system, “Magic Land”, is the cross-section where arts, design, media and technology meet together. It creates a new kind of interaction not only in museum environment but in communication and entertainment environments as well. The ability for the visitors to make a recording of themselves and watch themselves acting in 3D with other objects leads to a special kind of self reflection. Furthermore, to watch the scene from above with the possibility of manipulating the elements is unique in the media context.
Moreover, Magic Land is designed for multi-user experiences. Visitors can have their very own experience, depending on how they interact with each other and with other virtual objects. By stimulating visitors to play and help each other in exploring the exhibition, our Magic Land actually provides visitors very special and exciting social interactions, and thus, improve experiential quality.

2. Magic Land: an Application of the Mixed Reality 3D Capture System for Art and Entertainment

2.1 System Concept and Hardware Components

Magic Land is a mixed reality environment where 3D Live captured avatars of human and 3D computer generated virtual animations play and interact with each other.
The system includes two main areas: recording room and interactive room. The recording room, which has 9 cameras inside, is where visitors can have themselves captured into live 3D models which will interact in the mixed reality scene. In order to allow visitors to manipulate their own 3D recorded images in mixed reality environment, this version of Magic Land does not fully exploit the "live" capturing feature of 3D Live, but instead utilizes the fast processing and rendering algorithms for fast 3D Live record and playback features. Another version of Magic Land, which can be built easily for live capture and live viewing, is also discussed later in this paper.

After the visitor gets captured inside the system, she can go to the interactive room to play with her own figure. The interactive room consists of three main components: a Menu Table, a Main Interactive Table, and five playing cups. On top of these tables and cups are different marker patterns. A four cameras system (ceiling tracking system) is put high above the Main Interactive Table to track the relative position of its markers with the markers of the cups currently put on it. The visitors view the virtual scenes and/or virtual characters which will be overlaid on these tables and cups via the video-see-through HMDs with the Unibrain cameras mounted in front and looking at the markers. The system obtains images from this Unibrain camera, tracks the marker pattern on these images, calculates the position of the virtual viewpoint, generates a novel view of the captured subject from this viewpoint and then superimposes this generated view to the images obtained from the Unibrain camera and display it on the HMD.

The Main Interactive Table is first overlaid with a digitally created setting, an Asian garden in our case, whereas the cups serve as the containers for the virtual characters and also as tools for visitors to manipulate them tangibly. There is also a large screen on the wall reflecting the mixed reality view of the first visitor when he/she uses the HMD. If nobody uses this HMD for 15 seconds, the large screen will change to the virtual reality mode, showing the whole magic land viewed from a very far distant viewpoint.

An example of the tangible interaction on the Main Interactive Table is shown in the Figure 1. Here we can see a visitor using a cup to tangibly move a virtual panda object (left image) and using another cup to trigger the volcano by putting the character physically near the volcano (right image).

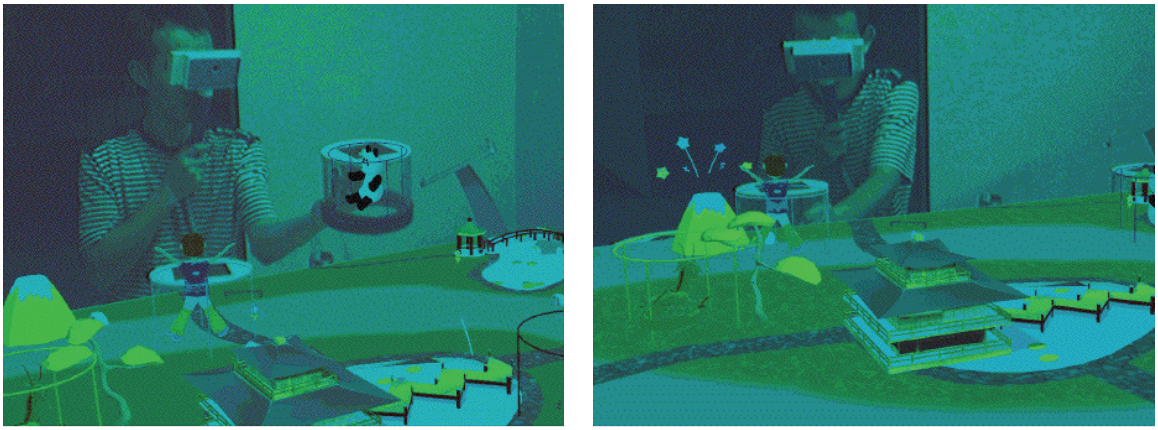

Fig 1. Tangible interaction on the Main Table: Left) Tangibly picking up the virtual object from the table. Right) The trigger of the volcano by placing a cup with virtual boy physically near to the volcano.

The Menu Table is where visitors can select the virtual characters they want to play with. There are two mechanical push buttons on the table corresponding with two types of characters: the human captured 3D Live models on the right and VRML models on the left. Visitors can press the button to change the objects showed on the Menu Table, and move the empty cup close to this object to pick it up. To empty a cup (trash), visitors can move this cup close to the virtual bin placed at the middle of the Menu Table.

In the Figure 2, in the left image, we can see a visitor using a cup to pick up a virtual object, at the edge of the table closest to the visitor are two mechanical buttons. In the right image we can see the augmented view seen by this visitor. The visitor had selected a dragon previously which is inside the cup.

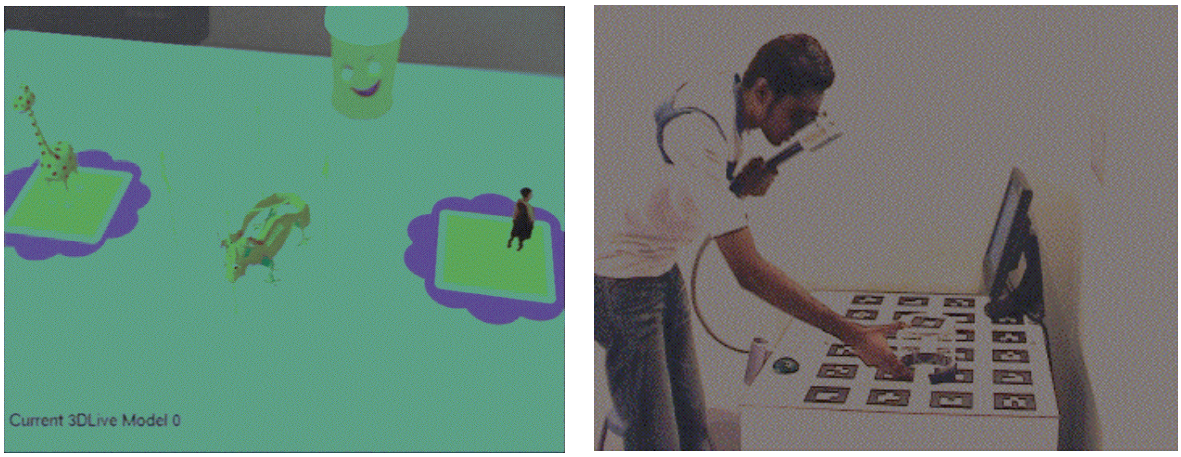

Fig 2. Menu Table: Left) A visitor using a cup to pick up a virtual object. Right) Augmented View seen by visitors

After picking up a character, visitors can bring the cup to the Main Interactive Table to play with it. Consequently, there will be many 3D models moving and interacting in a virtual scene on the table, which forms a beautiful virtual world of those small characters. If two characters are close together, they would interact with each other in the pre-defined way. For example, if the dragon comes near to the 3D Live captured real human, it will blow fire on the human. This gives an exciting feeling of the tangible merging of real humans with the virtual world.

As an example of the interaction, in the Figure 3, we can see the interaction where the witch which is tangibly moved with the cup turns the 3D Live human character which comes physically close to it into a stone.

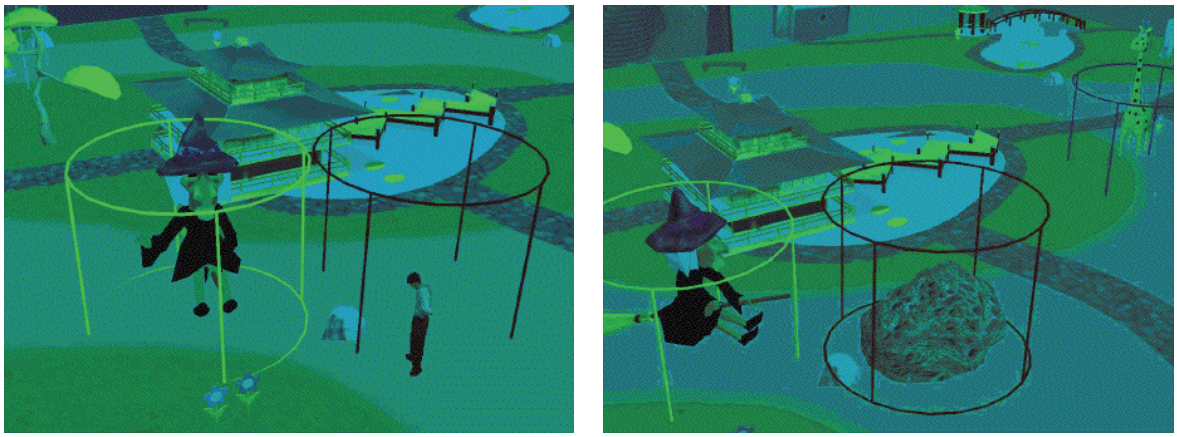

Fig 3. Main Table: the Witch turns the 3D Live human which comes close to it into a stone

2.2 Software Components

As shown in Figure 4, the software system of Magic Land consists of five main parts: 3D Live Recording, 3D Live Rendering, Main Rendering, Ceiling Camera Tracking, and Game Server. Beside these parts, there is a Sound module that produces audio effects including background music and interactive sounds for the whole system.

In this system visitors can record their live model for playback. The 3D Live Recording and 3D Live Rendering parts are this recording capturing system. After going inside the recording room and pressing a button, the visitor will be captured for 20 seconds. The captured images are then processed and sent to all 3D Live Rendering modules. The data sent from the captured computers includes all the processed images of all the frames captured in 20 seconds at a time. After that, a multicast protocol is utilized to send the 3D Live data to each User 3D Live Rendering and Menu 3D Live Rendering module of the 3D Live Rendering part. This helps to utilize bandwidth of the network as well as to ensure that all the receivers finish receiving data at the same time.

The Main Rendering part includes a Menu Rendering module and five User Rendering modules. These modules track the users' viewpoints, and render the corresponding images to the users. First, they obtain images from the cameras mounted on the users' HMDs, track the marker patterns and calculate the transformation matrix relating the coordinates of these markers with the coordinate of the camera. After that, basing on the transformation matrix, each module will render the image and output the result to the corresponding HMD. Especially, the Menu Rendering module also handles the users' inputs when they press the buttons on the Menu Table, or when they use the cups to select and remove virtual characters.

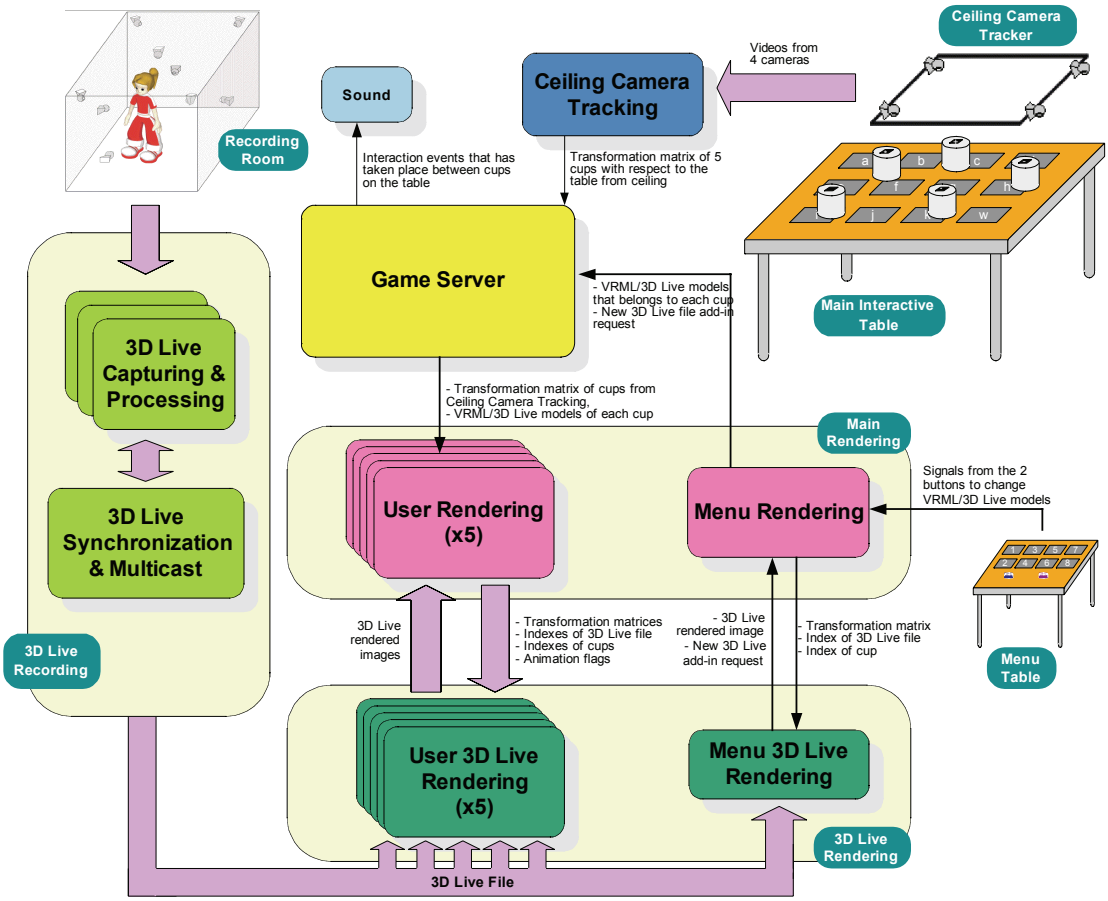

Fig 4. System Setup of Magic Land

The Ceiling Camera Tracking module receives images from four cameras put above the Main Interactive Table. It tracks the markers of the table and cups, and calculates the transformation matrices of the cups relative to the table from top view. After that, it sends these matrices to the Game Server.

Last but not least, Game Server is the heart of the system, which links all the modules together. It receives and forwards information from the Ceiling Camera Tracking, Menu Rendering and User Rendering modules. This Game Server coordinates and synchronizes what every user has in their cup in terms of type of the character and its animation, position and orientation. First of all, it receives the camera tracking data from the Ceiling Camera Tracking module and determines the interaction between the characters inside he cups, basing on the distances between cups. After that, it forwards this interaction information to the User Rendering and Sound modules so that these modules can render the respective animations and produce the corresponding interactive sound. The ceiling camera tracking data is also forwarded to the User Rendering modules for usage in the case that the users's camera lost the tracking of their cups' marker. When the users select a new character, the Game Server also receives the new pair of cup-character indexes from the Menu Rendering and forwards to all the User Rendering modules to update the change.

3. Artistic Intention

Magic Land demonstrates novel ways for visitors in real space to interact with virtual objects and virtual collaborators. Using the tangible interaction and the 3D Live

human capture system, our system allows users to manipulate the captured 3D humans in a novel manner, such as picking them up and placing them on a desktop, and being able to “drop” a person into a virtual world using users' own hands. This offers a new form of human interaction where one's hands can be used to interact with other players captured in 3D Live models.

The artistic aspect of this installation introduces to artists easy, tangible and intuitive approaches in dealing with mixed reality content. The main challenge of the project is to create a new medium located somewhere between theater, movie and installation. The outcome of the project is an infrastructure that gives artists new opportunities to transport audiovisual information and encourage artists of any discipline to deal with those new approaches.
We can perceive Magic land as an experimental laboratory that can be filled by a wide range of artistic content, which is only limited by the imagination of the creators. To watch the scene from above with the possibility of tangible manipulation of elements creates a new form of art creation and art reception that generates an intimate situation between the artist and audience.

The project itself brings together the processes of creation, acting and reception in one environment. These processes are optimized to the visitors experience in order to better understand the media and lead to a special kind of self reflection. The recording area plays the role of the interface between human being and computer. It is also a special experience for the users to watch themselves acting in 3D on the interactive table from the external point of view like the “Bird in the sky”. In Figure 5, are two bird's eye views of this system.

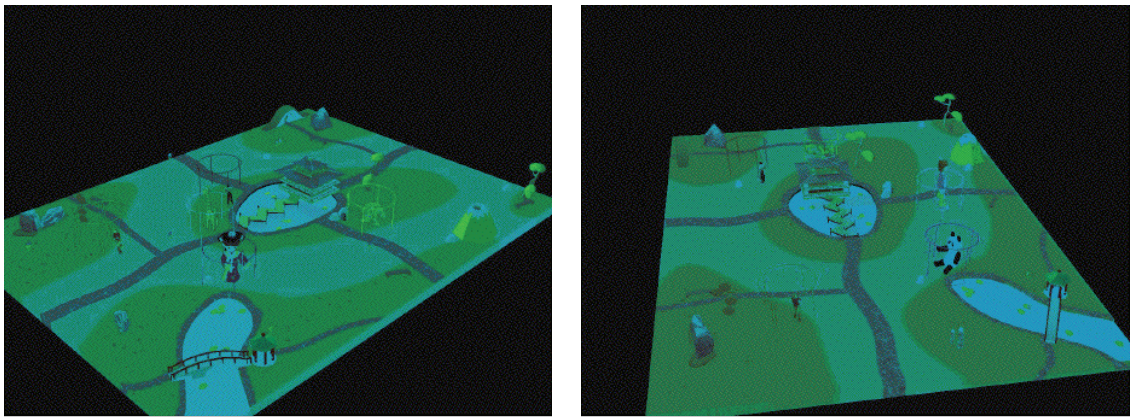

Fig 5. Main Table: The bird's eye views of the Magic Land. One can see live captured humans together with VRML objects

4. Future Work

Currently, we are developing a new version of Magic Land by exploiting the “real time” capability of 3D Live technology, in which, outside players can see on the Main Interactive Table the 3D images of the one who is being captured inside the room in real time. Instead of sending all the processed images of all the frames captured in 20 seconds at a time, this version uses RTP [5] and IP multicast to stream the processed images to all User 3D Live Rendering modules immediately for each frame. To guarantee continuous rendering, User 3D Live Rendering modules will buffer these images for a number of received frames before generate the 3D images inside one of

the special cup on the Main Interactive Table. Moreover, inside the recording room, the captured player wears an HMD to view the virtual environment in front of her at the viewpoint corresponding to the position of the cup on the table. The HMD is connected to a computer outside by a small cable going through the ceiling of the recording room. The cable is painted the same color with the room and its width is small enough to be eliminated by the filter step of 3D Live background subtraction and image processing modules.

In this context, the captured player can actively interact with other virtual objects in virtual reality environment when seeing them on the HMD, and the outside players will have fun seeing her reaction the in mixed reality environment. In our further future work, we want to explore the problem of whether the cup which represent for the 3D Live object can automatically move when the captured player moves inside the room. Such a system will give the captured person more freedom exploring the whole virtual world herself.

Technologies in Touchy Internet [3] can be applied to automatically move the special cup around the table. Touchy Internet uses special sensors and wireless system to track the movement of a pet at home backyard and control the doll's movement placed at the office corresponding to the pet's movement.

The future version of Magic Land will open a new trend for mixed reality games, in which players can actively play a role of a main character in the game story, be submerged totally in the virtual environment, and explore the virtual world themselves, while at the same time in mixed reality environment, other players can view and construct the virtual scene and new virtual characters to challenge the main character. Consequently, the game story is not fixed but will depend on the players' creativity and imagination, and follow their reactions when they travel around the virtual word.

5. Conclusion

This paper has presented Magic Land, a novel application of Mixed Reality and 3D Live technologies. The paper has shown that Magic Land improves experiential qualities not only in museum environment but also in other entertainment and communication environments. Our future work is to continuously improve the quality and speed of the whole system, especially the image processing, 3D Live rendering and networking parts. We believe that such mixed reality and 3D Live systems will become more and more popular in the future.

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Audio Guides in Disguise
Introducing Natural Science for Girls

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Abstract
This paper presents the concept, design and evaluation of a prototype of a guide system for the Universeum Science Discovery Center in Gothenburg. The guide system, Storytelling Animals II, is to be used within a limited area at Universeum called "The Water's Way" where children are taught about the Swedish landscape and some of its inhabitants. The aim is to develop an audio guide that will inspire children who are not interested in natural science to discover it in a new, more playful, multimodal way. The target group of the evaluation was girls between 8 and 10 years old.

1. Introduction

Storytelling Animals II was a joint project between Visions for Museums/Interactive Institute, Sonic/Interactive Institute, Universeum AB, Sennheiser AB and Gertruds Hus 2002-2004. It is a prototype audio guide aiming at engaging children who are not interested in natural science to explore it in a new, more playful multimodal way. It was developed for a zone called "The Water's Way" at Universeum, a Science Discovery Center in Gothenburg. Directed by Visions for Museums, a front-end evaluation was conducted with visitors, workshop and partners; concerning the concept and design of the prototype. Girls between the ages of 8 and 10 were chosen as the target group for the prototype evaluation [1], which was conducted at Universeum in November 16-18th, 2004.

2. Concept & Design

The audio guides present four different animals: wolf, beaver, adder and salmon – animals that follow "the water's way" through Sweden and which all have increasingly smaller habitats because of influences of mankind. In the audio guides, the child listens to one of the animals narrate about conditions governing its life in the Swedish landscape. Every audio guide consists of a headset and a bracelet decorated so as to associate to one of the animals (Fig 1) [2].

Fig 1. The headsets and bracelets

The four audio guides have separate scripts read out by different actors and they stop at different stations in "The Water's Way" area (Fig 2). The wolf's audio guide is the longest in time and the most multimodal of the four and stops at most stations [3].
It encourages the child to actively interact with the exhibit's environment and has environmental sounds, sound effects and dramatized music. The beaver's audio guide has no interaction but has environmental sounds that enhance the feeling of being out in nature. The salmon and adder are both without interaction and sound effects – they consist only of an actor's storytelling voice. These disparities allowed us to study how increased levels of interaction and auditory dramatization affect children's experience of the environment and stories of the animals.

The chosen technical solution is called Guideport and has been developed by Sennheiser. The headband of each animal contained a receiver and a set of headphones. Eleven small identifiers located throughout the venue at "The Waters Way", triggered the receivers to play the appropriate files when the child wearing the receiver entered a certain predefined area. The next audio track came on as soon as the child leaved the area and entered a different zone. This meant that the child could do things in her own pace.

Fig 2. *The layout plan of "The Water's Way"*

3. Evaluation

The questionnaire consisted mainly of multi-choice questions but also had a few open questions and the possibility for the interviewer to take notes of miscellaneous comments or observations. The questionnaire was divided into four different areas of interest:

1. Personal background of the respondent. (Age, interests and familiarity with museums).
2. Usability (Does the technical solution work? Is it easy to operate and understand? Are the headbands comfortable?)
3. The multimodal experience (What senses were involved?).
4. Content/facts (What do the children remember from the walk? Do they remember more when more senses are engaged?).

4. Results

1) Personal background

Girls 8 years of age specified friends and animals (especially horses and pets as cats and dogs), and girls of the age of 10 specified animals (horses, cats, dogs) and sports as their greatest interests. (Even though it is highly likely that friends still are important to 10 year olds they didn't mention it as an interest/hobby). Most of the girls were relatively familiar with museums and many of them had been to Universeum before but hadn't paid that much attention to the zone "The Water's Way".

2) Usability

The children answered that the audio guides were easy to listen to, and that it was easy to navigate in "The Water's Way" while listening. Most of them thought the headbands looked nice. (Despite this, some of the children pointed out that they did not like to stand out – i.e. they felt shy in front of their classmates who were not wearing headbands).

One of the reasons for giving the audio guides different animal attributes was to clearly demonstrate to the children that the animals seek out different habitats in "The Water's Way". And the test showed that the children with different looking headsets were not "fooled" into following each other, not even when they started walking simultaneously.
It took the children about 15-30 minutes to walk through "The Waters Way". A majority of the children thought that the audio guides were far too short and pointed out that they gladly would have listened to more!

3) The multimodal experience
The children appreciated the dramatic elements of the guided tour which encouraged the use of different senses, such as the sudden sound of a helicopter heard when "climbing" the mountain, the discovering of bone fragments when moving a branch of a fir or the sight of the nest of adders with many coiling snakes in a vivarium. These events were reported as the most exciting elements of the tour.
One question in particular proved to be effective in demonstrating how multiple senses can enforce the memory in learning processes - a question asked about what three types of water there exist. The children wearing the audio guide of the wolf had been asked to taste the salt, fresh and brackish water out of three plastic barrels. The girls that had not tasted the three different kinds of water (but only read about them) could not remember what types of water exist.

4) Content/facts
The children proved to remember more when several senses were involved. Especially the wolf's audio guide with environmental interaction and sound effects got many positive comments from the children. The audio guides made the children curious about the animals and they wanted to learn more about them.

Fig 3. Four test pilots at Universeum.

5. Conclusion and Future Developments

The children's positive reactions showed that the prototype audio guides were appreciated by the intended target group. With the conclusions and experiences gained from the evaluation it would be enjoyable to further develop the audio guide. Both the project group and the test pilots (the children) came up with many good ideas on how to improve the product. Some wishes and ideas for further development are:

- Creating more multimodal scripts with more assignments for the children to solve during their tour in the environment.
- Have more stations with shorter texts at each.
- Develop more characters and many different levels of difficulty.
- The audio guide should be available in many different languages.
- The text information could be purchasable on CD/tape or offered in some other way at the museum shop (for example, it could be uploaded to devices that the customer has brought such as mobile telephones).

Notes

[1] Girls were set as the target group on the grounds that Universeum, in its activities, aims to reach out more to children from groups that are today underrepresented within scientific and technical higher learning educations.

[2] The bracelet did not perform a technical function but served, partially as a visual cue so as to remind the child what animal she was bound to, partially as a placeholder were an eventual key to a deposit box for the audio guides can be attached.

[3] The wolf's audio guide is a total of 7:20 minutes long. The beaver's is 5:50 minutes, the adder's is 6:20 minutes and the salmon's guide is 5:20 minutes long.

Museum Of Voice

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Abstract
The Adivasi Academy, Tejgadh, Gujarat, India was founded by the Bhasha ('voice') Centre in 1996. Its aims are to develop education programmes for Tribal peoples; to profile adivasi culture through publications, talks and events; and to develop a Museum, workshop and library dedicated to adivasi languages, history, culture, art and craft.
This paper explores ways in which the museum can carry out this mission; it notes the difficulties of the project including the remote location, the extreme climate and limitations of space. A further area of consideration is the interaction of votive and artistic meanings in this culture.

1. The Adivasi

Bhasha stands as a platform for the 'voice' of tribal and denotified communities in India. The Adivasi Academy is the nucleus of the movement initiated by Bhasha for cultural identity, economic empowerment and social justice.
A Museum is being established in the Adivasi Academy in the village of Tejgadh, Gujarat to exhibit and document tribal cultures and to facilitate training and educational programmes for tribal peoples.

This paper will give a description of the project to date and raise questions of exhibition policy.

Adivasi is a term used in India to describe 8.14 per cent of the population – or 84.51 million people. These people are made up of groups of people who have been marginalized by the majority community for reasons of history, religion and cultural background. Such groups include Denotified Peoples, Nomadic Peoples and, more generally, "Tribals".

The British government of nineteenth century India designated these communities as 'criminal' for political reasons. Originally, the tribes were nomadic and traditionally carried important commodities such as salt and honey between the coasts and the inland forests. The British relied on these networks to establish their own trading relationships and to guide their armies through unknown regions. Indeed these traders and transporters of goods were crucial informants for the new rulers, who benefited from tribal knowledge of flora and fauna, transportation as well as communication. As railways and telegraphs were built in the 1850 such networks became redundant. The colonial authorities grew nervous about people who moved around, carrying intelligence they could not control directly.

Fig 1. Tribal women attending an information day at the Adivasi Academy, March 2005

In the aftermath of the Sepoy Rebellion of 1857, these former allies were seen as potential enemies. In 1871, an Act was passed for "the notification of criminal tribes". Hundreds of tribes that traditionally collected food from the forest became criminals. The branding of these communities as "criminal" was based on the community profession and regarded as passed on from one generation to the next. The Act provided for establishing reformatory schools and settlements for the reclamation of these people; their movements were restricted to specific areas; they could be arrested without warrant if there was any violation; children from 6 to 18 were separated from their parents and put in reformatory schools.
After independence this Act was finally repealed in 1952 and the communities "notified" under the act were "denotified" under the Habitual Offenders Act. Unfortunately this act contained the same draconian laws. The police force as well as the people in general was taught to look upon the 'Criminal Tribes' as born criminals during the colonial times. This attitude continues to persist even today. Illiteracy, malnutrition, health care, education, land rights, economic aid, have all been major issues in the life of these communities.

In 1965 the Lokur Committee set the following criteria for identification of a community as a Scheduled Tribe:

- Indication of primitive traits
- Distinctive culture
- Geographical isolation
- Shyness of contact with the community at large; and Backwardness.

The Indian Government has pursued the Tribals Issues under several plans since Independence. In 1972, the Tribal Sub Plan strategy had the main objectives of

a) Socio-economic development of Scheduled Tribes
b) Protection of tribals against exploitation.

Policy and economic aid have benefited the tribals to an extent under the "tribal upliftment" aims of various governments but other problems have emerged including

the drift from traditional livestock/forestry work to low-paid industrial labouring, the high drop out rates in education, and exploitation by others.

2. The Adivasi Academy

The Bhasha Research and Publications Centre was established in 1996 as a trust for undertaking research in Adivasi languages and culture. The name Bhasha, means 'voice', and the wide-ranging brief of the the Trust was to set up a forum for Adivasi expression that would address all aspects of adivasi culture, history, society, rights and development. The Bhasha Research and Publications Centre seeks to establish Tribal Studies as a field of serious philosophical and social thought. As a central realisation of this aim, an institution, the Adivasi Academy, was established in Tejgadh, Gujarat, and the Cultural Resource Centre and Museum of Voice were blessed by Smt. Mahashweta Devi on 15th August 2004. Tejgadh is an Adivasi village 90 kilometres east of Baroda on the borders of Madhya Pradesh, Maharashtra, and Rajasthan. The campus lies at the foot of the Koraj Hill on a ten-acre site.

Fig 2. Panels in English, Hindi and Gujarati

The objectives of the Adivasi Academy are:
- to become an institution of quality research and education in relation to Adivasi development and social dynamics;
- to translate the study and research undertaken at the Academy into interventions for empowerment of marginalized communities;
- to nurture a community of Adivasi thinkers and new thought processes so as to facilitate social transformation;
- to become a national institution for research, reference and study of social dynamics.

The philosophy guiding the academy is drawn from eminent Indian philosophers including Rabindranath Tagore, Shri Aurobindo, J. Krishnamurthy, Mahatma Ghandi and Ananda Coomaraswamy. This philosophy guides the teaching methodologies and aims of the academy. All courses are conducted on democratic principles: teachers and students negotiate structure, timing and assessment techniques. The leading aim of the academy is the empowerment of tribal peoples, encouraging them to assume

responsibility for their education, their society and their aspirations. Particular attention is paid to oral traditions, performing arts, handicrafts and visual arts.

3. Museum/Library/Workshop

At the Academy, members of the adivasi community lead the projects. Currently being developed at Tejgadh are a museum; a community work consultation complex which deals with healthcare services, rooms for short term visitors; a child development centre; an organic farming laboratory, and a classroom open to the sky 'Samvega' which was designed and built by the faculty and students; its name, 'Samvega' indicates 'fluidity of the intellect' in knowledge and transactions.

In the Museum, as with all Bhasha initiatives the voice of the tribals is dominant in deciding the design, curatorial practice and development of the project.
The Museum/Workshop/Library complex is one of the chief means of disseminating information about tribal peoples and creating respect for their culture.

The Museum buildings, like those of the rest of the campus, are designed by Karan Grover, architect and combine features of local architecture and historical monuments found in the area. The environment of the academy includes an archaeological site containing prehistoric rock paintings and a medieval fortification. The modern buildings are eco-friendly, earthquake resistant and of the local style.

Fig 3. Adivasi Academy, Tejgadh, Gujarat, India. Architect: Karen Grover

The aim of the Museum, according to the Bhasha prospectus is "to document, hold and dynamically display the adivasi expressions, both artistic and cultural, in the form of objects, artefacts, performances and digitised multimedia images. The Museum shall be the 'laboratory' for contemporary ethnic, anthropological and artistic studies. It is conceptualised as a unique Museum of Voice and the largest resource centre of Tribal Culture in India".

The Artists' Workshop is a platform for practising artists and craft persons and for documenting their art practices. It is hoped to introduce artist exchange programmes to the workshop.

The Library holds the relevant print and audio-visuals resources on tribal societies, endangered languages and related sociological issues. At present it has a collection of 20,000 titles and aims to have a collection of 50.000 titles for reference.

A performance area is another facility being developed on the campus.

The culture which this museum seeks to value is not generally included in the collections of museums or art galleries. Partha Mitter, in the Oxford University Press volume *Indian Art*, (published in 2001), devotes two pages to tribal art, in a catch-all chapter entitled '*The Non-Canonical Arts of Tribal Peoples, Women, and Artisans'*. The brief discussion is informative, however, as he says:

> *'There is a curious silence in Indian art history about these groups'hidden from history'. Their arts, as part of social rituals, have an ephemeral character and are therefore considered to be merelyfunctional and appropriately the preserve of anthropologists.'* (Mitter 2001; 157)

Fig 4. Training workshop in Adivasi Academy

The motivation for the Museum of Voice is to promote an understanding and appreciation of 'the artists, their intentions, and the aims of those for whom their art was created'. (Mitter 2001; 157)

The Museum of Voice/Library/Artist's workshop complex acts as,
- a centre of cultural identity; a people's institution
- a platform for sharing tribal knowledge
- a workshop for contemporary artists and craft makers to express Adivasi culture through objects, artefacts, performance and digital media

- a laboratory for ethnic, anthropological and artistic studies
- a centre for exchange programmes of artists and artefacts.

An 11th century tribal fortification and prehistoric rock paintings are near the site at Tejgadh. These are seen as a valuable area for research, meditation and stimulus.

Fig 5. Museum display, March 2005

4. Artefacts

The artefacts are displayed in the Museum building on the floor, on low plinths, and suspended from metal frames. Printed labels describe the state of origin and the name of the object, in several languages.
Most examples are from Gujarat and nearby states, but the aim is to represent the cultural heritage and artistic practice of tribes in all India.

The collection is made up of examples of:
- Pottery
- Wood Sculpture
- Textile Art
- Mixed media: objects such as musical instruments, bows, costumes and body ornament, relating to festivals and traditions of the Adivasi.

The collection of objects in The Museum of Voice will help to conserve the traditional arts. It will also serve as a catalogue of change. The artists continue to work in the context of demand and this may be the traditional requirement for tribal festivals and rituals; or a new market for decorative arts probably in the towns.

Fig 6. Pottery display in Samas, Vadodara, Gujarat

The pottery exhibits may be taken as an example of the range of contexts and meanings that the presentation in museum needs to address:
The low-fired terracotta is earthy and porous. Some people believe that this open-textured clay absorbs 'negative energy'. Domestic vessels and votive sculptures are often deliberately broken or left in the open to break down, and regularly replaced to satisfy an understanding, intuition or ritual practice. This custom of renewal makes sense in the context of practical (the low firing makes these pots unsuitable for continuous use with food) or spiritual well-being.

Fig 7. Unfired clay cooking stove

5. Issues

The major issue is that of realising the mission of the Museum complex to represent and communicate with the diverse community of tribal and nomadic people. How can the Adivasi be instrumental in developing this Museum? The collection needs to build through their awareness of their own culture.

Fig 8. Sacred site on Koraj Hill near Adivasi Academy

Literacy rates are very low among the adivasis, so alternatives to text are needed for information.
What levels of technology can help this project?

Extremes of heat, dust, and monsoons make the museum collection of objects difficult to exhibit, conserve and store safely. Physical space is very limited in the building.

Much of the work possesses votive characteristics as well as exemplifying art and craft practice.

The museum must be a unique institution to attract visitors. How can this be done?

What museums exist that could be useful reference in developing the Museum of Voice? The experience of Ireland, in re-establishing the value of traditional culture in a post-colonial context, may be useful as a museum model. The Blasket Centre in Co. Kerry records the life of the island community, and has a rich archive of documentation which is used as stimulus for creative interaction with the island history – most notably in the performance programme at the Siamsa Tire National Folk Theatre of Ireland, Tralee, Co. Kerry.

The Irish model including the recovery of a national culture at the time of the Irish Revival will, we hope, provide a useful starting point for raising consciousness among adivasis and the outside world of the rich culture of these tribal peoples.

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Time, Place and Technology in Museums: a Dialogical Approach to the Experience

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Abstract
In this paper we argue that design in museums should be informed by an understanding of people's experience. We suggest that experience is best understood in terms of the dialogical relations between place, space, time and technology. Bakhtin's 'chronotope', the novelistic basis for our dialogical approach to experience, orients Interaction Design toward potential and personhood in a world that, althtough already half designed, is always becoming in people's experience.

1. Museum Experiences

Here are some experiences with museums that we have had recently. One was in a traditional, folk museum that up to a couple of years ago was accommodated in an old Victorian house and is now in a straight-lined, polished concrete, and glass building. The exhibits are set out in beautifully designed and lit glass cases arranged as fragments of narratives of local and national history. Going around the museum, people spoke nostalgically of what the museum was like when they were children: how they were able to touch many of the exhibits and play with others, like map locations which lit up when visitors pressed buttons on a panel that were labelled with historically significant events.

Another was in the Victoria and Albert Museum in London, a huge Victorian sprawl of exhibitions evoking different parts of the world, kinds of artifacts, and activities. Often experienced as overwhelming because of the profusion of materials and the lack of direction about how best to move around them, it became more intimate and focused on a recent visit when the museum had compiled a soundscape for a small number of exhibits. The soundscape consisted of the auditory responses –music, abstract sounds, words- of a number of contemporary artists, to particular exhibits, each artist responding to one exhibit. Walking around with the headphones from one of those exhibits to the next, curious about the next response, added extra dimensions –direction, focus, texture, complexity, curiosity– that complemented the standing exhibition.

Finally, an exhibit in The Science Museum: a shiny metal tube extending from floor to ceiling. On the floor, the pole is surrounded by a white circular standing area, which is in turn surrounded by a black circular band with yellow trimmings. 'DO

NOT TOUCH' is printed three times on the black surface. First impressions reinforce the expectation that a museum would take care to keep its visitors safe. The exhibit has Health and Safety concerns 'written all over it'. However, the central pole has openings that invite insertion of a finger up to its first joint. When visitors do this, a 30,000 volt electric shock is delivered. It is a shock in two senses, a physical-sensual shock and a shock that 'The Science Museum' would do such a thing. Intellectually, the exhibit is humorous, enchanting and also raises the (scientific) question of why an electric shock is (or isn't) dangerous. Whereas some adults seemed indignant and did not interact with the exhibit more than once, children inserted their fingers repeatedly.

These experiences highlight some issues about museums that interaction design ought to attend to as interactive technologies are increasingly deployed in museums including:

- The quality of the experience people have in museums: The enchantment and educational quality of the Science Museum experience and the somewhat sterile experience of the civic folk museum that evoked nostalgia for a less ordered but perhaps more engaging past.
- The role of narrative and/or comment.
- The locus of the museum experience: The intrinsic experience of learning while exploring and the extrinsic quality of the soundscape in the Victoria and Albert.
- What kind of place a museum is: a place for fun and engagement, observation, and/or comment by outside voices.

Our position is that Interaction Design interventions should be informed by people's experiences in museums and that those experiences are best understood in terms of the relationships between place, space, time, and technology that constitute them. In what follows we will further elaborate this position and suggest that a dialogical approach to experience serves our need for a relational account of experience and that Bakhtin's 'chronotope' suggests a humanities –or novelistic- approach to understand relationships between time, place, and technology.

2. Place, Space and Technology

For about two decades now, HCI and Interaction Design have been concerned with the analysis and development of distributed technologies that mediate people's experience of space, for example: EuroPARC's work on media spaces (Dourish and Bellotti, 1992); Ciolfi and Bannon's use of phenomenology and humanistic geography to provide a technologically augmented experience of a museum (2002); Turner et al's phenomenological approach to enhancing the sense of place in virtual environments. Interaction Design has also, more recently, shown some interest in people's use of portable technologies (Taylor and Harper, 2002). It has also resulted in interesting discussions on the relative importance of space and place in interaction design.

Some characteristics of current conceptualisations of space, place, and technology limit their value in analysing people's experiences in museums, including the following:

- In some conceptualisations, 'place' seems to be restricted to stable structures such as buildings. This is too restrictive, as Interaction Design for museums needs to think about space and place in a way that addresses locative aspects of interaction with portable and fixed technologies, in bricks-and-mortar, and in virtual environments.

- Understanding of 'experience' is uneven in conceptualisations of place in Interaction Design. In some cases it is underdeveloped and in others its development is unnecessarily tied to a particular methodology. A pragmatic approach prepared to address multiple dimensions and aspects of experience may be more useful.
- The concept of 'agency' in people's experience of technologically mediated place is also underdeveloped. Given that one of the impetuses for developing the concept of place in Interaction Design was to elaborate the model of interaction as 'person-acting-in-context', this lacuna is curious and needs to be addressed.

In order to begin to address some of these limitations, we need to develop a more inclusive language of space and place in Interaction Design. McCarthy and Wright's (2004) conceptualisation of technology as experience can be used as the basis for an inclusive dialogical interpretation of place.

3. Dialogics of Time, Place and Technology

In order to think about experience in a way that gives due weight to its social, individual and personal aspects, McCarthy and Wright conceptualise it as an irreducible, dynamic interrelationship between person and environment, in which meaning has sensory, affective, and emotional dimensions as well as cognitive and socio-cultural aspects. They distinguish between the immediate experience that a person has and the meaning of that experience as it becomes known and thereby appropriated personally and communally. This draws attention to the ways in which immediate experience is associated with personal, social, and cultural sense making processes, specifically relational aspects of interpretation and reflection, and communal processes such as telling others of our experiences. Implicit in much of the foregoing is a sense of experience unfolding across time and space, e.g. in the museum experiences described above, the nostalgia for an older museum experience and the sense of culturally significant voices commenting on the museum exhibit that one is looking at.

McCarthy and Wright's dialogical approach starts with the idea that experience is like a conversation in which meaning is always changing as a consequence of what comes next. Even as both parties to a conversation seem to settle on an understanding, the utterance being made by one of them may unsettle that understanding and suggest alternative senses or meanings. Every utterance has many meanings, a history of use, and a number of voices associated with it. So the dialogical approach to experience draws attention to the ways in which people engage in activity with half an eye to what might be about to happen and half an ear to the nuances of what already has happened. In this sense, experience is responsive to the other and to the future, always in dialogue with the other and anticipating possible futures. This suggests that any unified or settled sense of place, such as a settled sense of museum as a particular kind of context, is accomplished through the relationship between self and place, and increasingly in Interaction Design through the relationship between time, place, and technology.

4. Bakhtin's Chronotope

For Bakhtin, all contexts are shaped by the quality of time and space that they produce. Although many philosophers took time and space to be fundamental categories of thought, Bakhtin was more interested in the quality of relationships between people and events on the one hand and their space-time on the other. He saw

different genres in novels as containing qualitatively different sense of space and time. For example, he described the Greek Romance as occurring in adventure time, in which characters seem not to be affected by the passage of time or experience. In contrast, in the nineteenth century novel, the detail of historical time and place permeates action and experience. In these novels, character and personality are shaped in important ways by the particular time and place in which people live. Finally, in the novel of emergence people and the world in which they live exhibit a genuine sense of "becoming", or change and development. Neither the people nor the world in which they live are given ready-made, rather they are created by the effort and actions of specific people living particular lives. The novel of emergence, especially when contrasted with the treatment of space-time in earlier genres, raises issues of potential, creativity, freedom, and initiative in a way that takes account of the fullness of time, the inner connectedness of past, present, and future. Here the unfinalisability and dialogicality of experience are made visible as we see the past and future in present objects, events, and situations.

Bakhtin uses the term chronotope to describe these different qualities of space-time or what we might think of as the sense of place that different settings have. To quote from Morson and Emerson (1990):

> "Bakhtin's crucial point is that time and space vary in *qualities*; different social activities and representations of those activities presume different kinds of time and space. Time and space are therefore not just neutral "mathematical" abstractions" (Morson and Emerson, 1990, p. 367).

Contrasting qualitatively different characterisations of space-time in novelistic genres is designed to make visible the salience of space-time in felt, lived experience. As ways of seeing, valuing, and expressing human experience, the novelistic genres described by Bakhtin make visible experiential contexts in which people are respectively indifferent to time and place, constrained by it, and always creatively connecting past, present, and future. As cultural memories for ways of seeing and valuing, they reveal a cultural-historical unfolding of prosaic experience from the disconnected monological to the deeply involved dialogical. Morson and Emerson (1990) push this way of seeing a little further by proposing a range of questions about any experience that try to uncover the space-time quality of that experience. They could be used to explore the space-time quality of museum experience for example. The questions include:

- Are actions dependent to a significant degree on where or when they occur?
- What kind of initiative do people have: are they beings to whom events simply happen, or do the exercise choice and control and if so, how much and of what kind?
- Is time open with multiple possibilities, or is it scripted in advance?
- Does social context change and if so, in what ways? Are time and space shaped by events that take place in them?
- Do personal identity and character change in response to events or are they fixed? If they change how when and to what degree?
- Are people understood as entirely "exterior" or is there real "interiority", and if so of what kind?
- How does the past impinge on the present, and what is the relation of the present to possible futures?

5. Museum Experience and Design

Morson and Emerson's questions probe the quality of the space-time in which we live and its implications for whether we experience life as emergent or determined, with every moment full of potential or already more or less determined. They could also be asked of the kinds of descriptions of museums and other places that are employed in Interaction Design. Whether interaction designers see a museum, its exhibits, and people's interaction with them as static, repetitive, and one-dimensional or full of change, growth, and possibility is likely to have implications for how they design interactive technologies to support and augment museum experiences. Whatever else museums are, they are increasingly contexts in which relationships between time, place and technology create potential for both momentary enchantments and ongoing stories. A dialogical approach to experience, particularly a chronotopic one that draws attention to the time-space quality of experience, is well suited for reflection on museum experiences in design.

Returning to the museum experiences at the beginning of this paper, we can see, for instance, the dialogical character in the design of The Science Museum exhibit. It is both educational and playful, drawing on the genre of childhood adventure and exploration (e.g. the finger holes just waiting to be explored) as well as the genre of science and the potential for hazard (the colours and message on the floor that suggest warnings posted in potentially hazardous laboratories). In this design, it is the relationship between the two genres that opens up the potential for an interactive space in which visitors to the museum are invited to complete their own experience. There is a similar dialogical quality to the use of non-didactic soundscapes in the Victoria and Albert Museum. They create a dialogue between the person viewing the exhibit and the artist who has previously viewed it and recorded an auditory response. They also create a sense of narrative, direction, and texture that is useful in such a large museum. In contrast with these two, the civic museum that now invites a kind of passive viewing throws visitors back on narratives of how it once was and how it might have been. Although we have limited our use of the dialogical approach to experience to critical evaluation of existing museum designs in this paper, the dialogical approach can also be used to generate frameworks for use in both design and evaluation (McCarthy and Wright 2004).

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Beyond Just the Facts: Museum Detective Guides

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Abstract
We present Museum Detective, a handheld guide designed for use by school children to encourage guided learning through paired discovery of one object displayed within the museum space. Initial analysis revealed that students exhibited a higher level of focused attention and short-term and longer-term retention of information about the artifacts in the gallery. However, we propose that the Museum Detective interface extends beyond the frame of the device and its application into the expanded contexts of space, time and social interaction, as we push on the notion that information delivery does not have to be the sole objective of handheld guides designed for the art museum.

1. Introduction

Handheld computer guides in art museums have added yet another tool for providing information to visitors. These new devices differ from audio guides because of the visual channel, from stand-alone kiosks because of their mobility, from web sites because of their situatedness, and from docent-led tours because of the self-direction. Although an oversimplification of these differences, the attributes of handheld guides often lead to designs optimized for exploring a tour of objects at one's own pace and to the desired depth of available information. Critics of these designs have highlighted what museum activities are left un-designed for in this approach (Boehner et. al., 2005; Boehner et. al., 2005; Ferris et. al., 2004; Hindmarsh et. al., 2002; Woodruff et. al, 2001) and how the focus on transmitting breadth and depth of information may present a distraction or even narrowing of the museum experience as a whole.

In this paper, we will present our experience designing a handheld guide for a very different type of interaction in the art museum: paired discovery of only one object, as opposed to individual discovery of a range of objects. The guides we will discuss were designed in collaboration between the Herbert F. Johnson Museum and the Human Computer Interaction Lab at Cornell University as part of a larger curriculum activity for a very specific population: third graders from schools in rural districts. The purpose of this paper is to begin articulating the critical questions and issues to consider when designing handheld programs to support this type of guided learning activity. We will begin by first identifying the goals of the project and the design choices made to support these goals. We will then present preliminary results from a prototype study. Finally, we will end with reflections on improving the guide and its evaluation.

1.1 Background

The Museum Detective handheld program was initiated by the Johnson Museum as part of a larger educational program for third-grade students called Objects and the Makers New Insights: OMNI, where the emphasis is on offering school children the

opportunity to experience the culture with which the curated objects are situated, such as learning a native dance or working with craft materials from the particular period. These exercises are coordinated with the school district's curriculum, in this case, studying the history of Ancient China.

In previous years, the museum's OMNI China program consisted of two exercises: a painting lesson in calligraphy, and an exploration of artifacts in the gallery through a paper and pencil activity called the Museum Detective. In the gallery activity, pairs of students were assigned to an object, given a sheet of questions such as: How old do you think this object is? What do you think this object is made of? Students spend 20 minutes with their object answering the questions and are also instructed to draw a picture of their object on the back of their question page. At the end of the 20 minutes, the students come back together as a class and visit each object assigned. The pair who had investigated an object is responsible for trying to explain the object to their classmates, with the teacher or docent facilitating. It was for this activity that the Johnson Museum felt a handheld computer could be a useful addition.

1.2 Design Objectives

The museum educators identified three main objectives for using handhelds in the Museum Detective Activity: 1) to present an exercise that is more interactive and engaging than the paper activity, 2) to help contextualize ancient artifacts difficult for contemporaries to connect with, such as the idea of tomb figures, and 3) to introduce the students to technology in the museum. Behind this last objective was the desire to connect the newness of the handheld computers with the typically more conservative and historical face of the museum's Asian art collection.

As designers of the system, we wanted to help the Johnson Museum realize its goals by making the application fun and engaging to use. We were also interested in exploring how we could use the devices in a way that extends beyond 'just the facts' learning, instead of using the devices simply for information transfer.

1.3 Design Choices and Tradeoffs

As with many applications of new technology, the original application envisioned by the Johnson Museum involved taking the same paper and pencil Museum Detective activity and translating this into the computerized format. The audio-visual and interactive nature of the devices would address the museum's first two objectives; whereas, the implementation of the devices themselves would address the third objective. From the HCI lab perspective, we were originally interested in using additional attributes of handheld technology for the children's tour, for instance, letting the students choose which objects interested them the most and what information they found to be most interesting about an object. We imagined the applications to be more about self-discovery and less guided. However, in working with the museum, it became apparent that the handheld application was part of a larger scripted activity. In other words, the designed interface of the handheld was not contained within the screen.

In order to guide the students through the discovery process, each object would be unpacked through a series of primarily multiple-choice questions, such as "When do you think this object was made? Discuss with your partner and then select one of the time periods below", or "What do you think this object was made of? Discuss with

your partner" followed by a selection of possible answers like wood, clay, stone. Selecting the correct answer congratulates the student on getting the question right and provides additional information such as drawing the students' attention to the wood grain in the object. Selecting an incorrect answer prompts the student to try again and gives hints to help guide their next choice. Questions and answers were worded in such a way to try and encourage the students, who would be working in pairs, to discuss with each other their answers. Some questions were open-ended, for instance, "What do you think Quan-Yin (Fig. 1) would say to you if she could talk"?

Fig 1. Students looking at the Quan-Yin goddess statue.

In addition to the question-based format, each object had one interactive element. These interactive elements included: a building exercise (for the Watchtower), drawing activities (e.g. for the Scholar's Screen), painting activities (e.g. for the Court Lady), and a narrative (for the Jue). For the Watchtower (Fig. 2), the building activity consisted of taking separate pieces of the tower and re-building it in the appropriate order. When the student completes the task, selecting the checkmark makes the tower sway back and forth. If the tower is constructed incorrectly, it falls down and the game begins again. This exercise requires the student to look closely at the object in order to construct their model in the same manner.

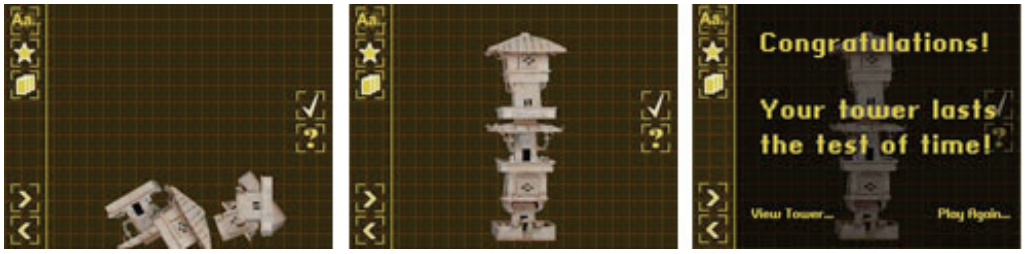

Fig 2. Three screen shots of the Watchtower activity

The Scholar's Screen object presents the students with a blank lacquer screen and instructions to make his or her own carving that they might like to have on their desk. The Court Lady tomb figure's interactive exercise is a painting activity (Fig. 3) where students refresh or redo her colors. Contrary to the Watch Tower exercise, the painting and drawing activities have no right or wrong answer – as such, they required less direct looking at the object. Finally the narrative activity for the Jue wine vessel involved no manipulation on the students' part providing instead an audio story of the taotie ogre legend.

Fig. 3. The Court Lady painting activity

The interactive elements broke up the series of multiple-choice questions and took advantage of the audio-visual nature of the handhelds. All of the activities, including the multiple choice questions, were attempts to promote active looking – scrutinizing the object more closely than a cursory glance – and/or active imagining – for example projecting the object into the present day or projecting the student back to ancient China.

The overall look and feel of the program are intended to reinforce the detective role-play. The colors and graphics of the program evoked a slicker, spy-feel of Mission Impossible than a traditional Asian motif of Tao Te Ching. However, where possible we did add traditional Chinese music elements to accompany the questions or the games. The music was added at the very end of the development program almost as an afterthought for it had no 'educational' content but served as extra exposure to the Chinese culture (and since one standard clip was put at the end of the exercise, it also served as a signal when the students had completed the exercise). As we will discuss in the later sections, this afterthought ended up being one of the most popular aspects of the program.

2. Methods and Results

The Johnson Museum's education staff wanted to compare the handheld version of the Museum Detective tour with the previous pencil and paper version of the same activity. This presented an opportunity for observing as outside evaluators how the activity changed with the addition of the handheld. We were not interested in creating direct comparisons or to establish that the handheld performed 'better' or 'worse', but instead saw this as an opportunity to explore how the experience differed from each other. For the purposes of this paper, however, we will mainly present our observations of the handheld version of the activity and use the pencil and paper version as a comparison point.

Overall, 211 third grade students participated in the Museum Detective activity with the handheld and 264 participated with the pencil and paper activity. We were able to directly observe and video record 4 classes of students (approximately 80 students) using the handheld and 3 classes (approximately 60 students) using pencil and paper, and the following observations are drawn from these 140 students. These numbers are an approximation due to the manner in which students were recorded during this preliminary data collection period. We are currently conducting a more rigorously designed round of video recorded observations to build upon the preliminary trends gleaned from this pilot study.

When a class arrived at the museum, the students were separated into two groups, one group of approximately 10 students participated in a calligraphy painting exercise in the craft room and the other group went to the Asia Gallery for the Museum Detective activity. Half-way through the students' field trip, the groups switched so that everyone participated in both activities. As discussed above, some of the classes used the handhelds for the Museum Detective portion and some used pencil and paper.

For both the handheld version and the pencil and paper version, students participated in the activity in pairs. For the handheld version, they had to share the device and were encouraged to take turns being the one in control. For the pencil and paper version, both students had their own clipboard with identical sheets of questions and a pencil for adding their responses and drawing a picture of their object on the back of their page. Although the paper version would allow the students to register different responses than each other, in the papers we collected, they all wrote the same response to each question and their responses differed only by their individual drawings.

When the Museum Detective activity started, again for both the handheld and paper versions, the students started with a "clue", a fragment of their object that they needed to find in the gallery. They were instructed that once they found their object, they would work with their object and discover as much as they could before telling the class about their object. Throughout the exercise, the educator used language to try and encourage the students to think of the object as theirs (e.g. "What can you tell us about *your* object?", "Which one was *your* object?", "You are the *expert* about *your* object").

At this point, the handheld version and the paper version begin to diverge. In the handheld version the students walk through a series of questions and finding the correct answer (e.g. When was this object made?) plus they each had one interactive module, such as the painting or building activities discussed earlier. In the pencil and paper version, the students were asked the same questions with multiple-choice answers, but there was no immediate feedback in terms of whether they selected the right answer. The interactive activity for the paper version was sketching the object on the back of the paper.

At the end of approximately 15 minutes, the students all came back together and walked around the gallery as a group stopping at each object and learning about it from their peers. This took place for both the handheld and paper version – the students who explored the object during the first part of the activity were then responsible for telling their classmates about it.

Both groups received instructions, assistance and supervision from the same museum educator. Moreover, they studied and discussed the same six artifacts: the model of an ancient watchtower, the statuette of a court lady, a tree-sap paper holder, a life-size statue of the Goddess of Mercy, a decorated wine warmer and an incense-burner.

When delivering their presentations, participants in both groups were given time to share with their peers what they had learned about the artifact. If any relevant information was left out, the museum educator proceeded to ask specific questions and, when necessary, probed the participants so that, at a minimum, the following

topics were covered for each object: age of the object, the object's material composition, and use of the object.

After approximately one month, we returned to the participants' school for an in-depth interview with a smaller subset of the participants regarding the museum activities and the specific artifacts they had studied. The museum educator served as the "moderator"; she separately interviewed the 34 students from the handheld groups and 33 students from the paper-and-pencil groups on all six artifacts. Such as in the immediate recall process, the educator allowed participants time to present what they remembered of the artifacts in question, and then followed up with specific questions if any relevant information had not been offered. However, due to the structure of the group interview, we were unable to tease out targeted information regarding the student pairs that were observed and recorded in the museum setting.

In assessing the role played by the addition of the technology in the delayed recall process, we looked at several variables across the handheld and paper and pencil conditions. To begin with, we considered the total number of correct and incorrect responses provided by the two groups and observed that the group using handheld devices offered 107 correct responses and 34 incorrect responses as compared to the 92 correct responses and 44 incorrect responses from the paper-and-pencil group. This suggests that the handheld guides may have contributed to overall greater accuracy of information recall with technology-assisted learning in our study.

We then took a closer, more focused look at these results by measuring whether the information provided by participants had been solicited or unsolicited by the educator/moderator across the two conditions. In other words, did the participants volunteer the information, or was recall prompted by a specific question? We observed that the handheld group provided 78 instances of correct unsolicited information and 14 instances of incorrect unsolicited information as compared to 59 instances of correct unsolicited information and 31 instances of incorrect unsolicited information from students using the pencil and paper version. Thus, the group using technology did not require as many specific prompts in order to bring back to memory correct information of the artifacts, nor did they make as many mistakes as the paper-and-pencil group in the free recall of information.

Furthermore, we distinguished between the specific types of information recalled by the two groups. More specifically, we categorized this information as either "hard"—referring to information intrinsic to the object per se (such as design, age, material out of which it is made), and "soft"—referring to attributes that are not inherent in the object itself, but rather external attributes associated with it (such as social usefulness, its surrounding mythology, etc.) Our preliminary analysis indicates that 72% of the participants in the handheld condition correctly remembered the "hard" facts about the objects as opposed to 62% participants in the paper-and-pencil condition.
However, both groups showed a similar facility for recalling "soft" facts, with 82% of the students in handheld groups showing correct recall as opposed to 78% of the students in the paper and pencil groups. We can speculate that any difference in recall between "hard" and "soft" may be accounted for by the fact that, through their use of activities, the handheld devices made difficult-to-remember information (such as an artifact's exact age or its material composition) more salient, which may, in turn, improve recall.

The observations discussed above focus on the delayed recall condition. In addition, we reviewed the video records from the students' engagement in the Museum Detective activity. This information provides initial anecdotal evidence for further controlled exploration. When using the handhelds, students seemed to be engaged with the devices and were highly focused on the interactive modules. In terms of attention, we noticed that the handheld groups seemed to be able to concentrate on the exercise for long periods of time without interruptions, or without succumbing to other environmental diversions.

As a downside of the use of technological learning aids, we found some participants that dedicated less time to the museum artifact in favor of focusing on the handhelds. Some of the children spent most of their time looking at the device rather than at the artifact, even though the latter was right in front of them and was, after all, the object of inquiry. As we had designed the interactive modules with varying levels of active looking encouraged between the object and the handheld, further analysis will be conducted on whether this behavior corresponded with a specific Museum Detective exercise as opposed to the handheld device itself.

3. Future Directions

To date, the Museum Detective application has been used with over 300 students from area school districts During the museum visits, students exhibited a high degree of participation, engagement and excitement while using the system, and its implementation has been successful enough so that the Johnson Museum has phased out the paper and pencil version of the Museum Detective in favor of the handheld guides. As the handheld Museum Detective device moved away from its origins as a paper and pencil activity, the technology has allowed us to design for a richer interactivity. It would, however, be an oversimplification to use these preliminary results to state that the handheld guides provided a more effective guided learning experience. Instead, we would like to investigate how the addition of the handheld system transformed the context of the scripted activity with which the Museum Detective application is situated.

3.1 Design Implications and Evaluative Challenges

Again, it is important to emphasize that the Museum Detective activity extends beyond the software installed on the handheld computer. The integration of the interactive application into the larger context of social interactions between student and student, student and teacher, student and museum educator, and teacher and museum educator should inform any future design directions of the Museum Detective activity. The negotiation between students for the control of the handheld computer is an example of this relationship between the social context and the technological system. While the form of handheld computers encourage mobility, the smaller physical size of the device somewhat limited the collaborative nature of the activity since only one student in each pair could actively control and hold the Museum Detective interface.

The refinement of the evaluation methods employed is an ongoing process, as we continue to collect data on the different school groups that visit the museum. Metrics of recall must be balanced with the attempted codification of the effects of the experiential and affective aspects of the system. For example, the music clip at the completion of the module had no ostensible educational function but was observed to

be a feature highly enjoyed by the students. Determining frequency counts of the correct answers to multiple-choice questions is arguably more quantifiable than uncovering the aspects of the system that stimulate curiosity, motivation, and sociality. The evaluation of such constructs, however challenging, must be carefully considered and implemented so that we can learn to design technological systems that move beyond information delivery.

Again, the larger context of the activity, outside the museum environment, must be taken into account as we try to assess the repercussions of the Museum Detective application as the students return to their classrooms. The students' interaction with the Museum Detective application did not occur in a vacuum; instead, the experience was co-constructed by the students, teachers and museum staff. As a result, the evaluation process should not be so student-focused as to provide designers with a restrictive view of how the system affects the interactions between the actors.

3.2 Expanding the Interactive Frame

The notion that the use of handheld guides in the museum space can serve as a distraction reifies the ideal museum experience as one that supports unmediated communion between the curated object and the visitor. However, the implementation of a technological system would not be the only so-called distraction in this narrow definition of a museum experience. The presence of fellow visitors or the architecture of the museum may also serve to draw attention away from the displayed artifacts.

Instead, we propose that the frame of the museum experience should be expanded to include these so-called distractions as a way to make the museum visit richer and more interactive. By broadening the definition of the museum experience away from the passive transfer of information between curator and visitor, a situated technological system can be designed to play upon the architectural details of the space or to encourage reflection upon the social presence of other museum visitors.
An expanded frame of the museum experience should also possess a temporal component as the introduction of a technological system during one visit may affect the visitors' future visits, which seems especially salient in an interactive guide designed for students. Again, the evaluation of the Museum Detective application should not focus solely on the educational facts that may have been retained by the children but should additionally consider whether the 20-minute interaction with the system encourages the notion that the museum experience can be dynamic and entertaining or compels the child to return to the gallery even without an available handheld guide.

We have presented an interactive technological system that was designed to provide support for guided learning and in turn, the educational function of the modern museum. Initial evidence suggests that Museum Detective may have been successful in providing a context for interaction that may have translated to an increased engagement with the physical objects shown in the gallery space. We propose, however, that the handheld guide experience often extends beyond the frame of the device as well as the time and the space in which the application was used. Instead, future work should be cognizant of this extended context, where systems are designed for what comes before and what comes after the encounter with technology in the museum space.

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From the Gallery to the Classroom; the Hunt Museum Teacher's Resource Pack

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1. The Hunt Museum education service accompanying *Shades of Light, Evocations of Summer* exhibition.

The Teacher's Resource Pack was produced to accompany our summer exhibition, on show in The Hunt Museum's exhibition gallery from 8 June until 16 October 2005. ***Shades of Light, Evocations of Summer*** is the major exhibition in The Hunt Museum in 2005.

The exhibition fulfils international standards of excellence and aims to reach the widest possible audience. Included are works by Sir John Lavery, William Leech, Estella Solomons, Walter Osborne and George Russell (AE), some of Ireland's greatest artists. Paintings were sourced from both private and public collections with many usually unavailable for public viewing.

Apart from creating a Teachers Resource Pack, there is an extensive calendar of events surrounding the exhibition with programmes having a strong educational input. Special interactive workshops will be available for primary level in June as post primary schools will be engaged in exams. Workshops will be available for both primary and post primary in September, and in October, until the 16th.

2. Aims of the *Shades of Light, Evocations of Summer* Teachers Resource Pack

- Develop a visual awareness, an understanding and a response to images, not only in the exhibition but also in the everyday environment.
- Promote an interest in visiting museums and galleries.
- Provide teachers with resources that can be used at both primary and post primary level.
- Provide teachers with the opportunity to teach aspects of curricula with a fresh resource.

Produce and distribute a high quality Teacher's Resource Pack to schools free of charge, made possible by our generous sponsors The ESB and O'Mahony's Booksellers, Limerick.

3. Contents of Teachers Resource Pack

- Reference card: Introduction, How to use this pack, Further use of pack, Glossary, Bibliography.
- Keycards include information on artists and the painting as the well as discussion points, activities, tasks and projects.
- Paintings chosen for this pack:
    - Sir John Lavery, The Red Hammock.
    - Sir John Lavery, The Walnut Tree.
    - William Leech, The Little Blue Cart.
    - William Leech, Paper Parasols.
    - Walter Osborne, On Suffolk Sands.
    - Estella Solomons, Hayfield Near Rush.

4. Reference Card

The reference card can be used as a way to find out more about the pack as it provides an introduction, instructions for use, a glossary and suggestions for further reading.

4.1 Introduction

'This pack contains particular images of paintings included in The Hunt Museum exhibition, *Shades of Light, Evocations of Summer*. Paintings in the pack the were selected for their variety of subject matter with the broad age range of Primary and Post primary school learners in mind.'

The author chose 6 paintings from the exhibition which numbers 23 in total based on how they would appeal, how familiar the learners might already be with the image (Leech's 'Paper Parasols' was used as the promotional image) and what sort of interesting themes the were explored by the artists. The author kept both primary and post primary curricula themes as a priority in choosing the paintings. *On Suffolk Sands* by Walter Osborne is a charming painting of a small boy sitting on a beach with a donkey; it was chosen for its appeal to younger learners. The author chose Sir John Lavery's *The Red Hammock* as it was such a large attention grabbing canvas that would probably be questioned by learners if they visited the museum. This type of painting would particularly appeal to teenage audiences due to the biographical details about Lady Hazel Lavery as the well as the opulence of the fabrics and textures rendered in the painting.

'The suggested activities can be organised as discussions, pair work, group work, individual projects, debates and homework tasks. Teachers should choose activities based on age and ability of learners as the well as the dynamic of class groups. Please note that the term learner has been consistently used throughout the pack as it is appropriate for all ages.'

The pack suggests different methods of engaging and responding to the paintings by organising learners into pairs, groups or individuals in the class context. It is also suggested that activities can be given as a homework task or turned into a debate or class project. The aim was to make learning about paintings fun, so the author suggested tried and tested methods used in the museum context. Learners respond especially well to being introduced to a concept and then engaging in tasks that may involve communication or response.

4.2 How to use the pack

Clear instructions were provided with a sample icon displaying the layout of the pack.

a. Each keycard has an image of the painting as the well as biographical information about the artist and a description of the painting on one side.
b. The reverse has an icon of the image for easy reference.
c. There are a number of discussion points under the heading Context, ranging from simple questions to more complex concepts. These should be selected according to age of learner group and can be used to set the scene for any of the suggested projects or activities.
d. The suggested projects or activities are laid out in a way that can be used directly in lesson plans while there is also the opportunity for teachers to adopt and adapt.
e. An overview of the project is provided on the side column to the activity. The logistical organisation and curricular links are suggested in this section.
f. The activity is then described in a step-by-step format following an introduction which briefly describes the aim of the activity. The process of discovery and the resulting piece of work are given equal emphasis.
g. Relevant weblinks are provided on each keycard and can be used in conjunction with particular projects on each or used as a mode of exploration in their own right.
h. Field trips are suggested with many of the projects. Links have been made with relevant local heritage and cultural institutions.
i. Links have been provided with other paintings in the *Shades of light, Evocations of Summer* exhibition as the well as the permanent collection of The Hunt Museum.
j. Some of these paintings feature in the pack but most do not. These paintings could be requested as the focus of your visit to the Museum. They could also be used for research for older learners.

4.3 Further use of pack

Although the pack was designed to accompany a temporary exhibition, sustainable links have been created with the Museums permanent collection, as the well as ideas for use beyond the exhibition dates. The author wished to emphasise the importance of tying in a museum visit with pre and post museum visit activities.
The following suggestions were made on the reference card:

- The exhibition of paintings can be seen from June 9 to October 15 2005 in The Hunt Museum. Why not combine project work with a visit to the exhibition?
- Use keycards to curate an exhibition in the classroom.
- Use some of the suggestions from the pack as a method of exploring any works of art which a class might be interested in. All that would be required is a little research about the artwork and an image that could be presented to learners.
- Visit The Hunt Museums permanent collection and book a class in for the *Painting with Words* workshop or any of the other workshops suggested on the individual keycards.

4.4 Glossary

A glossary was provided to explain relevant vocabulary linked to the exhibition. The glossary served a secondary function of highlighting unifying themes in absence of an essay about the exhibition and artists. The author included words such as 'Brittany', explaining that was a place that many artists visited to paint, including many of the artists represented in the exhibition. The author also included explanations of artistic genres and movements such as 'Impressionism' and 'Realism' as the well as artistic terms such as 'warm colours' and 'texture'.

4.5 Further Reading

References were made to books that were used as sources for the information about the artists as the well as publications referring to museum education.

5. Reference Card

Each keycard has an image of the painting as the well as biographical information about the artist and a description of the painting on one side. In the case of William Leech's *The Little Blue Cart,* the biography was focused on his life and training up until the time he moved to Brittany to paint. The description focuses on colour and texture, light and shade which are highly relevant formal qualities in this particular painting.

On reversing the keycard, users find an icon of the key image with a number of questions that can be used to provide a context of exploration. These can lend themselves to discussions or provide 'warm up' questions before embarking on one of the suggested projects. Teachers should choose the questions as required depending on the group and there are simple and more difficult questions.

Each keycard has a variety of activities that could address aspects of any part of the primary or post primary curriculum. The author have also provided activities that could take 15 minutes, and then others that could take 1 hour, although the author have not recommended the timing in our side columns that provide instructions about the activities.

A short activity on *The little Blue Cart* could be 'Choosing your angle', where learners are set up in a task that encourages study of subjects from different angles. A longer activity might be 'A picture without paint' where the class are arranged into groups so that they can reflect on what summer means to them by having a group discussion, the group can then demonstrate their ideas with music, words, poetry and visuals. With each activity, it is expected that the teacher will read through the pack before hand and then use the suggestions as appropriate to their classes. However, most activities can be used directly in lesson plans.

Each activity has a side column that suggests the curricular links and general organisation of the activity. Age and timing of activity had been suggested in an unpublished draft but a decision was reached that they should not be prescribed. Teachers would have a better understanding of their class group's abilities as well as the dynamic in the classroom.

Relevant the weblinks are provided on each keycard and can be used in conjunction with particular projects on each or used as a mode of exploration in their own right. For example, one of the researchers (MD) discovered an excellent section on artists working in Brittany in the 19th century on Brittany Tourism's the website. Also included was a website that detailed the history of flea markets. These sites could be explored by learners or by teachers wishing to collect some relevant supplementary material.

Many of the key cards include suggestion for field trips, not just to visit The Hunt Museum but to consider links to other relevant local and national sites and cultural institutions. What is also common to all of the keycards is a number of icons of paintings included in *Shades of Light, Evocations of Summer* exhibition, and in The Hunt Museum permanent collection. The aim would be that teachers could select these paintings as part of their school visit or study the images in the classroom by comparing and contrasting them.

6. Dissemination of Material

An important factor in producing this Teachers Resource Pack was to ensure that it would be used, or at least disseminated in a way that would make it easily accessible for teachers. One pack was designated to each Department of Education listed school in Limerick, Clare, Tipperary, North Cork and Kerry. It is hoped that the dissemination of material could encourage further visits to the Museum.

The pack is also available on our the website www.huntmuseum.com in PDF format meaning that it can be printed off so that all teachers in a school have access to it if they are online. This will also be a practical way of printing off copies of images for pair or group activities. Learners can also access the material on the web, this should be particularly useful for Junior Certificate and Leaving Certificate Art students.

7. Conclusion

A major difficulty encountered in producing this pack was the short time span allowed for its production with only 8 weeks from starting the project with only ideas to the packing of the completed design. While packs like this are in demand from teachers, it would be interesting to discover different methods and formats of creating education materials with links to permanent and temporary exhibitions in museums.

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Letting Visitors Surprise Us

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Abstract
Truly open-ended experiences move beyond a shallow interactivity that predetermines what visitors achieve. If we want to provide these complex experiences in our exhibitions, we must choose our media with great care. This paper uses two exhibit components from The Tech Museum of Innovation to illustrate seven principles for successfully designing effective open-ended exhibits that let visitors surprise us.

1. Introduction

I've worked at highly interactive science and children's museums for almost two decades, and over that time I've become incredibly picky about the kind of interactivity in the exhibitions I create. I'm not satisfied with a shallow interactivity where visitors thoughtlessly push buttons, turn cranks, and flip levers. I have little interest in tightly scripted experiences where the visitor follows a series of steps to arrive at a pre-determined conclusion. I want visitors to truly engage their minds and emotions as they imagine, invent, take risks, persevere through early failure, laugh, question, share, and reflect. These truly open-ended experiences demand choosing media – high-tech and low-tech – with great care. They require that we expect the unexpected and allow the visitors to surprise us. I've boiled down the things I think about when creating these kinds of experiences to a few design principles.

2. Exhibits

The two exhibit components I use as examples, FishFeeder and Bug Puppets, are very complex, so I'm going to describe them up front. Both are from exhibitions I developed with cross-departmental teams at The Tech Museum of Innovation in San Jose, California, USA.

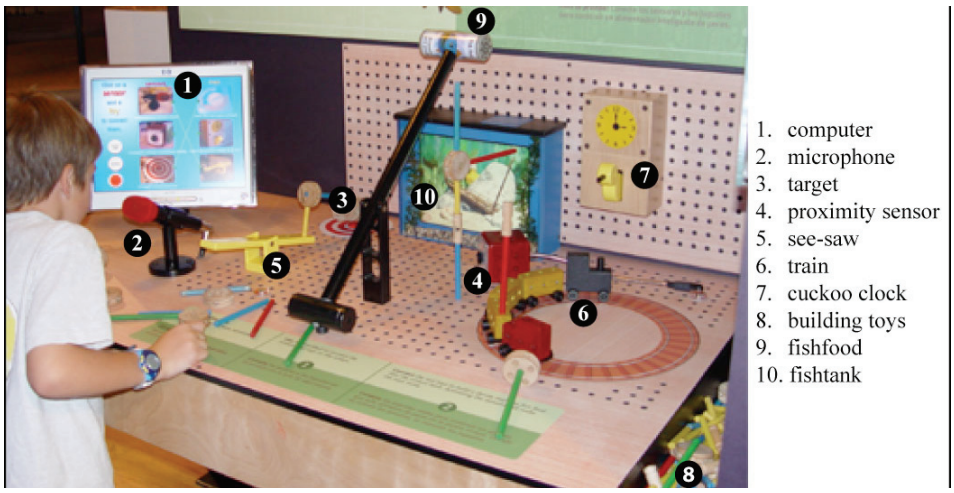

Fig 1. FishFeeder, from Silicon Workshop at The Tech Museum of Innovation, 2004

FishFeeder (Fig. 1) is a component of The Tech's Silicon Workshop, an exhibition about microchip design. For this piece of the exhibit, we wanted the visitors to design, build, and test a smart device – in this case, a smart fishfeeder. Visitors use a computer to link the input from three sensors (a microphone, a target, and a proximity sensor) to the output of three mechanical toys (a see-saw, a train on a circular track, and a cuckoo clock) that each move in a distinct way. The visitors build contraptions with wooden building toys (Tinkertoys) to make the mechanical toys knock a lever with fish food into the tank of a very hungry animated fish.

Bug Puppets (Fig. 2) is a component of Imagination Playground, an exhibit about creative play in this high-tech world. It is essentially a high-tech puppet show where visitors tell stories together. At each of the four stations, the visitor has a stuffed bug they move through the air to control a virtual bug on a large screen, a microphone that makes their voice sound bug-like, and a touchscreen with a camera that lets them give the virtual bug their own face.

Fig 2. Bug Puppets, from Imagination Playground at The Tech Museum of Innovation, 2002

3. Design Principles

3.1 Convince Visitors It's Worth Their Time – In Seconds.

These complex experiences work best if the visitor digs in and stays for a while, but there are a lot of things competing for people's attention in our exhibit halls. In order to be successful, the exhibit has just seconds to help visitors get started and to convince them that it's worth their time. Bug Puppets and FishFeeder have very different ways of achieving this. When visitors approach Bug Puppets, there are many things they can do first: they can talk into the microphone, pick up the bug and move it around, or they can use the touchscreen to take their picture. No matter which of these they do, though, the result is interesting, and they decide to stay and try something else. Eventually, the visitor puts the pieces together and begins to use all of the pieces together in a much richer way to create a personalized character that's part of the combined action on the puppet stage.

FishFeeder is potentially much more confusing. Although the affordance of each individual thing on the table is fairly obvious, the pieces interact in very complicated

ways. Early, more generic versions of the component did not include a fish to be fed, and when we prototyped the experience, visitors had no idea how to get started, and had a hard time thinking of things to do. When the materials aren't obvious to the visitor, I feel it is important to provide an obvious goal – in this case, to feed the fish. On his every loop around the fish tank, the animated fish knocks on the glass and pulls out a sign that says "I'm hungry!" in both English and Spanish. Visitors quickly notice his plight and set to work feeding him using the materials at hand. We also noticed that microphones are often starting points for visitors who aren't sure what to do, so we took advantage of that tendency to help encourage visitors to connect sensors to toys. In the exhibit's default mode, the microphone is linked to the train, the toy with the most obvious motion. When hesitant visitors speak into the microphone, they notice the train rotate and begin to get an idea of what they can do here.

3.2 Encourage Collaboration

I've always been interested in promoting visitor's social experiences in museums. Awareness of visitor's collaboration with each other is a particularly important tool for encouraging the divergent thinking these open-ended experiences need. Several Bug Puppet stations control the action on just one screen because we recognized that the stories people would tell with the bugs would be much richer and more spontaneous if they worked with other people rather than just one on one with a screen. We chose four different bugs with distinct characters ranging from butterfly to cockroach, to inspire narratives between the visitors. Certainly people are quick to tell stories with their family and friends, but the virtual nature of the puppet show also helps people feel more comfortable interacting with strangers. FishFeeder works well as a solitary experience, but there's plenty of room at the table for the two stools that encourage people to work together. The exhibit achieves cross-visitor pollination in another way as well. There are two complete FishFeeder tables side-by-side to encourage visitors to get inspiration from each other and to share ideas and solutions even as they work on their own contraptions.

3.3 Build in Opportunities for Finesse

To be truly open-ended, these interactives have to move beyond a discrete set of answers and reward finesse. Visitors should be able to make subtle changes to their creations and see a difference in what happens as a result. At FishFeeder, visitors build both the physical and logical structures of their smart device. If the visitor could only link sensors to toys and set up logical conditions for them to respond, there would be a limited set of things that the visitors could achieve. There would be no room for any sort of subtlety and finesse that is easily within a novice's grasp. With the Tinkertoys, visitors can tweak and nudge their contraptions physically using their pre-existing knowledge of the physical world to interpret the chains of cause and effect that they create.

3.4 Invite Creative Misuse

Even though FishFeeder gives people the goal of feeding the fish, it also rewards goals they set for themselves. The apparent goal gives visitors a way to get started, but the real point of the exhibit is to be a platform for their own explorations. Visitors use the materials on the table to build a wide variety of contraptions, and it's not uncommon that they have nothing whatsoever to do with the fish. The boy in the picture of FishFeeder excitedly showed what he had made: a rather sophisticated

feedback loop. He set it in motion with a shout into the microphone that made the see-saw go up and down. The see-saw continuously hit the target, making the train rotate and trigger the proximity sensor. The proximity sensor triggered the see-saw and the cuckoo clock so that all three toys would keep going forever and ever. Allowing for this sort of creative misuse of the exhibit was entirely intentional.

3.5 Throw in a Monkey Wrench

Materials that make visitors scratch their heads, and aren't obviously useful can encourage them to move beyond a quick and easy initial solution. Sometimes I try things in exhibits that I'm not sure will work. On the FishFeeder table, the cuckoo clock serves that function. I needed something that provided a linear back-and-forth motion, and I wanted to see how people would use it, since its motion is counter to what would be obviously useful to knock the lever into the fish tank. The engineers who were working with me were convinced that no visitors would have any idea of what to do with the cuckoo clock and resisted trying it at all. I finally convinced them to add it by calling it "Advanced FishFeeder" and agreeing that I would be satisfied even if only exceptional visitors used it at all. In the final exhibit, many visitors are intrigued by the cuckoo clock and try to incorporate it into their contraptions. Some visitors specifically set themselves the goal of using the cuckoo clock to feed the fish.

3.6 Prototype, Prototype, Prototype

Never lose an opportunity to learn how your design communicates to visitors. Since these truly open-ended exhibits require complex behaviors from visitors, I take extra care in the prototyping stage to see what affects the way visitors approach an exhibit. When prototyping Bug Puppets, we found that simply changing the arrangement of the microphone, bug, and touchscreen proved vital to how visitors used the exhibit. The motion capture device in the bug functions the best when the bug is in the middle of the table. However, when we prototyped it that way, groups of children used the pieces as separate experiences. We found that the exhibit worked much better for the visitor when the microphone was in the middle. After we made that change, people started telling stories and putting on puppet shows. If we hadn't prototyped it, the engineers would have insisted that we leave the bug in the middle, and the exhibit would never have worked.

3.7 Make Sure That Your Team Knows What Success Looks Like

This is not really a design principle, but it is an important project principle when creating open-ended, generative exhibits that let visitors be creative. Some visitors might not be willing to give these experiences the time they need, and they might not achieve that apparent goal of the exhibit: they might not feed the fish, they might not tell complex stories with the puppets. Even when visitors really do dig in, they might "invent" for themselves the exact same thing that the last ten visitors "invented." So what does success look like? What percentage of visitors actually digs in for a reasonable length of time? What percentage is enough? What sort of creative misuse is appropriate? If people don't know what success looks like, they won't recognize it when they see it.

4. Conclusion

I believe these open-ended experiences are worth the extra challenges in development and the extra care they often require for upkeep. I've made it my goal to provide

opportunities in every exhibition for visitors to create their own experiences, and have been rewarded by watching visitors engage deeply with these exhibits as they invent, imagine and learn. I'm sure I'll continue to use these design principles and to discover even more ways to make exhibits that let visitors surprise me.

Acknowledgements
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It's the Message, not the Medium

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Disclaimer
As working exhibition designers Martello relish any opportunity to step back from the fray to reflect with fellow practitioners, academics and researchers on people's experiences in museums. However, any insights we have to offer others are firmly grounded in our own working experience. So we make no apology for basing this paper primarily on the successes and failures of technological initiatives in museums and exhibitions with which we have been involved.

Abstract
Martello began as fervent evangelists for the potential of interactive computer technology to realize the 'Constructivist' dream of museums that explore multiple narratives and exhibits that allow visitors to construct role- playing scenarios and 'alternative outcomes'. However, after nearly twenty years, the diverse visions and aspirations of a range of clients and curators has taught us that us that the structure and the message are as significant as the media employed.
The 'Post-Modern' learning experience rejects a 'received' linear narrative.
The diversity of popular needs and modern expectations suggests that any single interpretative approach, or technological solution used in isolation, is unlikely to satisfy. Open information structures, changeable exhibits, non-linear spatial layouts and local community involvement can all be as important as interactive technology for creating successful 'Constructivist' learning spaces.
Thus Martello have been forced to evolve from being multimedia software 'experts' into 'Narrative Architects'; a diverse multidisciplinary exhibition design team willing to deliver on any combination of appropriate techniques to achieve our original 'Constructivist' goals.

Fig 1. Stowe Pavilion – The integrated design of a garden, a building and audio-visual content

1. Overview of the Evolution of Martello's Approach

1.1 The Multimedia Software Company

Martello began in the mid 1980's as the computer visualization arm of the LFA architectural design practice. The use of Apple's pioneering hypermedia program

HyperCard to create user interactive walkthroughs of buildings led to a gold medal from the British Computer Society and a conviction that the future of education lay with computer interactivity. Involvement with the Battersea Power Station Project and a proposed outstation of the V&A (Victoria and Albert Museum) in Bradford gave a Martello an interest in museum design.

1.2 The struggle to evolve 'Post Modern' Multimedia Exhibits

Producing interactive multimedia for exhibitions seemed a good place to try putting Martello's ideas into practice. Martello were anxious to explore the potential of role playing games, object labeling systems and open access to collections via the internet.

1.2.1 Open Outcome Scenario Games

An encouraging early interactive exhibition project was the Crawfordsburn Country Park in 1993. The Northern Ireland Environment Service saw the potential of Martello's enthusiasm for role-playing games. Touch screens allow visitors to scroll the Belfast landscape through 10,000 years of natural history. Visitors can also choose a type of home similar to their own and experiment with designing their own wildlife friendly garden. Crawfordsburn was an archetype of an 'infinite outcome' scenario that Martello developed into the more ambitious 'Virtual Sweden' in the Vatenfall Energy Attraction in Gothenburg in 1997. Here, visitors explore the likely environmental impact of a whole range of political, social and economic policies. Multiple points-of-view are encouraged; a range of virtual experts give conflicting advice before each decision is enacted.

Fig.2 Playing with infinite outcomes by redesigning Sweden

In 1994, the Louth County Museum saw the advent of multimedia as an opportunity to extend their limited collection with virtual artifacts. Instead of providing a pictorial database of linen objects in the care of the Ulster Folk Museum, Martello persuaded them to develop a computer game that challenges visitors to figure out the complexities of making a linen garment. Visitors could then use any combination of linen clothes to dress mannequins.

Despite the self-evident power and popularity of acquiring knowledge by such active problem solving, traditionalists could point out that this display would only achieve validity from the nearby presence of real linen artifacts. The intricacies of linen can be illuminated by any number of other display techniques; ideally by using the virtuous reality of real objects such as the working looms evident in Lisburn's Irish Linen Centre.

Despite the shortcomings, installations in Ireland soon attracted awards and attention from Britain. New commissions included a virtual clipper ship for a museum in Scotland. All of the possible outcomes and scenarios were based on archive newspaper clippings about the real voyages of the Dundee Clipper Line. Historic fact was being packaged in the matrix of seemingly random computer games. This was 'Constructivism' as a form of 'Presbyterian Predestination'.

Fig 3. Deconstructing the Catalogue in the Victoria and Albert Museum Silver Gallery

1.2.2 Deconstructing the Museum Catalogue

In 1995, the Keeper of Silver at the V&A in London saw Martello's virtual Dundalk in the Louth Museum as a basis to deconstruct the rigid 'taxonomies' of this classic Victorian institution. She commissioned a display that would take the objects in the Silver Galleries out of glass cases and set them off against objects, costumes, furniture and paintings from other departments of the V&A in the living tableau of a London street that could be scrolled through time. Visitors could click on doors and windows to explore different buildings within any time layer, or they could explore the changes through time within one location such as the shop, workshop, the bedroom, the dining room, or whatever. With hindsight this would have made for an engrossing CD-ROM to browse at home. But lack of investment in hardware meant that one small touch screen tucked away in a corner did little for the visitor experience of the serried ranks of object cases within the Silver Galleries.

In Ireland, the National Library realized the evident conflict between the 3 minute attention span of people standing in galleries, and the ability of the new technology to present every known document, image, memento and map in their collection, connected with the 1798 Rebellion. The four touch screen programs made by Martello for the 'Fellowship of Freedom' exhibition in 1998 were far more successful when published as a CD-ROM for schools than as gallery interpretation tools.
Other projects were even less successful in terms of Martello's 'Constructivist' pretensions. Screens in the Earth Galleries in London's Natural History Museum tell the story of 'Plate Tectonics' and 'Continental Drift'. Any hint of role-playing, or problem solving, apart from 'Go Next' was proscribed. The idea of celebrating alternative narratives by interweaving the human story of the heretical geological visionary Otto Wegener was rejected in favour of a cold 'scientific facts as they are now known'.

Fig 4. Updating information without multimedia skills at the National Concert Hall

1.2.3 Object Caption Systems in Museum Galleries

Nonetheless, many curators continued to be inspired by the possibilities of touch screens as object labeling systems. Under the banner of 'layering' the information, visitors can be confronted by bottomless pits of text, objects and images. Painful editorial decisions about what not to put on display can be conveniently avoided.

The difficulties inherent in 'object labeling' systems were demonstrated in the original Curator's Choice Gallery in Collins Barracks, Dublin, in 1998. A touch screen was the focus of a two -storey high display cabinet. A beautifully executed programme created by staff and the multimedia producer X-Communications, elegantly cross-referenced all of the objects against relevant sources. Unfortunately, the architects had placed auxiliary screens in a location where the magnificent cabinet and its contents could not be seen. The richness of information presented raised the unfeasible expectation that every case in Collins Barracks should have a similarly wonderful facility. The Curator's Choice was presumably intended for a rotating succession of favorite objects. This would demand constant and costly updating of the software.

One solution to the challenge of up-dating museum gallery systems suggested itself when Martello produced the foyer information system for the National Concert Hall. A 'drag and drop' template that allows staff without multimedia design and programming skills to update information (including video clips) on performances, times, ticket prices on a network of 50 inch plasma screens. Such a system could readily be adapted for museum cabinets with rotating exhibits.

2. Exhibition Design

2.1 The Limitations of the Multimedia Approach

In Martello's experience most museums and exhibitions are designed from the outside in. The spaces are often designed by architects who have yet to be told what is to be put into them. The AV and interactive programmes are often afterthoughts, inserted to mop up surplus content. Clearly, if the 'Post Modern' museum was to emerge, the narrative themes, the spatial layout, display media, lighting, audio-visual hardware, and interactive content all needed to be designed together. Thus, in 1999 Martello Multimedia determined to return to its architectural design roots to become Martello Media – Narrative Architects.

2.2 Martello Media Design – Narrative Architects

Several factors prompted Martello's transformation into an all-encompassing exhibition design/build company. Firstly, Ireland had benefited for a number of years from the attentions of London based design companies. These were international leaders in their field who had set high standards. Irish subcontractors such as Martello had learned much by working with them. However, the work of talented Irish designers such as Orna Hanley, Jack Harrison, Anne Scroope and others, had clearly demonstrated that the nuances of Irish narratives benefited from native design sensibilities.

Secondly, Martello realized that its in-house software production team also possessed the graphic, architectural and computer-visualization skills required for exhibition design. Thirdly, the problems of overlap with hardware installation companies had forced Martello to take over responsibility for specifying, designing, building and installing bespoke AV & multimedia installations and their casings and stands. It was short step from building these sophisticated exhibits for others to designing and building exhibitions as a whole.

2.3 Technology in Exhibitions Designed by Martello

Broadly speaking, exhibitions and visitor experiences divide into those based around 'interpreting' collections of real objects, those designed to interpret a particular location such as a historic building, garden or natural wonder, and educational 'play spaces' intended to let visitors explore a particular educational message, theme, concept or narrative independent of location and artifacts, such as a 'Children's Museum' or a Science Centre. In such places the audiovisual media can sometimes comprise the entire experience

Martello have had opportunities to design all three types of 'exhibition', whilst experimenting with technology in five principal areas. The first is in enhancing particular objects to stimulate the creative imagination of the beholder.

The second is to try to create immersive audio environments to carry the primary narrative and to take the pressure off text panels and object text labels.
The third way has been to use visual technologies to do much the same thing. The fourth area has been in developing audiovisual technologies to enhance rather than replace the human guide at historic sites. The fifth area has been in creating virtual experiences, role-playing and group collaborative learning in artifact free 'visitor experiences' where the audio-visual technology is obliged to carry the entire story.

The internet is important for museum promotion and remote access to objects and for creating new virtual collections, and so forth. But although Martello have been involved in web-based education projects such as Tree of Knowledge, the Welsh National Heritage and the RTE Millennium web sites, we have yet to work on any significant web projects for museums.

2.3.1 Helping Objects Speak

'A feature of good interpretation is that it has no imaginative prepossession on its audience; what it offers is an essay on or an exploration of the subject that at some vital point leaves it to the imagination of the viewer.....the role of authentic objects in establishing realms of imaginative freedom cannot be overstressed'(Cooke, 2000, 380).

Martello have had various opportunities to use technology to enhance particular objects to try and stimulate the imagination of the visitor. One way is to reverse the paradigm whereby multimedia programs mediate between the viewer and representations of objects. Instead, real artifacts can become the front end for role-playing programs. One example is the salvaged bridge of a real Manx Steam Packet boat in the House of Manannan in Peel which has large monitors in every window. Visitors are challenged to us the ships wheel and engine room telegraph to maneuver down the Mersey to reach the Isle of Man.

The 'Street' area in Birmingham's ThinkTank Science Museum contains everyday building materials and machines such as fire alarms, mechanical diggers, microwave oven and vending machines. All of them have embedded multimedia programs that allow visitors to explore their inherent qualities, inner workings and so forth. The user interface is always the object itself however.

Martello placed period telephones in the barracks museum at Dungarvan Castle that ring from time with urgent military messages, public complaints, etc. The Colclough Library in Tintern Abbey contains a filing cabinet of document and artifacts for visitors to rummage for each of 14 successive owners. The surprise element is audio 'sound paintings' of relevant events, a court case, a duel, a political execution and so forth.

Fig 5. Elements of surprise at Tintern Abbey

2.3.2 Using Immersive Audio to Carry the Narrative

Given that the subject matter was music it seemed appropriate to create an immersive audio environment in the Hot Press Irish Music Hall of Fame in 1999. Object and exhibits were placed in 23 successive, chronologically themed, zones. Looped sound tracks were delivered into each zone via directional infra–red emitters. The tracks could be picked up by headsets worn by visitors depending on their direction of view. Thus any single space could contain multiple sound-tracks, whilst any group facing the same video screen, or exhibit, would always enjoy a shared experience. Visitors could roam at will knowing that they would always hear the appropriate music and narrative, whatever they were looking at, without having to carry an audio guide or twiddle with track selection knobs.

The technical success of this approach was developed in a more interactive way when the Navan Fort Centre was refurbished in Armagh in 2001. In each of 15 exhibition zones, a looping iaudio track invites visitors to engage with a problem solving interactive screen, such as a virtual dig or an artifact dating game. Once a program is initiated, its sound track encourages others to join in and engage with the role-playing game as a sociable group activity.

2.3.3 Using Visual Technology to Carry the Narrative

The ‘textbook on the wall’ approach has been the bane of much recent exhibition design. In a recent refurbishment of the Monaghan County Museum Martello stripped out all of the text panels that seemed to gratuitously relate the entire history of Ireland so that the brightly lit galleries could be darkened and the beautiful artifacts dramatically highlighted. New touch screens allowed visitors to select a topic related pictorial slide shows using the museum’s extensive image library and document archive. Space was made for interventions and contributions by the local community.

The new exhibition in the Glendalough Visitor Centre employs a 'user responsive building' approach. Objects are displayed without captions in darkened galleries with darkened glass walls. However, if an infra-red beam detects a visitor showing interest by pausing at any particular model, artifact or tableau, back-lit text and images will appear on an adjacent wall space. Thus large amounts of information are available on a 'want to know' basis, without visitors being intimidated by a daunting cavalcade of wall panels or touch screens.

Fig 6. Responsive information walls in the Glendalough Visitor Centre

In the Herschel Museum in Bath, Martello decided to 'pre-interpret' the artifacts. Formerly, the visitor experience was an amble around a Georgian house with dusty glass cases full of dull looking tools, scientific instruments and un-decipherable notebooks. Martello used all of these as props and all of the rooms as locations for a filmed costume drama on the lives of William and Caroline Herschel and the discovery of Uranus. Viewed by visitors in the 'Sky Theatre' at the start of their tour, both the house, and the objects now take on the aura and mystique of a 'movie' set. The real is dramatized and validated by the virtual.

The Ireland Pavilion at the current EXPO 2005 in Japan tries to overcome language barriers by conveying a sense of Ireland almost entirely by sound and images. A limited amount of captioned objects are surrounded by plasma screen slide shows and floor to ceiling backlit transparencies. Touching objects such as various types of musical instrument triggers audio-visual footage of the same instrument being played on a nearby plasma screen. The ceiling of the central dome shows the 'day to night' cycle of Irish skies including a rain-storm and rainbows.

2.3.4 Audiovisual Systems to Enhance the Role of Tour Guides

One of the most satisfying types of visitor experiences is one mediated by a personable and knowledgeable tour guide. Many historical sites and heritage attractions are rightly committed to this approach. Attempts to combine this with audio-visual technology such as an AV theatre have often served to undermine the role of the guide and/or create circulation bottlenecks. Martello have recently been working with the OPW (Office of Public Works) on new ways of using AV technology to enhance the primacy and immediacy of the human guide.

St Mary's Church at Gowran in Kilkenny contains a cornucopia of medieval stone carvings. It was felt that a traditional exhibition display would intrude on the medieval ambience. Instead, a touch screen, discretely hidden in the pulpit, allows the OPW tour guides to surprise visitors by covering the chancel wall with linked sequences of images as they 'preach' on a range of topics, such as the Normans in Ireland, exterior carvings at Gowran, tomb iconography, heraldic symbols and soforth. Guides can use a matrix of pictograms to hop, skip and jump intone with the interest and questions of the tour group.

A more ambitious development of this approach to using multimedia as a prop for 'human performances' can be seen at Kilmainham Gaol, where the old 27 minute introduction AV was causing visitor flow problems on peak days. Nowadays, a two-projector system allows guides to present a range of topical slide shows that include audio, still and moving images against ambient mood projections. The guides can customize their content and overlay key point captions in a range of languages to cater for different interests and visitor numbers.

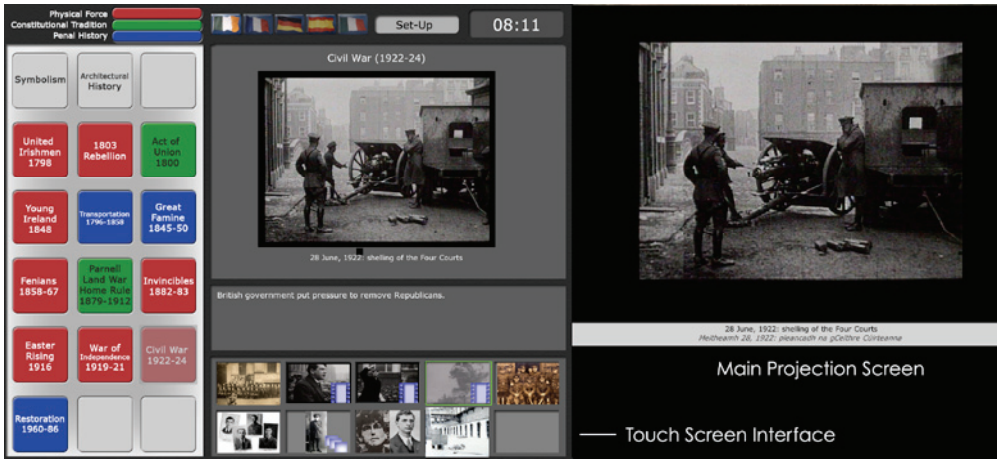

Fig 7. Tour guides can customise an audio-visual on the fly at Kilmainham Gaol.

2.3.5 Group Learning in 'Visitor Experiences' with no artifacts

Currently Martello are involved designing two new 'visitor experiences' where there is no collection of objects to be interpreted. The possibilities of technology have inevitably comes to the fore in creating immersive audio-visual and group collaborative exhibitions.

The first is the forthcoming Cliffs of Moher Centre. Here the cliffs are the unassailable focus of any visit. So the primary function of the Centre is to ensure that a good cup of coffee and clean toilets are at hand for 750,000 visitors annually. However, the cliffs can be obscured by bad weather one day in three. An engaging, all weather, exhibition that conveys the immensity of the place should be an adequate consolation prize for the many that come on the wrong day, and an inspiration to learn more for those who come in good weather.

The exhibition will have four themes; Ocean, Rock, Nature and Man, and like the Ireland Pavilion in Japan, attempts to overcome language barriers by keeping text panels and spoken narration to the minimum. Instead, self explanatory back-lit images, video projection and interactive graphic animations will be used. Competitive group learning will be encouraged by clustered consoles for networked 'video games'

such as ‘Atlantic Predators’- starting as plankton players can move up the food chain in the hope becoming sharks.
The climax will be a computer generated ‘virtual reality’ experience whereby groups of up to 100 people standing on a replica of the famous O’Brien’s Ledge are wafted into the air to soar the cliffs as a bird and then to plummet to the seabed and encounter all the teeming plant and animal life at its base. This is intended be an experiential ‘multiple narrative’ of the non-human kind.

Fig 8. Cliffs of Moher proposal

The Cliffs of Moher Centre will use a multi-sensory range of media to interpret its setting. Simple ‘touch’, ‘smell’, ‘listen’ and ‘place’ interactive quests and games will balance the more sophisticated technologies. The new Fit To Go gallery in the W5 science centre at the Odyssey in Belfast, on the other hand, is a pure example of the third category of exhibition. Here the interactive gaming technology comprises the entirety of the exhibition. Martello are collaborating with Immersion Studios of Toronto, who are the inventors of the ‘Immersion Theatre’, a cinema where everyone in the audience has a touch screen console. As well as voting on courses of action at key points in the dramatic narrative, viewers can research background information and use this knowledge to assist the on-screen characters to eradicate viruses, shoot down asteroids, avoid sharks, and so forth.
At W5, visitors will participate in space drama to save the crew of a mission to Mars infected by alien microbes. They will send ‘nano-probe’s into the human body to tackle the invaders. They can also use the surrounding Laboratory to play other problem solving games on issues touched on in the main video presentation, such as human reproduction, immunology, nutrition and exercise, and the basic requirements for living in space.
‘Fit to Go’ will also use the interactive cinema technology in an opinion monitoring space. Viewers can call up difficult topic such ‘Global Warming’, ‘Re-cycling’, ‘Smoking’, ‘GM Food’, ‘GM Babies’, and so forth, to hear contradictory ‘expert’ and ‘vox pop’ opinions. They can then use the consoles record their own views on a questionnaire. The sequence of questions is graduated to make visitors question their

own initial black and white assumptions. The results will be tabulated for the edification of successive visitors.

2.4 Non Technological Exhibitions

Since 1999 Martello have also been challenged by projects where the budget, or the nature of the subject matter, precluded using technology to drive the narrative. In the Botanic Garden of Wales for instance Martello designed a small museum called the 'Physicians of Myddai' which used very traditional display techniques to compare and contrasted the native Welsh tradition of herbal medicines with the great plant medicine traditions of the world such as the Mediterranean, Africa, China and the Americas. Nonetheless this still encouraged multiple voices and representations of the central topic.

Fig.9 The 'Physicians of Myddai' a very traditional display

More recently Martello designed an exhibition for the English National Trust in the Sheringham Park estate in Norfolk. Access to the real artifacts in Sheringham Hall is denied. In a nearby barn visitors are left to rummage through scrapbooks, cabinets drawers, suitcases trunks and scrapbooks crammed with facsimiles of personal letters, diaries, invitations, newspaper cuttings, keepsakes, toys, hair lockets, photo albums, game books, plant cuttings, tools, bills of sale, notes and architectural drawings. This has been well received by the public who enjoy being left to form their own judgments on the Upcher family and the ideas of the influential landscape designer Humphrey Repton.

3. Conclusion

During the 1990s Martello as multimedia developers worked hard to establish that the internet and interactive computer games could be used as the primary means to open out and deconstruct the traditional museum and replace it with the 'Post Modern' learning space demanded by 'Constructivist' theory.

Since becoming full scale exhibition designers Martello have learned that whilst artifact-less 'visitor attractions' can profitably use interactive technology as the

primary visitor experience, many heritage sites and most traditional museums with collections of objects to display benefit from a multi-sensory mixed medium strategy.

Detailed research and evaluation at the Boston Museum of Science supports this approach, providing evidence that a mixture of traditional methods of presentation (cases with artifacts, dioramas, graphic panels, labels) supported by hands on sensory components (touch, listen, smell) and interactive problem solving is the most successful solution for audience engagement. Rather than throwing out old exhibits in favour of high-tech replacements they recommend a strategy that 'preserve the more traditional cases and exhibits but increase access by adding multi-sensory interpretative components' (Hein et al, 1994, 237)

Many of the defining characteristics of the Post-Modern museum, such as open non-didactic information structures, multiple voices, group collaborative activities, role-playing games, non-expert interventions, local community contributions, visitor opinions, and so forth, can often be achieved by relatively low-tech means. So at the end of the day it is the structure, strength, and clarity of the message and/or issues to be highlighted and debated that is the most important starting point for designing an exhibition. When considering technology in museums it is the message being sent and not the medium being used that makes the most impact.

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Rethinking Interactivity: Design for Participation in Museums and Galleries

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Abstract
There is a growing interest in museums and galleries to deploy novel technologies, such as computer exhibits, information kiosks and Personal Digital Assistants (PDAs) in their exhibitions. Museum managers and designers hope these technologies can help to facilitate new forms of participation and interactivity and enhance people's understanding of exhibitions. This paper puts the impact of social interaction on people's museum experience and understanding at its heart. It briefly discusses observations and findings from video-based field studies that we have undertaken to explore visitors' conduct and interaction in museums and galleries. It uses the finding from our studies to begin to develop a number of design sensitivities that may be considered when designing and deploying new technologies and systems in museums and galleries.

1. Introduction

In recent years there has been a growing interest in creating new forms of participation in museums and galleries. Substantial funding has been committed to the design and development of new exhibitions and galleries in order to facilitate the engagement of visitors and enhance the experience of visitors and their learning opportunities. New tools and technologies have played an important role in this regard enabling designers, curators and museum managers to develop exhibits that facilitate interactivity and enable visitors to engage in more complex forms of participation in the museums and gallery space (Schiele & Koster 2000). In some cases, these technologies are used to provide more flexible and wide-ranging information concerning established objects and collections, in others they form part of the exhibit itself (Bradburne 2000; Ciolfi & Bannon 2002; Hall, Ciolfi, Hickey & Bannon 2002; Koleva 2001; Schulze 2001). However, it is increasingly recognised that these new forms of interactivity, whilst enhancing the individual's engagement with particular exhibits, often do so at the cost of impoverishing co-participation and collaboration. Indeed, 'interactivity' is not infrequently conflated with social interaction (Heath, vom Lehn & Osborne 2005).

In this paper, we wish to provide a brief overview of a programme of research concerned with interactivity and interaction in museums and galleries that we have been undertaking over the past five years or so. The programme involves close collaboration with curators, museum managers, educationalists and designers, and with museums and galleries that specialise in the arts and decorative arts as well as science centres and science museums. The research primarily involves fine grained video-based field studies in museums and galleries concerned with understanding the conduct and interaction of visitors both with and around exhibits. It also involves working closely with designers, curators and artists in developing and deploying

interactive exhibits and undertaking studies of their use. Underlying the research is a commitment to using new and old technologies to enhance engagement and participation in museums and galleries and in particular to create new forms of co-participation and collaboration. Towards the end of this paper, we will sketch one or two more general design sensitivities that have emerged through our empirical studies and naturalistic experiments.

2. Interactivity

In science museums and science centres there has been a growing commitment to the deployment of conventional computer exhibits that are largely based upon standard hardware and interfaces. Screens are relatively small and rather than a keyboard the exhibits often rely on a touch screen interface. Leading museum spaces such as the Wellcome Wing of the Science Museum in London and science centres such as @Bristol and the Glasgow Science Centre have a significant number of these types of exhibit. The model of interaction embodied in these exhibits is a conventional computer-based exchange that largely consists of a series of actions by the user coupled with prompts and/or responses provided by the system. Through a series of moves the user seeks to achieve a particular goal.

The form of interaction afforded by these conventional computer exhibits prioritises the individual user and largely neglects collaboration and simultaneous co-participation. The systems require an individual to follow and respond to instructions displayed on the screen. The interaction with the system is scaffolded to elicit successive, single actions from the user in response to 'moves' by the system, be they instructions, questions, queries or whatever. It is organised by a series of two part sequences of action, computer-user, computer-user and so on, - which is designed for the use of a single respondent. Indeed co-participation is often restricted to a friend or family member attempting to help someone understand and use the system. Not infrequently, when they do try to engage in the task, the principal user will try to resist their interference (Heath, vom Lehn & Osborne 2005).

The impoverished forms of co-participation afforded by these conventional computer exhibits can often be seen in the ecological arrangement of visitors that gather around exhibits. For example, it is not unusual for queues to emerge where people waiting in line have restricted access to both the user's actions and the system's operation. Moreover, people often arrive at some point during the activity, so by the time it is their turn, they already have a fragmented partial experience of the exhibit. The scale and positioning of the screen and the interface and the structure of the interaction afforded by the system, do not simply prioritise the individual user, but also transform those gathered around, often waiting to use the exhibits, into an audience that has impoverished access to the activity that they are witnessing. This is hardly surprising since museums and galleries have liberally deployed conventional computing technologies primarily designed for single users into their public, collaborative spaces (Heath, vom Lehn & Osborne 2005; Semper 1998).

These problems are not only limited to the deployment of computer exhibits in science museums and science centres. In the arts and decorative arts there has been a growing interest in using screen-based systems to provide visitors with enhanced information concerning the objects and artefacts within the gallery and exhibition areas. Two developments have been of particular significance, information kiosks and multi-media mobile devices (Exploratorium 2001; Schulze 2001). The deployment of these devices in museums raises one or two problems. *Information kiosks* largely consist of a screen alongside particular exhibits. The screen provides information

including, for example, brief films of the piece's production and operation, textual descriptions, diagrams and the like. When people arrive at the exhibit they often turn to the kiosk and become an audience to the information delivered by the system and spend more time with the system than with the original object. In these cases, the information kiosk displaces the object (Heath & vom Lehn 2004; vom Lehn & Heath 2005).

Multimedia-mobile devices like PDAs have risen in popularity with museum managers because they promise to address some of the problems of information kiosks. They allow visitors to access digital information while examining particular exhibits. Our observations suggests that while people face the exhibit they often attend more to the device than to the original object. Like information kiosks PDAs may displace the object (vom Lehn & Heath 2005).

Both, information kiosks and mobile devices prioritise the individual user. They are operated and accessed via small interfaces that do not support collaborative use and enquiry. Yet, people often come with companions to a museum and try to coordinate their exploration and examination of exhibits and information resources with each other. In many cases, they develop a curious division of labour, one participant attending to and voicing the information delivered by the system the other viewing the original object and articulating her/his discoveries. When all members of a group use a PDA they either separate for the duration of their visit or try to synchronise the information delivery by the system; they attempt to press the 'play-button' at the same time or may look for possibilities to connect multiple headphones to one device. In many cases, their attempts to collaboratively view and examine a museum fail when they use novel digital resources. They give up either the device or the interaction with others.

3. Contingent Participation

Our studies of people's interaction with and around computer exhibits and information systems have arisen in the context of a programme of research through which we have recently begun to explore how visitors explore and make sense of museums and galleries. We hope detailed, video-based studies of visitors' interaction with and around different kinds of exhibit may make a contribution to the development and deployment of novel exhibits and exhibitions. We are particularly interested in the ways in which people experience exhibits in and through their interaction with others, both those they are with and others who happen to be 'within perceptual range of the event' (Goffman 1981).

Our studies demonstrate that social interaction forms a pivotal and a virtually unavoidable part of people's experience of museums. Visitors normally come and explore exhibitions in concert with companions and in coordination with other people who happen to be there at the same time. While participants explore the museum they are continually aware of and sensitive to each other's actions in the same space. Their awareness of events in the locale allows participants to organise their participation with exhibits with others (vom Lehn, Heath & Hindmarsh 2001).

The studies begin to reveal that the context in which visitors see and experience exhibits is not prefigured by the design and arrangement of the artefacts but emerges in and through their action and interaction. Participants see an exhibit in the light of exhibits they have seen before and in anticipation of exhibits they see next (vom Lehn, Heath & Hindmarsh 2001).

When participants arrive at an exhibit in use they draw on their observation of the action and other material to gradually become involved in the interaction at the

artefact, for example, by commenting on and instructing action, by helping the user in interacting with the exhibit and understanding its meaning, and so forth. They often examine and see exhibits in collaboration and interaction with companions. They try to stimulate a particular response to an exhibit in them by providing them with resources to make sense of the artefacts. Through their bodily and material conduct they animate and enliven the exhibit's features to configure how others may see the exhibit (Heath & vom Lehn 2004).

4. Crafting Participation: Naturalistic Experiments

Our video-based studies in museums have demonstrated the complexity of the ecology of participation in exhibitions that needs to be recognised when designing and deploying exhibits. We have used our detailed observations and findings to undertake a series of naturalistic experiments in close collaboration with the Interactive Crafts Group at the University of Staffordshire.

The experiments with the design of particular objects and artefacts help to develop an understanding of those exhibit features and characteristics that may facilitate social interaction and collaboration. They involve the successive design and display of arts- and craftwork in public exhibitions to explore the effects of changes in exhibit features on people's conduct. Resulting from our collaboration with the Interactive Crafts Group we displayed a number of exhibits, including "Deus Oculi" (1999), "Ghostship" (2002) and the "Universal Curator" (2003/04). The exhibition of the craftworks was accompanied by detailed, video-based studies of people's interaction with and around the pieces that informed the design and deployment of each next exhibit. The three craftworks were intended to occasion humour, surprise and discovery, encourage enquiry and exploration and facilitate social interaction and collaborative examination.

The video-based studies of the craftworks reveal that they stimulate relatively long sequences of engagement and interaction in which people discover the functionality. The functionality is embedded in the relationship between spatially distributed parts of the exhibits. People discover the relationships between their parts by collaboratively exploring the pieces and by observing others' interaction with and around them.

Social interaction and collaboration are critical for people's understanding of the craftworks; without interacting or collaborating with others people cannot discover the functionality of these pieces due to the physical distribution of their functional parts. We have observed different forms of interaction and collaboration at the exhibit. For example, participants produce relationships between exhibit features by virtue of verbal explanations accompanied by gestures and bodily conduct, participants coordinating their examination of different parts of the craftworks with each other, participants revealing the functionality between different parts of the exhibit by generating surprise and occasioning laughter, and participants collaboratively producing their own exhibitions and creating stories that bring their pieces to life (Heath, Luff, vom Lehn, Hindmarsh & Cleverly 2002; Hindmarsh, Heath, vom Lehn & Cleverly 2005).

The exhibits were relatively successful in generating different forms of participation and interaction both amongst companions and between strangers. Yet, in some ways they failed individual visitors. Individuals had difficulties in understanding the relationships between the different parts of the pieces. They relied on a member of staff, the researcher, the artist or another visitor to step in and make the exhibit work with them (Hindmarsh, Heath, vom Lehn & Cleverly 2005).

5. Design for Interaction and Collaboration

The design and deployment of exhibits and systems in museums and galleries is an extremely challenging task that cannot ignore that people normally examine and make sense of exhibits in and through social interaction. They explore museums in interaction with their companions and coordinate their conduct with other visitors who happen to be in the same space.

Exhibits are used and examined by people from diverse socio-demographic and ethnic backgrounds, of different age groups and with different educational biographies in highly complex and contingent social situations. This puts huge demands on exhibition designers to create artefacts that can be inspected and understood by a variety of people who just happen to be in the museum at the same time interacting with each other. Detailed, naturalistic studies in museums may help revealing the social organisation of people's conduct and interaction and inform the design of new exhibits and systems.

The analysis points towards a number of research interests and opportunities that we currently pursue in collaboration with exhibition designers and curators. We will further explore and unpack theories and concepts of 'interaction' and 'participation' that currently pervade the work of museum managers, designers and evaluators. We use our studies of people's conduct and interaction in museums, galleries and science centres to create a catalogue of 'design sensitivities' that may inform the development and deployment of future systems created to enhance people's experience and understanding of exhibitions. The most relevant for the development of exhibits and interpretation resources that facilitate social interaction and collaboration are (Hindmarsh, Heath, vom Lehn & Cleverly 2005; vom Lehn & Heath 2005):

- Recognising that social interaction is critical to people's experience of exhibits and exhibitions. They come with companions and meet others who happen to be there at the same time.
- Providing opportunities for sustained interaction with and around exhibits by offering resources for participants themselves to creatively shape and configure the experience of others, either by changing aspects of the display or by other means.
- Creating spaces for individual, private participation with exhibits and providing individual visitors with resources to examine and make sense of exhibits designed for multi-parties.

With our research we hope to shift away from the impoverished notions of the 'viewer' and the 'user', 'interaction', 'participation' and 'collaboration' that pervade discussion and debate in disciplines concerned with the design, deployment and evaluation of exhibits and information systems. We currently collaborate closely with exhibit designers and curators to experiment with novel techniques and technologies to create exhibitions that facilitate and support a social and collaborative museum experience.

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Using Technology in the Permanent Exhibit of the United States Holocaust Memorial Museum—Thoughts after a Major Evaluation

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Abstract
A recent major evaluation of the Permanent Exhibition (PE) at the US Holocaust Memorial Museum resulted in findings suggesting that visitors want more information about the history, but at a time other than just after their exhausting tour of the PE. New technologies such as radio frequency identification can extend their visit and provide opportunities for follow-up that may result in community-building and better learning.

1. Introduction

From September 2003 through December 2004 the United States Holocaust Memorial Museum (USHMM) conducted an extensive evaluation of its Permanent Exhibition (PE)—the Museum's main exhibition on the history of the Holocaust. Various findings from the evaluations suggest ways in which technology can be effectively employed to improve the visitor experience. For the purposes of this position paper, I will concentrate on the implications of the assessment on how technology can be used within the PE to extend the relationship with visitors once they leave the Museum. That extended relationship provides opportunities for deeper and better kinds of learning—learning tied to the key messages identified for the PE.

The Call for Participation for the Re-Thinking Technology in Museums workshop seems to "take to task" the way technology has been used in museums heretofore. In the USHMM, we long ago made the decision that the use of technology like computer kiosks within the PE would be overkill. There is an abundance of visuals, text, film, and sound already integrated into the Museum's very popular exhibit, and any more technology would seem intrusive and superfluous. Still, in this writer's opinion, there are opportunities to use technology in ways that don't intrude, but focus attention, and don't isolate people from one another, but create community.

There are certainly opportunities for creative and successful applications of technology in the USHMM's traveling exhibits. The traveling program produces exhibits that are, by necessity, flat and not experiential like the PE. There, technology can serve to be a barrier to the kind of "window shopping" that visitors tend to do in traveling exhibits that are text-heavy, and packed with unfamiliar history. Technology can focus, orient, and create spaces (schemata) in visitors' minds into which this new information can fit.

Furthermore, technology can build community rather than isolate. Lee Rainie, from the the Pew Internet and the American Life project, recently wrote about the future of

the Web that "interactivity matters profoundly." Rainie adds that "you are in constant conversation with your users" and "people like to create content and expect to be able to interact online." He backs that reality up with research: 44% of adult Internet users have created content and posted it online, and 57% of broadband users have done so. In other words, people—especially young people—are building their communities online. There is no reason technology within the Museum space can't be the starting point for that community.

For the remainder of this paper, I will concentrate on the PE evaluation and the possibilities I see for technology with the Museum's walls.

2. Evaluation Reveals Opportunities for Using Technology

The Permanent Exhibition at the United States Holocaust Memorial Museum is an immersive experience. Visitors who come to the Museum not knowing what to expect often anticipate a "ride" or some other intensive experience. They usually are not disappointed by what they experience. They start by receiving an "ID Card" of a person that was a victim of the Holocaust (who either perished or survived) and are told to refer to those cards throughout the exhibit. Once they receive the card, they are captivated by an exhibition that takes between 90 minutes to three hours to tour. The exhibition has many parts and much information as this is a complex history, but the goals of the PE can be summarized in "seven key messages:"

1. The constant need for vigilance in protecting civil rights in democratic societies.
2. The scope of the Holocaust and Nazi persecution was an unprecedented human tragedy.
3. The dangers of racism, bigotry and Antisemitism.
4. Individual choice can make a difference.
5. Even in impossible circumstances, resistance and hope are possible.
6. Thought the Holocaust occurred in Europe, America was not unaware or uninvolved.
7. War enabled genocide to happen.

One broad conclusion of the Evaluation of the Permanent Exhibition prepared by People, Places, & Design Research for the USHMM is that "the general outlines of the Holocaust story are known to most people who visit the Museum." Another is that "in the months following their visit to the Museum, visitor perceptions and reactions endure but become more generalized, and that "visitors perceive the interpretive messages in their own terms." These results suggest that visitors are trying to make sense of a history that they already have some information about. But as the Museum's key messages filter into the minds of its visitors, are they really taking root? One piece of the evaluation results suggests not. "In the months after visiting the Museum, about half of the visitors' perceptions about vigilance are expressed as "never again." "Never again" is a powerful but simplistic slogan that really seems to relieve the individual of their responsibility in a society. The use of "never again" suggests that visitors had a powerful experience, but might not remember enough of the key messages for it make a difference in their lives. Can technology help? I think so. But let's look at one other bit of data from the PE evaluation.

Asked at the exit of the PE, "Would you be interested in any additional experience—such as a film, program or special exhibit on related topics—or does it feel like this is enough for today?" 31% of the 419 visitors responded that they had an appetite for more on the day of their visit, while 61% said they would like to "attend" continuing programs at some later time. These data suggest that we should concentrate on expressions of the history outside of the Museum to reach those who want more, but on a different day. Web technology is well suited for this.

By offering "stations" within the PE next to exhibits that are popular or offer key messages, information of interest to visitors can be gathered. Once visitors return home, the information they gathered is waiting for them on a personalized Web page built by an automated process based on their preferences. By using radio frequency identification (RFID), a technology which allows an object or person at a distance to transmit data to a receiver using radio waves using some form of tag or card (commercial applications include inventory), these stations can fit right into the existing exhibit without seeming to add an extra layer of technology. Visitors to the PE could carry some sort of tag with a ultra thin RFID "tag" that allows them to collect information from areas of the exhibit that interest them. The information collected would be organized according to the seven key messages the Museum wishes to convey on the visitors' personal Web pages.

We can look at another area of the PE evaluation for a clue as to what kind of RFID tag-embedded item visitors might carry with them. Visitors already carry an "ID Card" with them throughout the PE. When asked whether the ID Cards add something to the visit, 81% answered that they do, and the majority agreed with the statement that "ID Cards remind us that the events of the Holocaust were not so far in the past." The ID Cards are a positive experience for visitors, although some said that they would like more information on "their" person. In addition, according to the writers of the PE evaluation, "some visitors suggested that it would be interesting to connect the ID Cards to parts of the exhibition where their story was relevant."

There is commonality between these two results from the PE evaluation: visitors would like more information, but at another time, and they like the ID Cards and that it would be interesting to connect them to parts of the exhibit. There is an opportunity to serve the needs of the visitor and the expressed needs of the institution and its seven key messages via a technology intervention of RFID-embedded ID Cards. Walking through the PE, visitors may collect information by simply touching their card to a "collection point," or some other action. What waits for them at home is a unique Web page with the ID Cards they carried with them (and appropriate links from the card to people and places associated with the history of that person) and the information they collected. That information could be categorized by the seven key messages further reinforcing the ideas that the USHMM considers most important.
This kind of technology intervention is built upon each individual's experience in the Museum. Furthermore, it does not interfere with the "communal space" that the PE can be by allowing visitors to experience each other as they tour the exhibit. Indeed, this approach has the potential to build community. Upon returning home, visitors presented with a personalized Web page may be asked to contribute their ideas to the Web site, add comments to a forum, or write about some aspect of Holocaust history that touches them. In addition, the technology offers us the ability to present information about other visitors to the PE who may have common interests. Perhaps

there were a few people who collected nearly the same information during their visit to the PE. They may want to chat about that. RFID allows us to collect some demographic information. We could suggest places in the visitors' local community where more information may be found. Moreover, we could offer suggestions for getting involved in one's school curriculum or efforts to prevent antisemitism or genocide.

Follow-up experiences such as these may result in the history becoming more a part of individual's experiences and responsibilities. If so, the Museum stands a chance to turn "never again" into "not this time, and not on my watch."

3. Epilogue

The USHMM continues to do research on the use of RFID and other technologies in the Museum to increase visitor understanding and involvement. Other development includes "camera kiosks" that allow visitors to respond to a question related to USHMM exhibitions by leaving a video message that may be posted on the Web or used on monitors with in the Museum, orientation kiosks to help wayfinding, stations for e-ticketing and membership, and the use of the high speed network of Internet2 to connect secondary schools and universities with the live events that happen in the Museum.

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Informant Design with Children - Designing Children's Tangible Technology

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Abstract
This paper introduces two informant design workshops involving schoolchildren. By employing museum objects in a virtual museum exhibition room, and by telling children what is happening in the museums, museum environments were created in both workshops. We found children like visiting museums especially with their friends. They are more aware of the relevant technologies than we thought. They like wrist band and handheld small devices which they can carry around. We also found boys demand more technological looking devices than girls. 'Cool stuffs' like dinosaurs in the museums interest children a lot; they enjoy drawing and it is a way for them to express their ideas.

1. Introduction

School children are one of the major groups visiting museums; we are focusing on designing technologies to help them to learn in the museum environment. The project title is "Designing Tangible User Interfaces (TUIs) for assisting children's learning", the workshops are examples of involving children at the earliest stage of concept development as co-creators; in the future, similar work will be done for the different stages of the design process leading to the production of a final prototype.

To understand the users, their needs and preferences, children are involved in the design process, 'informant design' (Scaife, Rogers et al. 1997) is the method we are using. In the design, children or teachers are seen as experts or 'native informants' informing designers of key issues related to their experience, helping to develop early design ideas and testing prototypes in development (Facer and Williamson 2004).

Children are different from adults, they love to draw, use clay, build with blocks, watch videos and play games, and most of these activities are in the form of playing. Unlike a traditional classroom, the museum learning environment is informal and less rigid, which can provide children with more freedom and opportunities to do the things they like, therefore motivating and helping them to learn. Interesting exhibitions can support children's curiosities, foster their learning motivation and trigger new ideas in their young minds; the visiting experience may benefit them for life.

Children learn from playing, and fun is one of the key factors in their learning. Therefore creating an 'Edutainment' (educational and entertaining, a game-like educational environment) environment is sensible.

2. Design Tangible Technology for Children

From a psychologist and educationist point of view (O'Malley and Fraser 2004), tangibles are beneficial for learning because: physical action and concrete objects are important in learning; physical materials give rise to mental images which can then guide and constrain future problem solving in the absence of the physical materials;

learners can abstract symbolic relations from a variety of concrete instances; and physical objects that are familiar are more easily understood by children than more symbolic entities.

What is required for a new technology from children? Druin (Druin, Hanna et al. 1999) pointed out that what children want in technology are control, social experiences and expressive tools. The technology should support their curiosities, their love of repetition and their need for control (Druin and Solomon 1996). Tangible User Interfaces (TUIs) can be the technology for children and fit these requirements. There are already some works (Hall, Ciolfi et al. 2002) have carried in the museums with tangible technologies, which gave us some insights in the practical side of the new technology.

Unlike traditional interfaces that rely on a limited variety of physical objects and a limited range of our abilities, TUIs offer direct manipulation of physical objects and provide more means of interaction. They overcome some of the limitations of traditional interfaces: they are more explorative, collaborative and expressive compared to the traditional interfaces.

Tangible technologies can benefit children's learning in many ways; the following are some of them.

TUI requires little time invested in learning how to use the interface. We are born with the ability to manipulate objects tangibly with little cognitive effort. TUI is a natural interface which requires little cognitive effort to learn, therefore children can concentrate more on the task rather than how to use the computer or software.

TUI offers users alternative methods of interaction and control of the computing environment. TUIs can offer a variety of interactions, they allow users to solve problems with concrete physical objects and physical actions when they fail using more abstract representations and complex syntax, therefore TUI can empower children with the control of the computing environment; they will feel and "own" the environment, will be actively engaged, and will not lose interests so easily.

TUI supports 'Trial-And-Error' activity. TUIs give continuous presentation of the object of interest. They use rapid incremental and reversible actions whose impact on the object of interest is immediately visible.

TUI supports more than one user. The advantage of using a TUI is that it is no longer restricted to a single user; children can sit down and collaborate with their friends face to face in an entirely natural way. It can provide children with a social experience. Also children are more productive when they cooperate, therefore compared to a single child a group of children may be able to do a task more efficiently and benefit more from the experience.

3. Informant User-Centred and Learner-Centred Design

There are different ways of involving users at different stages of the design process: user observation, user testing, informant design, participant design and cooperative inquiry. Our project is at the outset stage and we need to get initial ideas about our design; informant design is appropriate at this stage (Facer and Williamson 2004) (Read, Gregory et al. 2002).

Informant design starts with early discussions principally motivated by specific subject-related issues in which children and teachers are asked to identify problems and issues in their educational experiences. Based on these initial inputs, teams working with informant designers are able to transform the list of problems and issues into 'high level functionality requirements' for the design. What follows is low-tech prototyping using everyday materials such as plasticine, crayons and paper, in which

children and teachers, working together with designers, come up with designs and ideas for motivating activities and interfaces.

3.1 The Design Workshops

We planned the workshops in advance with the aims, output, duration, participants and settings decided. Also we checked the plans with the teachers for final confirmations.

The first informant design workshop involved twelve children (age between eight and nine) and four researchers. Children were divided into two groups by gender. The theme of the workshop was about "Devices to support a museum visit"; they were provided with pictures to recall museum scenarios. The pictures represented museum objects, people (alone and in groups, children and adults) in museums with and without technology devices. Then we let children imagine they were in the environment and asked some questions including: 'What do you like and dislike in museums?', 'What do you like to do in museums?', and 'What would you like to have with you during the visit?' The last twenty minutes was given to them to draw the device and make it with paper, card, and other low-tech prototyping materials.

The recent workshop was different from the first one in the ways of organising and the people who were involved. The workshop involved only five children, they were slightly older (age between nine and ten) and two researchers, we all worked in one group. The style of the workshop was more guided compared to the first one. "Designing personal pen based devices" was the design theme. The workshop was carried out in a room of around fifty square meters. We made it empty, thus providing a hazard-free zone for the children and us to work on the floor. Two antique cameras were borrowed for our 'museum display'. Paper and craft materials were used for the low-tech prototypes (Fig 1).

Fig 1. 'Museum Artefacts' and Low-tech Design Materials

To start with, both researchers welcomed the children and one of the researchers told the children what we were thinking about: a device that is carried around a space and is operated just with a pen. When the device gets near to something interesting it gives information about it maybe to read, to listen to or to see, it lets you take notes at the same time and may let you explore other information about the device.

Then we started designing the device, which contains three stages: design the logical device, design the physical device and design the interaction. We explained the tasks to the children and gave them the time constraints.

3.1.1 Design the logical device
We asked children to tell us what the device should do; we generated a list of tasks that the device would do on a whiteboard that everybody could see. We agreed on the essential tasks that the device needs to support; we also wrote the list on post-it notes for each individual child.

3.1.2 Design the physical device
We asked the children what the device would look like. They did their own design sketches; afterwards they spent twenty minutes to make the physical device by using papers and crafts. The sketches in Fig 2 show their designs for the physical device.

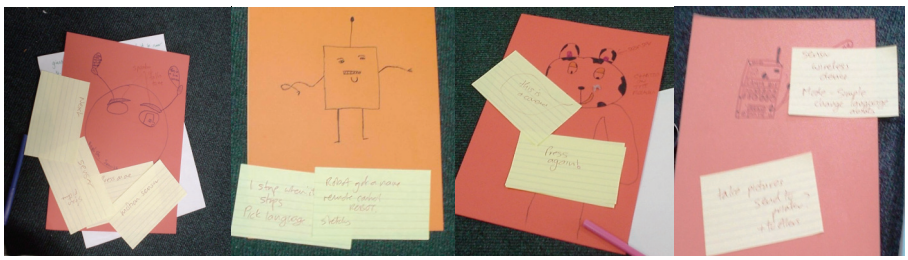

Fig 2. The Children's Design Sketches

3.1.3 Design the interaction
We asked children how their devices worked: each child acted out with their devices as the others watched. They made walking robot, 'talking box', and handheld teddy bear guide (fig 3); also a device with mobile phone functions and a monster look guide were made (fig 4). One thing to be noticed is that most of the children s designs are very functional and with the looks they like or familiar with.

Fig 3. The girls' designs

Fig 4. The boys' designs

During the activities, we supplied certain supervisory support, and provided additional information when needed. Some records were taken of the different stages included pictures and notes.
At the end, we provided encouraging feedback to the children and told them how their contributions will be used. We also thanked them for their participation of the design activity.

4. Discussion

There are several valuable outcomes from our low-tech prototyping activities:
Likes and dislikes
In the earlier workshop we asked the children some questions including: 'What do you like and dislike in museums?', 'What do you like to do in museums?', and 'What would you like to have with you during the visit?'

Several of children mentioned they liked dinosaurs in the museum and would take a camera with them. Most of the children would like to take their friends or families to the museum as a company. They like information about the exhibitions which are easy to access. We found most of them liked the idea of something wearable, starting from simple wrist pointers and displays and adding telephones, internet connections, gameboys, etc.
Little dislikes were mentioned by children.

Awareness of the technologies

We found that most children were aware of everyday technologies; they referred to: earphones, sensors, cameras, printers and wireless in their designs. Some of the children, especially boys, were keen on using the current technologies: one of their prototypes was very similar to a mobile phone. Children are becoming exposed to computers and technology at an increasingly early age; this will help for them to accept and adopt the new technologies.
Very interestingly, none of the children's prototype has a pen in their design. There may be many reasons: maybe because we researchers did not emphasize and guide them towards the design? Or simply because children do not like or understand the idea of pen based devices?

Gender differences

Boys and girls worked in different ways and the prototypes they designed were also very different. We observed that the boys worked more independently than the girls, they did not ask for much help from us. Instead, girls were asking help from time to time. Maybe this was because both of the researchers were female.
Children have made some impressive design prototypes, though the girls' and boys' designs turned out to be very different (Fig 3. and 4.). Girls designed 'cute' type of robots and teddy bears; on the contrary, boys tended to design 'cool' high-tech monsters. Their designs reflect their different needs and interests.

Dominant ideas VS creativity

Sometimes a dominant idea in a group can affect the others creativity. This happened in one of our design workshops. One of the boys had an idea of wrist laser pointers, the others boys started to follow his idea and they ended up turning their initial ideas into prototypes quite similar to each other.
Overall we found that children were absorbed in the workshops and enjoyed activities a lot. They were also very happy with the outcome they had generated. We believe we can soon invite them back for more design activities.

5. Conclusions

Both of the workshops were participative designs. They have been planned and organised differently, hence the processes and the outcomes were very different. Also the children we invited for the two events were from different schools and different ages, which gave a wide representation of our user group.
Useful things learnt from children are: design something in the context they are familiar with: in real life or in their favourite movies and stories. Gender differences have to be considered in the design. Children like 'cool stuff', they welcome technologies that they can grasp or play with. Children like drawing; it is way for them to fully express themselves, also for adults to understand more about them.
We found the method informant design is helpful for understanding the users, their needs and preferences. It gives some new ideas at the initial stage of the design. On the other hand, we have to encounter the pitfalls the method may bring. Although informant design provides first hand experience of needs, requirements, interests of

users; the scope can be limited by the participants we chose. The children's design helps us to free-up our ideas towards more innovative and original resources, but we also have to assess the feasibilities of those ideas.
In the near future, a pilot test will be made in the real museum environment during summer time when there are some organised children's museum visits.

Acknowledgements
We are grateful for the support from the Child Computer Interation group, and the for the contribution made by Janet Read to this paper. We would also like to thank Prof. Alan Dix for his participation to the design workshop.

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Time to Play: Experiential Learning Using Interactive Technologies

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Abstract
This paper offers a case study of a permanent gallery curated and developed by the author for one of the National Museums of Science & Industry in the UK. The gallery was composed entirely of interactive digital media art installations that were employed in an experiential interpretation strategy drawing attention to technology-based issues of an intangible nature. A short introduction to the project is followed by a brief description of the Curatorial Agenda and its implementation, as some appreciation of this background is important in understanding how the experiential mode of address was intended in relation to the subject. The paper then seeks to explain how we might figure the nature of the experiential encounter with the technology-based exhibits contained within the gallery. It does this by developing an account of the visitor experience that draws upon descriptive phenomenological approaches to understanding our relations to objects and events.

1. Introduction

This paper presents a case study of a permanent gallery curated and developed by the author for the National Museum of Photography Film & Television (NMPFT). The NMPFT is a large state owned and publicly funded museum in the UK whose remit is to explore the history and relations between media technology, the creative industries and culture. The museum possesses a world-class collection of over three million artefacts and has particularly good coverage of early photographic history, early cinematography, and early British television. Within this context, the object of the new gallery was to enquire into the way audio-visual experience is evolving through a broad set of digital interactive mechanisms into what has been referred to as the 'post-cinematic' and 'post-broadcast' world. The project resulted in a gallery that was composed entirely of interactive digital media art installations employed in an experiential interpretation strategy that drew attention to our relationship and engagement with digital media technologies. As such, the installations were not presented as secondary didactic sources (as in, say, the standard interactive information kiosk paradigm) but as primary artefacts in themselves. Many used novel unencumbered interfaces to interweave the virtual with real gallery space to create so called 'hybrid' or 'mixed reality' spaces. These larger-scale installations not only had explicit space shaping architectonic effects, they were also designed to construct distinct visitor performances within designated areas. The project was first opened to the public in 1999 but is now in the process of being decommissioned. This workshop therefore provides an appropriate event in which to take stock of the NMPFT project, which was generally seen as one of the most ambitious experientially based digital interactive gallery projects of its kind in the UK.

2. Curatorial Agenda

The Curatorial Agenda drew upon the developmental history of lens-based and mechanical media as revealed in the collections of the NMPFT. An essential aspect of this history can be characterised as the progressive investigation of the temporal and spatial modalities implicated in the development of machine media - from single image photography, to chronophotography, through to the framed movement of early film - and in particular how these properties indicate 'presence' and narrative form. The new gallery posited the continuation of this vector through computer-based audio-visual media, with the fictive (or virtual) time and space implicit in the artefact emerging beyond the confines of the image screen into a wider frame that takes in the real world of user interaction and directly encounters the 'embodied' sensory-motor time and space of the viewer[1]. This account emphasised concepts of interface and interactivity, with these contested constructs being seen as the sites of a critical encounter between the technological, the psychological, and the sociological. An encounter in which the 'restricted freedoms' of the rule-based (computational) system can effect complex individual and social narratives that frequently challenge common perceptions of place, space and identity.

3. Conceptualisation-Orchestration of the Visitor Experience

The figuration of the Curatorial Agenda implied a decisive move beyond the traditional ('exo-physical') investigative stance of the detached observer synonymous with static artefact-based galleries, to a participative ('endo-physical') exploration of the temporally and spatially dynamic dimensions of interactive experience from, as it were, the inside. In this conception, a way of *experiencing* the world would be a way of *knowing* the world[2]. To achieve this the curatorial agenda was first expressed as a series of 'paradigms' or short statements encapsulating the core principles and assumptions underpinning the project and casting a meta-level interpretive perspective relevant to the entire the gallery. This 'paradigm level' set the framework for the development of secondary level elements, conceived as 'domain' based groupings of cognate themes and issues offering a more detailed analysis of, and/or perspectives upon, the paradigm (i.e., gallery) level statements. The key elements of the domain descriptions were then developed and expressed as a series of artefact level examples. This crucial move from domain level descriptions to creative experiential constructions was guided by heuristic considerations that sought to dramatise the potential of digital media technologies to impact upon human sensibilities and thus facilitate interpretation of the domain (and behind it, gallery) level themes. In this way the visitor experience was orchestrated as series of inter-textual relationships between three semantic levels: (1) readings of individual artefacts; (2) readings of 'domain' clusters of artefacts; (3) readings of the relations between domains at the gallery level. (It is also important not to forget the framing functions of the wider museum, and its more traditional galleries, in relation to this 'experiential' gallery). Actual texts pertaining to all three levels of interpretation were positioned at strategic points throughout in order to gently orientate and guide the thought of visitors. But these were fairly short and discrete with the emphasis placed firmly upon the experiential installations, picked out in pools of light within the generally darkened atmosphere of the gallery. This darkened (cinematic) space encouraged visitors to disconnect from everyday experience, to suspend disbelief, and to actively engage as actors/participants within the interactive 'event-spaces' of the installations (the prescribed 'play-areas') as the principal way to understand the gallery.

4. Play as Experiential Learning

The exhibition was thus posited as a form of participatory or living theatre in which visitor interaction behaviours were made explicit and became a vital ingredient in the understanding of the exhibition. The spirit of play was central to this approach – play as discovery, as invention, and as a means of rehearsing the self in new situations[3]. Thus the learning dimensions were delivered through the way the three-levels of the system space encouraged and supported a playful dialogical intertwining and interaction of multiple agencies, mechanic and human (visitors as observers, as actors, as avatars, as subjects, as authors) frequently involving the ludological pleasures of 'rule-set' exploration (in emergent patterning, increasing familiarity with system-states, flow and immersion)[4]. The relationships arising from these agencies were composed of verbal and non-verbal reciprocities, commitments, and refusals, and the emotional, reflective and cognitive inputs - observations, speculations, agreements, humour - deriving from these processes.

5. Experiential Dimensions of Interpretation

The primary sites of interpretation and understanding for visitors were the individual domain artefacts. Some of these can be characterized as largely self-contained electronic worlds. But many presented mixed 'reality' environments combining the virtual with the real within designated 'event-spaces' in ways that drew upon visitor performances within the physical gallery space. In these event spaces interpretation turned upon, at least at the outset, the search for appropriate strategies that might elicit the artefacts intentionality (i.e., the underlying rules governing its state) in relation to the domain level readings. This engagement consisted of a series of play activities through which actors became aware of the potentialities of their agency within the system. Typically, participants were not initially sure what was possible; they were obliged to probe the environment and interactivity became a process-related variable constructed around this act of investigative play. This developed into a type of search and evaluation game that took place within the temporal and spatial conditions imposed by the 'event space' of the responsive artefact, and which required that actors moved iteratively through a series of perceptual, affective and evaluative cycles in order to discern, interpret, elicit and control, appropriate system responses. The separation of experience into perceptive, affective and evaluative states is, to a degree, a heuristic device intended to aid our understanding. In practice there are seldom hard boundaries between the three conditions and interpretation is based upon the coordinated operation of the three in combination. This accepted, a tentative description of this experiential process from a first person perspective follows:

5.1 Primary Perceptions

I begin with my awareness of the phenomenal presentation of the work. As I enter the 'event space' of the artefact I trigger a response and my perceptual systems process the feedback data. I am aware of the simultaneous and momentary events of choreographed movement, colour and form that my presence initiates. There is a kind of mystery to it, but I also sense the 'ecology' of behaviour and meaning within the system that I intuitively know I must deduce. As I move deeper into the process of exploration I become drawn into a phase that can be characterized as immersion.

5.2 Affective/Constructive Immersion

The state of immersion holds as I become absorbed in the artefact. It can perhaps be seen as consisting of two levels. These are not wholly separate (it is really a question

of emphasis) but there are, arguably, discernable states, and my experience consists in a sort of flipping between these.

5.2.1 Affective Immersion

I become aware of the rhythm of the events, their pace, arrangement and punctuation. I can become involved to the point where my awareness of myself as a separate entity is significantly lessened and I become caught up in, and connected with, the system or 'game' state. This might be thought of as a kind of 'aesthetic consciousness of presence' - or what video-gamers call 'being in the zone' - a sort of game-play 'Zen'. Of course there is cognitive processing going on, but it is automatic and not the primary object of my awareness. The object of my attention is essentially my fitting into the activities within the 'event-space'.

5.2.2 Constructive Immersion

Secondarily, there exists a more constructive, as opposed to affective, state of cognition. As the kinesthetic begins to structure into recognisable patterns I begin to discern agency and meaning and to assess my experience. At this kind of secondary level of immersion my awareness is drawn beyond the range of the immediate phenomena towards other possibilities and probabilities - suggestions in which I am drawn to evaluate possible meanings, the significant characteristics, agreements and disagreements with other installations in and beyond the immediate domain. Continuing in this manner, my (earlier) experiences and thoughts regarding particular artefacts become, over the duration of my visit, (and hopefully beyond), subject to deepening re-interpretations of their sense.

5.3 Disengagement

Finally, the 'interactive' experience ends when I master the logic driving the system to the point where it ceases to be interesting. The sense of rapture diminishes and may be followed by feelings of satisfaction, or perhaps frustration and/or even boredom. However, it is important to note that the more constructive level of engagement (identified in 5.2.2 above) continues to develop after I remove myself from the event-space of the installation. Furthermore, domain assemblages contain a degree of redundancy, meaning that any specific installation has the power to link with, and at least partially explicate, other installations, and other domains. In this way a dense overlapping information environment is created where rich links can be discovered between the applications and what they stand for. Thereafter, as I continue to move around the domains encountering other installations and critical texts, so the constructive critical dimension of engagement with the gallery continues to develop, hopefully taking on a more reflective nature.

6. A Dialogical Intertwining of Multiple Agencies

At the heart of the experiential process described above is the issue of 'agency'. That is, the nature of my relationship with the system, and how I sense its intentionality, my own presence in the way it acknowledges me, and the way in which it manifests or mediates other human and machinic presences for me. In short, there is a complex, multiple agency system at work that induces a continual flipping, or oscillation, between sometimes complimentary, sometimes conflicting, identities. How I experience and evaluate the complex interactions between these ontological entities is a primary source of the epistemic value of the gallery. A brief description of the

principle agencies therefore follows, although the manner and intensity in which they would manifest would fluctuate according to the specifics of the installation and the people using it.

6.1 Myself as Agent

Primarily I am conscious of myself as protagonist. This self-awareness is developed through the way my sense of 'presence' is acknowledged in and through the system (see 6.4 below for example). The critical dimension of my self-awareness is also attuned by the existing ideas and beliefs that I bring to the artefact, and then further alerted by the semantic context - be it the domain or gallery level prompts.

6.2 Other 'Actor' Agencies

In some of the multi-user installations, the work must be performed in concert with other visitors, with the systems implementing playful types of connection between participants. Thus I sense that my manipulation, understanding and appreciation of the scene is dependent, in part, upon the will to participate of others. In this way, although the installations are formal systems constructed around rule-play discovery, they generate informal behaviours and experiences based mostly on social interactions, where participants experience aspects of commitment, reciprocity and verbal and non-verbal communication, as mediated by the machine[5].

6.3 System State Agency

The software engine executes a series of logically connected operations according to pre-established rule-sets that transform inputs before mapping them to outputs. In this sense it has no real intentional relationship to the world. Yet my demand for inter-subjective dialogue and meaning adds to, or 'completes', this input/output cycle through readings that are disposed to ascribe an intentional stance to the phenomenal presence of the machine-system. Thus as noted in Section 5.2 above, I become aware that there is a script, or program (rule-set) within the machine orchestrating the system and that I must discover and 'read' the 'character' and 'role' of this script (its 'intentionality') through the evidence of its performance - its feedback patterns and cycles that are do with pace, repetition, looping (etc) as mentioned earlier. If the system also stages AI 'bots' the experience and its demands are mediated through these avatar presentations and their associations, (see below).

6.4 Myself as Avatar

In some of the gallery's digital environments, my presence is implemented through an avatar. My relationship to this construct is problematic. Occasionally the 'avatar' is little more than an on-screen graphic element, as in the 'Digital Portal' (see Fig. 1), which enables me to be immediately and directly aware of my 'presence' in the 'event-space'. Other installations present scenarios in which I am invited to invest strongly in an electronic representation of myself, for example, in 'Telematic Dreaming' (see Fig. 2), and in 'Another Time, Another Space' (see Fig. 3). But in both these instances the systems conspire to produce something of a distancing effect that inhibits strong identification with myself as the owner of the actions and feelings generated within the installations. Yet again, other installations, such as 'TechoSphere II' (see Fig. 4) stage the avatar as a separate character, whilst at the same time inviting a degree of identification with it that allows me to view myself as implemented within the fictive electronic world. Thus in the same way that I flip between affective and

constructive modalities, so at the same time I can flit between these double fictitious avatar states: my presence simultaneously being outside the fictive space and within it by virtue of the avatar.

6.5 Others as 'Avatars'

I can experience the presence of 'others' as avatar representations within the environment. These could be real people, as in 'Telematic Dreaming', or AI 'bots' as in 'TechnoSphere'. The experience and challenge will, of course, be very different depending on which it is, and I am likely to be more conscious of my performance if I suspect that a real mind is observing from behind the electronic representation.

6.6 Others as Spectators

At any time there will normally be people watching my performance, and most likely commenting. As with the case of the avatar representations of other participants, so I am apt to be split between my own edification and that of the audience for whom I also, in a very real sense, perform.

6.7 Authorial/Curatorial Agencies

The issue of authorship is closely tied up with the way I am disposed to read the intentionality of the system. As noted in 6.3 above, a given system state has no real 'interest' in the world: rather it is the author that has instituted any intentional relation by constructing rule-sets whose outputs have significance within a given operational context. Therefore, while I may be disposed to depict intentionality as a feature of the machine-system, I may nonetheless be at least faintly aware that it 'speaks' for a displaced artist/programmer as creator. Furthermore, at times I am likely to be acutely sensitive to the fact that I am being presented with a particular set of digitally induced encounters within the domains, contextualised by the artifice of the gallery, and that the entire spectacle was brokered by other (curatorial) wills.

7. Subjectivism & Indeterminacy

It may be thought that a risk was carried in the way the gallery privileged the individual experience of the subject and in the way that cognition was almost literally 'performed'. Certainly, authenticity in the context of this project was not so much related to materials, unambiguous authorship or design (the traditional evaluative categories pertaining to museological presentation) but to qualities of *experience* and *interaction* and of the *meanings* inscribed in particular performances. Moreover, this immanent involvement of the visitor had the potential, at times, to eclipse any clear curatorial/authorial reading. Thus depending upon the circumstances encountered within an installation, such as the density of users and their interpretive disposition (i.e., character, mood and points of interest) so different, even contradictory, interpretations could arise. In this sense every visitor 'performance' had the potential to be unique with the 'actors' bringing forward voices and thoughts not rehearsed by any curatorial/authorial agencies. However, these 'unregulated' interpretive acts were, in the case of this gallery, of fundamental importance, for one of the principal points of the gallery was to suggest that single point perspectives on the subject are inadequate and over-simplistic. Moreover, it would be wrong to characterise the situation as one of massive indeterminacy and undecidability. Rather, as we have seen, the tripartite organisation of the gallery as a series of discursive 'texts' coded meaning and helped to move the individual interpretive experience into a shareable

inter-subjective domain - thus bringing a degree of 'stability' to the interpretive acts of the individual. In this way some of the obligation for meaning making (although by no means all) was displaced from their subjectivity.

8. Concluding Remarks

This paper has discussed a particular museological project that sought to negotiate a new relationship with contemporary audiences by promoting experiential learning based upon the open-ended interpretation of creative media technologies. By most accounts it was at least partially successful in this: during its lifetime the gallery proved itself popular with both lay audiences and media professionals, and was consistently voted best of all the NMPFT's public galleries in the museum's Annual Independent Visitor Survey. Its success was also acknowledged through several prestigious national awards, including the Design Business Associations 'Design Effectiveness Awards'. Nevertheless, in reviewing its progress, perhaps one of the key lessons of the project is that participatory and experiential exhibitions, and especially high-technology ones, still rely (possibly more than most museum projects) upon the articulation of deeply embedded and coherent underpinning curatorial agendas. These agendas must be flexible in ways which allow thinking around the subject to develop relationships with the audience that permit individual experiences to play significant roles in the making of meaning and the evaluation of worth. In this way the museums sector will find important means to remain relevant to culture in the 21st century.

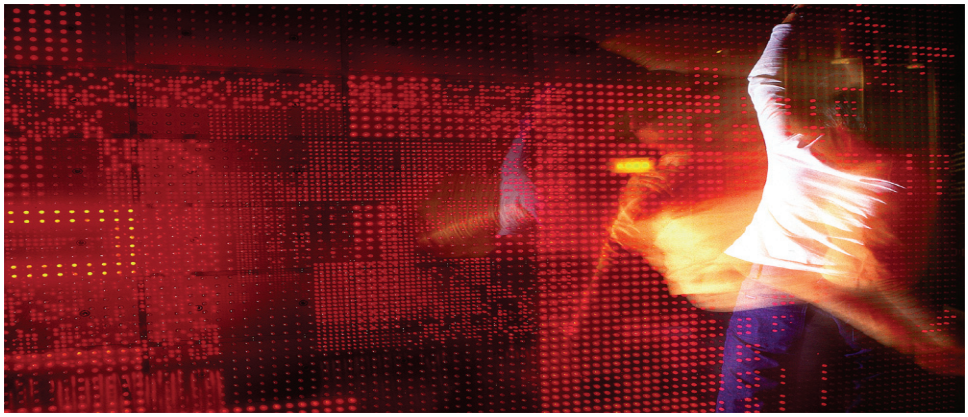

Fig 1. 'Digital Portal' Artist: Nigel Johnson. Curator/Producer: Malcolm Ferris

Fig 2. 'Telematic Dreaming' Artist: Paul Sermon. Curator/Producer: Malcolm Ferris

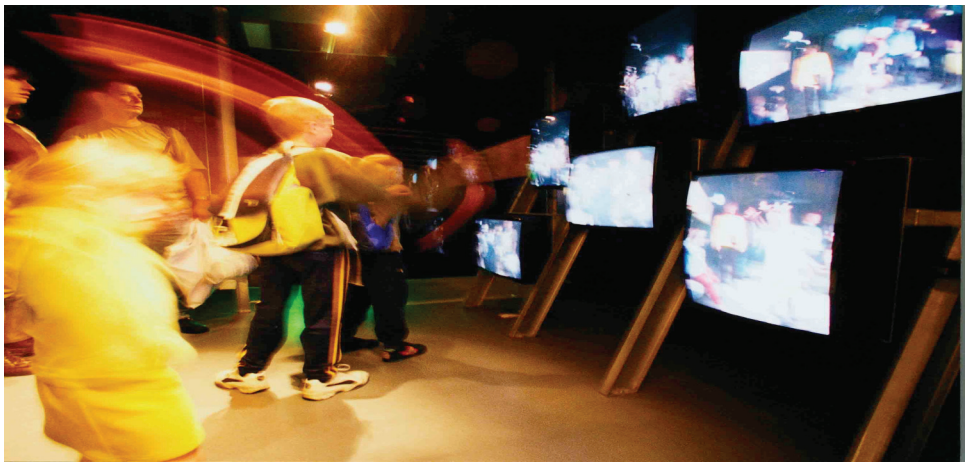

Fig 3. 'Another Time, Another Space' Artist: Toshio Iwai. Curator/Producer: Malcolm Ferris

Fig 4. 'TechnoSphere II' Artist: Jane Prophet. Curator/Producer: Malcolm Ferris
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NOTES

1. This is, of course, an extremely simplified presentation of the progressive development of machine media, a subject that could be interpreted from any number of perspectives. However, the approach developed for this project was an extension of issues that emerge within a particular strand of contemporary philosophical aesthetics. Deleuze, for example, distinguishes two main episodes of cinematic development. A first episode in which time is subordinated to movement, and a post-war episode in which time becomes the ground for an aesthetic showing of the Modernist conditions of subjectivity. The Deleuzean account does not really take account of the impact of digital media technologies, and the NMPFT project sought to take this description a stage further, suggesting that 'new media' surrenders the intensities of the traditional screen image in favour of a wider frame that directly implicates itself in the life of the subject. This is an embodied involvement that implies an equal emphasis upon movement in relation to time and which transposes the screen to the site of the subject, who becomes the image. For example, with 3G mobile technologies this wider frame moves beyond the designated 'event-space' of a stand-alone gallery installation, so that instances in the 'every day' life-cycle of the subject become the locus of the scene. See Gilles Deleuze, Cinema 2: The Time Image. Trans. H. Tomlinson and R. Galeta, Athlone, London, 1989.

2. Central to this approach was a phenomenological conception of meaning-making that drew upon Heidegger's concept of techné, that technology is more than simply a tool or instrument, but an activity through which the self and the world are represented and made sense of. Also of influence was Merleau-Ponty's view that perception is more than a mental or psychological effect of Mind, but the body's "intelligent orientation" in the world. See Heidegger, M. "The Question Concerning Technology", in Krell, D. F. (ed), *Basic Writings Martin Heidegger*, Routledge 2004 edition. And

Carmen, T. "Sensation, Judgement and the Phenomenal Mind" in Carmen, T. & Hansen, M. B. N. (eds), *The Cambridge Companion to Merleau-Ponty*. Cambridge, 2004.

3. Just as art is seen as a primary means of understanding the world and ourselves, so many commentators perceive play as an essential aspect of art making and aesthetic appreciation. Again, this view of play as an essential means of orientation and navigation is a view that is strongly represented in the phenomenological tradition, especially as it develops through Gadamer. See Grondin, J. "Play, Festival, and Ritual in Gadamer", in Schmidt, L. K. (2001), *Language and Linguisticality in Gadamer's Hermeneutics*, Lanham (Maryland): Lexington Books.

4. Although the gallery interactives were distinct from computer games in both form and content (see note 5 below), as computational aretfacts they shared some of the latters structural qualities. Much of what follows in this paper concerning the ludological has drawn upon the computer games studies literature, in particular the ongoing debate concerning gameplay and narrative and the relation of both to learning. For a discussion of this subject that maps the debate see Lindley, C.A. 'Conditioning, Learning and Creation in Games: Narrative, The Gameplay Gestalt and Generative Simulation' presented at the "Workshop on Narrative and Interactive Learning Environments", Edinburgh, Scotland, 6th-9th August 2002. Also see Jules, J. 'Games Telling stories? A brief note on games and narratives.' Archived at Game Studies, The International Journal of Computer Game Research, Volume 1, Issue 1, July 2001. http://www.gamestudies.org/0101/juul-gts/ More recent discussions of gameplay in relation to narrative can be traced through the 'GAMESNETWORK' (Games Research Network) list archive at:
https://listserv.uta.fi/archives/gamesnetwork.html

5. Although this paper traces a connection between computational rule-sets and play, it is important to note that most of the installations in this gallery project worked outside traditional video game paradigms in that there was no overt competitive element - no real winning or losing, gain or loss, as in most computer games of progression. This did not, of course, preclude participants from inventing competitive play strategies within installations if they so chose.

Tasting the Wine Culture: the Design of an Experience

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Abstract
This paper aims to report on an interaction design project focussed on collective spaces. It describes a pilot study exploring possible applications of a design method based on multidisciplinary approach and co-evolutionary process to a particular context. Outcomes of the design process are discussed and considerations about the adoption of the specific design approach are expressed.

1. Introduction: The Siena Design Project - Design for Collective Spaces

The project described in this paper was carried on within the Siena Design Project (SDP) 2003[5]. Inspired by the Apple Design Project[6], the SDP is an event for sharing interaction design projects among Education Centres in Europe. Given the aim to plan integrated systems of communication for collective spaces, each team involved was assigned a specific place and context of design intervention. The pilot study described in this paper focuses on the spaces of the Enoteca Italiana in Siena, Italy. The Enoteca Italiana is a quite unique public institution that stores, promotes and sells Italian wine. It may be considered an atypical exhibition space (Fig 1), since it represents the most important showcase of Italian wine and vineyards all over the country and abroad. It offers to the visitors the chance of getting in touch with the culture, the qualities and the history of the finest wine, giving also the possibility to buy and appreciate wine inside the suggestive halls and terraces.

[5] The number zero of the SDP (2003) was promoted by the University of Siena. Founding partners of the event are: University of Siena, Italy; University of Limerick, Ireland; Royal Institute of Technology, Stockholm, Sweden; Royal College of Art, London, UK; Philips Design, Convivio Network.

[6] Saddler H. (1996), *Seeing the light go on: the Apple design project*, in *Interactions* Volume 3 , Issue 3 May/June 1996, NY, ACM Press

Fig 1. The Enoteca Italiana's cellars

The Enoteca Italiana is located in the North Eastern bastion of the Medicean Fortress in Siena. This ancient building is a 15th century military architecture built during the French-Spanish conflict in which local major cities were involved.
The members of the design team were professionals and students with different expertises and backgrounds: architecture, history, music, interaction and visual design. Thus, the project was based on a multi-disciplinary approach.
The concepts and the prototypes produced within the process were presented and discussed during the final event of the SDP held in Siena on July 2003.

2. Thinking The Design Intervention: Imitative And Augmentative Perspectives

Each project developed within the Siena Design Project - design for collective space - was supposed to encounter or to take start from the needs expressed by the institution providing the context of each design intervention. In this case, the references were the Enoteca Italiana's management and administrative committee, who committed a general intervention aiming at extending services and facilities of the Enoteca by enriching the experience of visit on-site and providing Italian and International wine customers with a view of the Enoteca's collection through the Internet.
It was soon realized how broad was such commitment, suggesting a wide range of solutions from the design of a web portal to the creation of installations or interactive attractions. Such consideration pushed the design team to debate the kind of attitude to maintain along the course of the project. It was worthwhile to frame the discussions around the 'imitative' and 'augmented' use of technologies within museum contexts and exposition spaces, a theme well exploited by Antinucci (1998) on his contribution to the subject of museums and new technologies.
As the early usages of word-processor have been based on a 'replica' of paper contents in digital forms, in the same way, he states, the "virtual museum" (defined as the collection of interactive 'objects' in exhibition contexts) is yet mostly based on the mere reproduction of museum contents on different supports. Examples of such imitative use of new technologies are museums web-sites or CD-ROMs. The growing diffusion of interactive technologies and the huge capabilities they can offer (in terms of elaboration speed, data storage, etc.) pushed the research towards the more intriguing use of technologies "in presence", that is the explicative and educational use of artefacts in the same place where artworks are located. These type of technologies, whether properly designed, express the added value of allowing visitors' cognitive system to access the exhibition contents in a perceptual-experiential

modality, extremely more powerful than the textual-symbolic traditionally used in these kinds of tasks.
In the past few years, most of the interaction design projects within museums and exhibition contexts (HIPS[7] and SHAPE[8] projects, to mention just few) have been conducted in the 'augmentative' perspective, allowing visitors to experience richly interactive and informative environments, through the support of collections of artefacts and media distributed in different locations.
During the early stages of the project, the team negotiated the perspective of the design approach. The decision was to move onto the augmentative perspective instead providing the Enoteca with a new appealing website. Although such strategy might seem obvious, in most of the interaction design research contexts, negotiating design directions is an issue of primary importance in the case of design teams involving so different backgrounds and competencies.
Moreover, this early reflection concerned important parts of the project vision and led us towards the definition of the project aim, which was designing a sensorial and knowledge based tasting experience enabling Enoteca's visitors to access the collection of wines through the creation of personal multiple-paths.

3. Parallel Converging Streams: Analyses And Concepts Definition

Over the past few decades, the research in the domain of HCI and Interaction Design described a wide range of strategies and methodologies, all agreeing the common objective of generating design solutions centred on the users. Although fundamentally different each to the other, those frameworks share the key phases of the design processes, namely: activity analysis, concepts definition and evaluation. According to Marti and Rizzo (2003) different contexts and objectives characterise three main levels of design: reactive, proactive and emergent. Each level is defined by the relevance that each phase assumes within the design process. In the reactive level, for example, the designer aims at solving problems related to the use of an already existing artefact. In this case most of the efforts focus on the assessment of the system functionalities, rather than on activity analysis or concept generation.
As previously stated, this project aimed at designing a novel experience rather than supporting an already existing one. Therefore we referred to the 'emergent' level in which the designers are asked to envision human activities that would not exist without the artefacts being designed. In such co-evolutionary design processes analyses and theoretical reflection move in parallel with a divergent phase of high-level concepts generation for then converging in the definition of envisioning scenarios in which users roles and artefacts are described in the specific context.

3.1 Analysis

In the present project, the analytical phase was conducted under different perspectives, according to the three main disciplines composing the design team: user/activity studies, historical view and spatial/architectural analysis. Each one of these was approached using peculiar methodologies of the discipline and each one gave different results. In particular:

[7] HIPS (Hyper - Interaction within Physical Space) - collaborative R&D project funded within the ESPRIT i3 programme of the European Commision - Project Nr. 25574
[8] SHAPE – Situating Hybrid Assemblies in Public Environments – IST 2000 - 26069

- observations of the main activities, interviews and focus groups with visitors and stakeholders were conducted with the aim of deeper understanding Enoteca's potential and critical issues, and to elicit stories about rewarding and regretting experiences;
- planimetries, building sections and materials were studied to explicit the architectural elements of the Enoteca building and the ancient Fortress in which it is located;
- historical files research, bibliography collection and interviews were carried out for providing an historical perspective of those buildings and their functions

3.2 Brainstorming

Parallel to the analytical phase each member of the design team was involved in creative brainstorming sessions with the aim of generating high-level concepts. Each idea was sketched in a template composed by few elements (a title or a name, an inspirational image and a brief description). At the end they resulted in a collection of 15 concepts coming from different perspectives or source of inspiration (music, architecture, history, drama, oenology).
Once the outcomes from the creative and analytical phases were collected, it came the need to synthesis, in order to address the following designing efforts in one particular direction.

3.3 Convergence

With the convergence phase, all the different concepts and ideas produced by the team in the first instance were analysed on the basis of specific features emerged from the context study.
This was to narrow the number of the design solutions to focus on and to define the specific path to follow.
The analysis of users, spaces and activities enabled the team to identify few scenarios, named control scenarios, each involving specific actors, actions and settings which were considered relevant and necessary for a complete understanding of the context.
The selected scenarios were:

- tasting experience (on site)
- educational activities
- surroundings
- virtual community
- remote places
- artistic performances.

These context specific aspects were intersected in a grid with the dimensions that are needed to take into account in the design for collective space, which are:

- personal relations
- environment
- contents
- tools
- identity.

In this way it was possible to map the concepts produced in the divergent phase against these two sets of variables, and it helped also to make the inner qualities of each design idea clearer.
Once the different concepts were spread into the grid, the selection of a specific sector needed to be made. Focussing on the understanding of the user needs resulted from

the earlier analyses facilitated the choice of the wine-tasting experience scenario. This decision pushed forward the design process by restricting the different aspects to consider and refer to.
Based on this deeper understanding of the context, the design team was at that time able to phrase their design goal.
That was to introduce the potential visitors of the Enoteca Italiana to the *wine culture* and to enhance wine tasting experience. By *wine culture* we mean a set of cultural assets, defined as follows:

- a collection of wine bottles preserved in the cellar of the Enoteca;
- the stories expressed by each typology of wine in terms of geographical origin, production and taste;
- the knowledge of the institution in selecting and preserving oenological products;
- the expertise in serving and appreciating wine taste;
- the peculiar architectural aspects of the fortress in which the Enoteca is hosted.

The intention of the design team originates from the recognized unbalance between the *wine culture* preserved in the Enoteca Italiana and the unawareness of the visitors not acquainted with it.
The peculiarity of this pilot study consists in the effort of shaping a novel wine tasting experience by acting on the context in which the experience occurs.

4. The design of an experience: exploring, learning, enjoying

To shift the role of the visitors to *active* users, who construct individual experiences exploring the Enoteca's *wine culture,* the design team attempted to provide them with rich resources for the experience.
The following four design concepts were produced to support the visitors to interiorise the assets available within the Enoteca and to support the paths to partly or entirely be followed.

The Tastevin

It is the tool used by sommeliers to savour wine. The design team used it as a metaphor for a wearable and wireless device for capturing information tagged on wine bottles. The cellar preserves a huge array of oenological products, some of them disposed on expositors. Currently, the geographical origin of wines is the only information displayed. The Tastevin design concept (Fig 2) provides the user with a novel role. It gives the possibility to acquire information about the history of each type of wine in terms of origin, production, stories, comments of experts and visitors who tasted the wine.

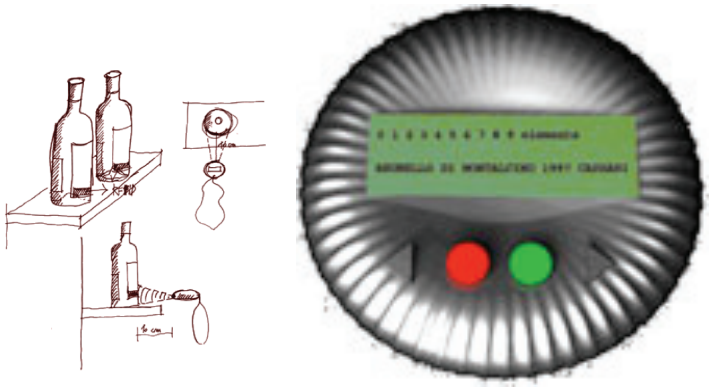

Fig 2. The Tastevin concept: sketches and prototype

The Smoke Tube
It is a unique point of visualization in the cellar displaying information collected by using the Tastevin. It shows both evocative images and specific information about single bottles and the Italian wine culture (Fig 3). The peculiar chimney shafts embedded in the ceiling of the cellar inspired the smoke tube concept. In the past the chimney shafts had the function to release outside the fortress the thick smoke produced by the detonations of cannons placed inside the bastion.

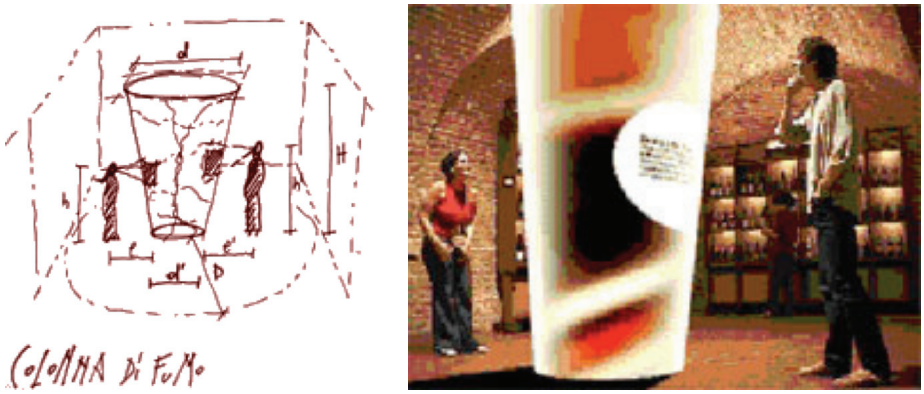

Fig 3. The Smoke Tube concept: sketch and prototype

Micro-particles
It is a system of sensors, lamps and speakers that creates a suitable atmosphere for the tasting experience. It dynamically reacts to what occurs in the drinking hall. Micro-particles aims at making explicit gestures and attitudes of wine tasting by distributing in the environment magnified effects of people interactions. Sensors perceive the social milieu created by people in the drinking hall under certain parameters (e.g. the tone of voice, the chairs moving around tables, the arrangement of glasses, the typology of wine. An embedded system processes the collected information to create a slight and non-obtrusive change in the lightscape and audioscape.
Dionysian Spheres
It is an artistic installation of lightened spheres located all over the fortress. Each sphere is connected to the micro-particles system. The installation conveys ambiguous information that is a valuable resource in order to capture visitors' attention. As claimed by Gaver and Benford (2003) "ambiguous information, by impelling people to interpret situations for themselves, encourages them to start grappling conceptually with systems and their contexts".

5. A multiple access experience
The four design concepts were further developed and articulated into a video-scenario prototype. The video-scenario explored the role (Houde, Hill, 1997) of each concept in enhancing the wine tasting experience of the visitors in the context of the Enoteca. Mock-ups of the four concepts allowed people to experience the look and feel of the artefacts.
In the team's view the defined concepts are elements of an articulated experiential path developed on three different levels (Fig 4).

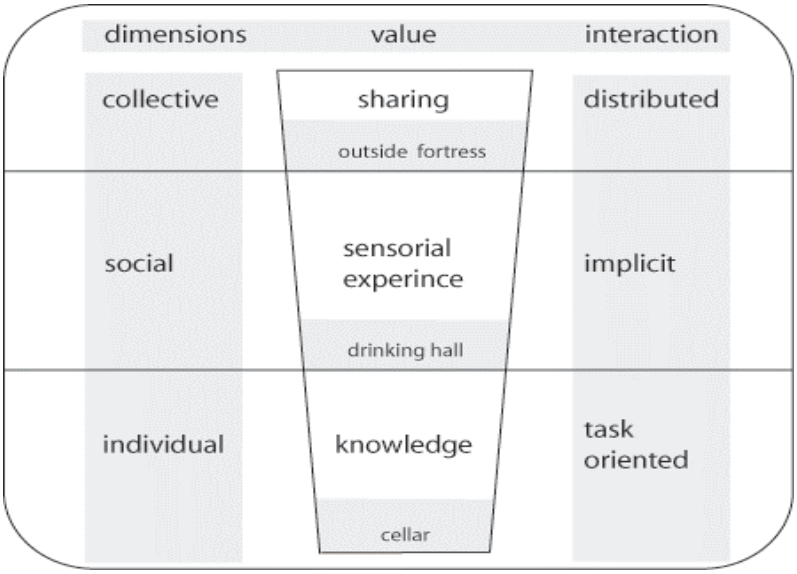

Fig 4. The experiential path framework

Each level expresses a key value, it characterises a privileged modality of interaction, it addresses a specific dimension and it is anchored to a specific setting. The Tastevin and the Smoke Tube located in the cellar are designed for allowing visitors to elicit stories around wine collection, thus the key value here is the knowledge, the interaction is task-oriented and the dimension is mainly individual. In the second level the context-aware Micro-particles make explicit gestures and attitudes of wine tasting. The main value here is the sensorial experience, the interaction remains implicit and the founding dimension is the social one. Finally, the Dionysian Spheres installation in the outside characterises the sharing value by affecting the collective dimension through a distributed interaction.

6. Conclusions

In this paper we reported a design study conducted within a particular and probably unique exposition setting, the Enoteca Italiana inside the Medicean Fortress. We attempted to define the methodological approach that led us to envision a concept scenario describing an articulated experience of wine tasting. Moreover, we tried to point out the qualities of the concepts supporting the overall experience and the dimensions they relate with. As described in the paper, the design process has been characterised by the creative contribution of different disciplines. Most of the interaction design research is based on multidisciplinary (or interdisciplinary) approaches and the HCI field itself defines a common territory for different contributions. Nevertheless, in our case we experienced a project conduction in which people with different backgrounds originally contributed at every phase of its development, from aim definition to mock-ups implementation. We believe that such approach deeply affected the project identity, and moreover it helped the team to elicit peculiar qualities of the setting otherwise difficult to understand and exploit.

Finally, the need of all team members to speak a common language led us to the progressive definition of a selection of shared meanings condensed in metaphors and representations. As a main example, the qualities expressed by the ancient chimney shafts (i.e. the inside/outside connection, the smoke dispersion through different levels) were exploited by the team to construct a shared framework to account the dimensions and the qualities of the experience.

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