

# Designing Interactive Museum Exhibits □ Enhancing visitor curiosity through augmented artefacts

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## ABSTRACT

In this paper, we describe the current work being conducted at the Interaction Design Centre on the design and development of a novel interactive museum exhibition. The particular context and cultural setting of the museum calls for a careful approach to the introduction of technology in such a context. We present some of the findings from our early field studies, and discuss how we are attempting to take these findings into account in our ongoing design processes.

## Keywords

Museum technologies, engagement, design process, role of artefacts.

## INTRODUCTION

This paper provides an outline of some of the work being done by researchers at the University of Limerick Interaction Design Centre (UL IDC) on the EU Disappearing Computer SHAPE (Situating Hybrid Assemblies in Public Environments) project. Our focus here is on issues in designing innovative interactive experiences for visitors to the Hunt Museum located in Limerick, Ireland.

The introduction of technology into museums and exhibitions is a difficult and delicate matter, as the museum is a rather complex entity from the point of view of experience, interaction and exhibition design (Falk & Dierking, 1995), e.g. educational issues, curatorial necessities, pleasurable visitor experiences, etc need to be merged. A number of distinct communities, with different disciplinary backgrounds and thus “cultures”, are involved in the process: pedagogical and curatorial concerns have to be understood and supported by exhibition, information and interaction designers and technology developers.

We need to understand the ecology of artefacts, spaces and practices with a view to trying to create some changes or interventions in that context. How to take into account these different perspectives is not an easy question to answer. In what follows we describe our evolving approach to this topic in the context of our on-

going work in the Hunt Museum. This is still work-in-progress, and thus what follows is an interim report, and presents our reflections on the process to date. The frame of this paper is formative, rather than evaluative, and it aims to discuss the process of design rather than completed designs. We have been evolving what we term a number of ‘design sensitivities’, based on an extensive data corpus collected during nearly 8 months of field studies. The focus of these observational studies is on the features of the museum environment, the artefacts, and the public interaction with the objects in the different museum spaces.

## THE SHAPE PROJECT AND THE HUNT MUSEUM

This research is being conducted within the EU-Disappearing Computer SHAPE<sup>1</sup> project (Situating Hybrid Assemblies in Public Environments). The project focus is on creating hybrid public environments that allow visitors to actively interact with features of both physical and digital spaces. SHAPE is specifically investigating these issues of hybridity and assembly in the context of public spaces such as museums and exploratoria. “Living Exhibitions”, where our explorations are exhibited for public experimentation and evaluation, are planned at selected European museums which have agreed to participate.

The SHAPE team at the UL IDC is currently working with the Hunt Museum on a SHAPE Living Exhibition planned for the Summer of 2003. We are currently developing design scenarios for a number of exhibits to be located within a specific room at the Museum. These scenarios are based on our analysis of field study data displaying human behaviour within the museum environment, and, specifically, the way visitors

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<sup>1</sup> Members of the SHAPE Consortium are: the Royal Institute of Technology-KTH (Sweden; Coordinating Partner), King’s College London (UK), the University of Nottingham (UK) and the University of Limerick (Ireland).

approach and make sense of particular exhibits and specific objects in the Museum.

The Hunt Collection is an internationally important collection of original works of art and antiquities. It is a personal one, formed by a couple (John and Gertrude Hunt) who judged each piece that they collected according to the standard of its design, craftsmanship and artistic merit. These criteria they applied to objects of all ages - from the Neolithic to the twentieth century. Since 1997, the collection is arranged on three floors of the historic "Custom House" in Limerick City Centre.



Figure 1. The Hunt Museum, Limerick.

The whole collection is presented in a way that highlights the *personality* of the owners: for example, a wall panel in the Museum, near several artefacts, shows a photograph of the Hunt Family's home kitchen. It is possible to locate these precious Museum objects in their original 'everyday' place in the Hunt home. A remarkable example is the "Plat Del Dia" ("The Dish of the Day") by Pablo Picasso, a small oil on cardboard that Picasso painted for a Restaurant in Barcelona to advertise daily specials, and that was used for the same purposes in the Hunt family's kitchen!

The information available to the visitors in the proximity of the displays is minimal: simple labels to indicate the nature, the provenance, and the period, are placed near an object or a group of objects. This is intentionally done by the museum management as they wish to encourage personal discovery, also allowing for mediation of information by person-to-person communication with human experts in their very engaging "Docent program".

The Docents are volunteers who, according to their time and availability, are available in different parts of the Museum, and can provide visitors information about specific objects or sections of the Museum, their features, history, and also stories about how these objects became part of the Hunt family collection. The Docents are also in charge of guiding small groups of visitors through the Museum and assist other museum personnel during hands-on activities and educational workshops.

As well as the human help and guidance provided by the Docents, panels presenting more general information about the collection are displayed on the

walls throughout the Museum. The panels are either related to the Hunt family and the process of acquisition of the collection, or to a specific section of it (e.g., glass, earthenware, bronze, etc.).

Whereas the nature and structure of the collection responds to Victorian criteria of classification and display (Newhouse, 1995), the Hunt Museum differs from most museums of this kind in that it has some extremely interesting features that integrate the "classic" content of the exhibition with elements of direct, "hands-on", engagement for the visitors. We discuss these features in later sections as we turn to our observational studies.

## OBSERVATIONS

Gaining a thorough understanding of the way visitors move through the exhibitions and interact around the objects on display is a crucial element in designing effective museum installations (Ciolfi et al. 2001). More generally, it is crucial to understand the way visitor interpret the museum and the story it tells through artefacts and information resources (Hooper-Greenhil, 1992).

In the specific context of the Hunt Museum, we were particularly interested in how visitors explore various assemblages of drawers and cases in the museum and how such exhibits engage people. Another focus of our investigation was gaining an understanding of the structure, nature and content of the exhibits, the informational material available, the role of human guides and the related educational activities the Museum organises for groups of children and adults. We conducted an extensive set of field studies in the Museum including informal observations, interviews with experts, curators and docents, and video observations of visitors focused on specific parts of the collection. Following this phase of study, some relevant features of the museum emerged as crucial in shaping the visitors experience of the Hunt Collection. We are presenting three most notable examples in the following sections.

### The Cabinets of Curiosities

We studied how visitors move through and approach the exhibits, noting which areas and features of the museum were favoured by the visitors, and where interesting interactions occurred. We found much of interest in the areas where "cabinets of curiosities" were located (See Fig. 2).

These cabinets can be viewed as an "assembly" of objects/artefacts - prompting complex dynamics of understanding and sharing knowledge amongst the visitors of the museum (Pearce, 1994). The cabinets contain several kinds of artefacts (from decorative arts pieces, to archaeological findings, drawings, tapestries, etc.) arranged in a way that reminds of that in which John and Gertrude Hunt originally displayed them in their own house.

Visitors are free to open the cabinet's drawers in the sequence they prefer and explore their content. They are allowed to take a very close look at the objects as the only protection is a thick glass panel on top of each drawer.



Figure 2. Visitors exploring the Cabinet of Curiosities in the Study Collection room.

Visitors are surprised by the fact that the traditional cultural “rules” of behaviour in a museum do not apply to the Study Collection room, as it is possible for them to touch and open the drawers, and to get closer to their contents. Sometimes, people do not actually realise they are allowed to do so. However, when visitors find out about this possibility, they engage in observations, interaction and discussion around the cabinet exhibit.

After conducting observations of people interacting around the cabinets, the analysis of video footage revealed a lot of communication around the objects, with the visitors striving to collaboratively make sense of the exhibits. Interpreting objects and collections means not only understanding specific aspects or details belonging to each object, but to make sense of the whole arrangement in which they are displayed and of the connections among the different parts of the “story”. As well as the variety of objects on display, the Cabinet of Curiosities has another appeal to the visitors. The drawers, chests and boxes stimulate curiosity and exploration. These containers, usually accessible only by their owners (and usually in private settings rather than museums), suggest the presence of secrets, of strange objects, sheltered from the eyes of the public (Elsner & Cardinal, 1994, Bachelard, 1969). Uncovering the secrets and discovering the precious, hidden content is perceived as very rewarding by the visitors, considering also that the touching of exhibits is often forbidden in “traditional” museums. Curiosity and expectation act as facilitators of the process of making sense of the objects, and of learning through active discovery (Shuh, 1994). Through stimulating their curiosity, the cabinets and drawers encourage children and adults to both act and reflect, and involve the visitors in an engaging experience. The interactions around the drawers reveal interesting patterns of collaborative understanding of the objects, emotional

responses associated with the experience and a growing interest in, and appreciation of, the exhibit itself.

### The Archaeology Workshop

The Archaeology Workshop is one of the “hands-on” activities the Museum Education Department organises for children and adults. This activity is particularly targeted at primary school classes.



Figure 3. The "Bronze Age" sandbox used for the Archaeology Workshop.

After visiting the Hunt Archaeology section, guided by a museum docent, the children are brought to a specific educational area of the Museum where a number of sandboxes are located (See Fig. 3). These boxes are used by Museum staff to hide objects, which can then be unearthed by the children, thus simulating, in a crude form, some aspects of a real archaeological “dig”. The class is divided into three groups, and each group is required to unearth artefacts from a specific sandbox (there are three different sandboxes containing, respectively, Stone Age, Bronze Age and Medieval replica artefacts).

The children are shown how to “dig” using a set of tools, and encouraged to document their findings through drawings, sketches and written descriptions. When all the objects are found, each group has to identify the period of the dig, guessing as to which historical phase their findings belong.

From our observations, children enjoy “playing the archaeologist”: they are shown how to skim the sand with trowels to search for objects, and how to clean the dust away from the objects with brushes, and they usually apply these instructions very carefully. Finding hidden objects is a very engaging experience. The orchestration of the experience is also very effective - involving children in all the phases of the workshop: digging, discovering and documenting.

Collaboration and discussion naturally occur among the children, even if each of them is provided with a specific area of the pit for digging. Comparing objects, instructing each other on how to use the trowel and the brush, guessing the nature of their findings are the main topics of discussion.

The children are also involved in placing back the objects in the pits after the final discussion session, and they greatly enjoy this phase of the activity as they can in some way influence the experience for the future participants.

Another important feature of this activity is the insight it gives the students into how objects might be found, and an awareness of the long path from discovery of some pottery shards to the exhibit of some cleaned, re-assembled pottery bowl in a exhibition case in the Museum. In the archaeology workshop children are able to understand the way parts of the collection might have been found and then assembled.

The Archaeology workshop is a highly effective educational activity, judging from student and teacher evaluations, and the obvious engagement of the students during the sessions. It is also a simple, compact, and understandable activity for all concerned (Csiszenti Mihaly & Hermanson, 1994).

### Handling Sessions

Handling sessions are a hands-on activity for adults also organised by the Museum Education department. The participants can handle the 'real' Museum objects distributed to them under the supervision of the Hunt Museum education officers (See Fig. 4). The participants experience great pleasure in exploring the surfaces and materials of the objects, feeling their weight and manipulating them in the way they must have been handled by their past owners. Verbal accounts from the observation sessions show how the participants collaboratively create stories featuring the objects, and their past owners, their possible use and the physical locations where they might be placed and used.



Figure 4. A Handling Session involving school teachers.

The people perform a variety of gestures around and on the objects as they discuss them. These reveal interesting recurrent patterns of behaviour associated with specific physical features of the artefacts: fingering the details of the surface, testing its function, looking for hidden details on the bottom or the back of the objects and exploring cavities and inner surfaces (Ciolfi & Bannon, 2002a).

The social aspect of the experience also plays a significant role: the pleasure of discussing and enjoying objects together is strongly felt by the participants at the session. The participants experience a real sense of discovery and excitement (e.g. "Are they 'actual' Bronze Age artefacts?"), and communicate this emotional involvement to their companions and to the Hunt personnel leading the session.

### Shaping design sensitivities

We now wish to move from observation and analysis towards the design of novel and engaging augmented reality environments within the Museum context. This is a difficult assignment, as this environment is extremely complex:

- artefacts have implications for the shaping of the emotional experience;
- the museum's cultural rules and constraints play a role in terms of the range of interaction possibilities that are given to the visitor
- the multiplicity of artefacts involved and their mutual relationships require a flexible method of designing interaction.

Thus it is not easy to collect a traditional set of 'requirements' that we can then implement. Likewise, general design guidelines or heuristics are insufficiently detailed to help us in our task. However, our Hunt Museum observations have provided us with a set of *design sensitivities* that are presently shaping the process of scenario and technology development, hopefully without oversimplifying the Hunt Museum experience (Ciolfi & Bannon, 2002b).

In order to keep the user's interest and engagement high, we must envision ways to support different 'layers of activity': this could provide participants with the ability to engage in a progressive sequence of actions (both alone and with others) to provide successive surprises and discoveries. For example, more and varied information on assemblies of objects and their mutual relationships is provided to those who want to explore further aspects of the exhibit.

The SHAPE "Living Exhibition" should support visitors in discovering features of the exhibits both individually and collaboratively. Thus the interactivity we support should not be limited to that between an individual and an exhibit, but we should consider the different degrees and combinations of verbal and gestural interaction amongst individuals around the artefacts. The installation should, if possible, provide some kind of added-value associated with collaborative interaction around the drawers.

Children should be allowed to take part in the activity and to take notes or sketches around the exhibition. The installation should also give children the possibility to lead the process of discovery and to show things to their companions.

We must also consider possible ways of *encouraging* interaction with, and around, the exhibition, and specifically collaborative interaction. The

technologically augmented exhibit should provide clues, triggers and adequate affordances to make visible which actions the visitors are allowed to perform on each component of the installation. The "Living Exhibition" should support the group visit experience with appropriate feedback that all the members of the group can appreciate. The possibility for the visitors to engage in direct face-to-face interaction around the exhibit must also be insured, as discussing the objects together is an essential part of the group experience around the exhibit. This means that devices as head-mounted displays or headphones are not appropriate for such an installation.

The exhibition should offer insights on the life of the objects before they become part of the collection, thus providing some historical context for the present collection. This would encourage visitors to go back to the actual objects on display and look at them in a different way, allowing them to see different things as they visit a section again.

The SHAPE Living Exhibition should provide an added value to the museum visit both for casual visitors and a more expert audience, and should integrate seamlessly with the current information services, e.g. the Docents and informational material.

The SHAPE exhibition should allow visitors to leave a trace of their visit and their interaction with the objects, something which might in turn shape and influence the experience of other, later, visitors to the Museum.

As well as the design of specific interactive experiences concerning artefacts and their display, we must also be concerned with the *orchestration* of the overall visitor experience, in order to create a sense of engagement for the visitors and a seamless transition between the existing collections and the "Living Exhibition" (Ciolfi & Bannon, 2002a).

### CHALLENGING DESIGN

From the field studies and the consequent analysis, it clearly appears that traditional museum technologies as touch-screen terminals and audioguides cannot be possibly be used in the design and installation of the "Living Exhibition". These devices are too limited to respond to the demands emerged from the series of design sensitivities, both on the technical and cognitive level. The design sensitivities themselves call for an innovative installation that takes inspiration from the current museum exhibits, but offers new possibilities to the visitors as direct involvement and interaction with the artefacts, triggers to encourage collaborative behaviour, possibility for the users to reconfigure the exhibition.

Ultimately, the Exhibition itself and the objects on display should be the interface that allows visitors to access digital content. Through direct manipulation and interaction, many of the goals and features expressed by the design sensitivities can be achieved.

Several current research projects involve the design of graspable interfaces and the use of physical icons instead of graphical user interfaces (see for example

Ishii & Ullmer, 1997), and also explicit design principles for tactile interaction on interactive objects have been developed (Challis & Edwards, 2000). However, the object itself is usually not considered as the locus of information nor the focus of attention. Rather, objects are essentially tools for interacting with a computer system, and they are intended to act as a physical representation of surface interface elements such as icons and pointers.

Our approach is distinct, as we are interested in objects as both material and symbolic devices in their own right, with a history, context of use, etc, both mediating and being the object of interaction. We are interested in exploring these issues, both from a theoretical perspective and in order to inform the design of such artefacts.

We believe that one somewhat neglected aspect of the study of artefacts is their potential for stimulating creativity and imagination in the user. We intend to conduct a theoretical investigation on these issues as part of the design process in the immediate future, for it is particularly critical to fully appreciate the particular role that the Hunt artefacts already have, and we wish to support and enhance this aspect through the Living Exhibition.

Specifically, in developing the design scenario for the Hunt Museum, we intend to further investigate the cognitive and interactional nature of objects in the context of the Hunt Museum, and to reflect on the ways they could be designed as media - connecting the physical locale of the museum and the virtual world of information.

### GENERAL THEMES AND OPEN QUESTIONS

In exploring the design space we have been developing various use scenarios (Carroll, 1995), building on sketches (see Fig. 5) and storyboards (see Fig. 6). These helped the design group in visualising possible assemblies of different exhibition components, and in clarifying some of the distinct properties of the technologically augmented exhibit that we wished to create.

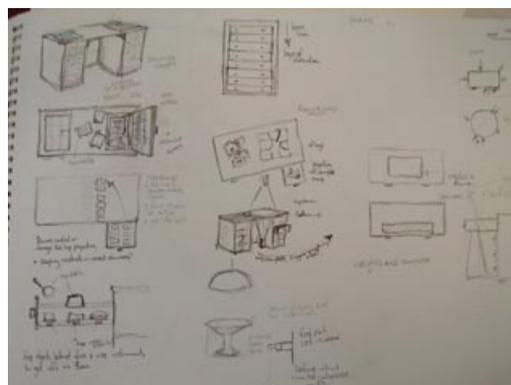


Figure 5. A sketch informing the process of scenario development.

From the discussion and integration of paper sketches, we designed a first demonstrator using unobtrusive technology to endow objects with "digital" properties (see Fig. 7). For example, we placed radio-frequency identification (RFID) tags onto two ceramic figurines and placed them in a drawer. RFID systems include electronic devices called transponders (the tags), and reader electronics to communicate with the tags.

These systems communicate via radio signals that carry data either unidirectionally or bidirectionally. When a transponder enters a read zone, its data is captured by the reader and can then be transferred through standard interfaces to a host computer or server for storage or action (Hall & Gallagher, 2002).



Figure 6. A storyboard visualising elements of design scenarios.

The tag reader has been hidden inside the chest of drawers, the figurine did not have any wiring or connection to the reader. When placed on top of the chest of drawers, each figurine triggered a different visual description and a sound background to be displayed. When both the figurines are placed on top of the chest, a third description appears. This is just the beginning of an extended scenario that we are developing, involving several objects and different kinds of informative output, that we will be testing with users to evaluate the most salient features of such an assembly of technologically enhanced artefacts.



Figure 7. The first demonstrator using RFID tags.

We are aware that we have only begun to scratch the surface of the problem. Many questions of how to develop useful and engaging interactive sequences have to be answered. Issues of how to embed computational capability into objects have to be addressed.

Other issues are related to the museum structural and cultural context. How do we make a seamless fit between the current exhibits and information services and our interactive ones, or do we try? How do we deliver content? However, we do believe that our observational work to date has given us insight into what visitors find engaging, and that our design approach is taking seriously the challenge of developing engaging and appropriate augmented interactive objects and spaces in the Museum. We hope to assess the validity of this claim in the coming year, when our Living Exhibition will be open for public viewing and critical assessment.

#### ACKNOWLEDGMENTS

We are very appreciative of the support from all the personnel at the Hunt Museum, and particularly to Peter McNamara and Nora Hickey for their enthusiastic support of our work.

Thanks to Tony Hall, Kieran Ferris, Krispin Leydon and Paul Gallagher for their work on scenario and technology development, and to other EU Disappearing Computer SHAPE projects participants for useful discussions.

#### REFERENCES

- Bachelard, G. (1969), *The Poetics of Space*, London: Beacon Press.
- Carroll, J.M. (1995), *Scenario Based Design*, New York: Wiley.
- Challis, B.P., Edwards, A.D.N. (2000), "Design Principles for Tactile Interaction", in Brewster, S., Murray-Smith, R. (Eds.), *Haptic Human-Computer Interaction*, Heidelberg: Springer.
- Ciolfi, L., Bannon, L. and Fernström, M. (2001), "Envisioning and Evaluating Out-of-Storage Solutions", *Proceedings of ICHIM01-International Cultural Heritage Informatics Meeting*, Philadelphia: Archives and Museum Informatics.
- Ciolfi, L., Bannon, L. (2002a), "Observing, Analysing, Designing: Towards enhanced interactive museum exhibits", in Gallwey, T., Waldmann, T., O'Sullivan, L. (Eds.), *Irish Ergonomics Review*, Proceedings of the Irish Ergonomics Society Annual Conference, University of Limerick, April 2002.
- Ciolfi, L., Bannon, L. (2002b), "Learning from Museum Visits: Shaping Design Sensitivities", Technical Report, IDC-University of Limerick, April 2002.

- Csizsentmihalyi, M. and Hermanson, K. (1994), "Intrinsic motivation in museums: why one does want to learn", in Hooper-Greenhill, E., (Ed.), *The Educational Role of the Museum*, London: Routledge.
- Elsner, J. & Cardinal, R. (Eds.) (1994), *The Cultures of Collecting*, Cambridge, MA: Harvard University Press.
- Falk, J.H. and Dierking, L.D. (1995), *The Museum Experience*, Washington, D.C.: Whalesback.
- Hall, T. and Gallagher, P. (2002), "RFID Overview", Technical Report, IDC-University of Limerick, April 2002.
- Hooper-Greenhill, E. (1992), *Museums and the Shaping of Knowledge*, London: Routledge.
- Ishii, H. & Ullmer, B. (1997), "Tangible Bits: Towards seamless Interfaces between People, Bits and Atoms", *Proceedings of CHI'97*, New York: ACM Press.
- Newhouse, V. (1995), *Towards a New Museum*, New York: Monacelli Press.
- Pearce, S.M. (1994), *Interpreting Objects and Collections*, London: Routledge.
- Shuh, J.H. (1994), "Teaching yourself to teach with objects" in Hooper-Greenhill, E., (Ed.) *The Educational Role of the Museum*, London: Routledge.