Interaction as a Public Phenomenon

SHAPE IST 2000-26069 Workpackage 2 Deliverable D 2.1

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Situating Hybrid Assemblies in Public Environments

26069

**Deliverable D2.1
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1. Introduction

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1.1 Document Overview

This document is the first deliverable arising from Workpackage 2 of the SHAPE project, which is funded as part of 'The Disappearing Computer' (DC) initiative of the European IST programme 'Future and Emerging Technology' (FET). SHAPE is devoted to understanding, developing and evaluating room-sized assemblies of hybrid, mixed reality artefacts in public places. Within this general context Workpackage 2 is devoted to exploring and analysing the practices of participants in public places as they interact with artefacts and each other. SHAPE considers museums, galleries and exploratoria as social spaces that have relevant commonalities with a variety of public places. Therefore the focus for both social and technical studies in SHAPE has been on such research settings. Indeed, we outline below some of the major benefits of taking museums and galleries as the principal research settings for our studies.

Workpackage 2 consists of three interconnected and interrelated strands:

- To explore patterns of communication and interaction that arise with and around various types of exhibit and exhibition in a range of museums and galleries.
- To assemble and evaluate various (relatively) low tech exhibits in order to undertake small scale studies of the affordances of particular combinations of artefacts.
- To develop design sensitivities and sensibilities for use in the development and deployment of hybrid artefacts.

This document charts our progress in each of these three strands of work and it will be demonstrated that significant progress has been made. Although we describe the structure and content of the deliverable in more detail at the end of this chapter, it may be worth noting that our reporting of field studies, literature reviews and low tech prototypes focuses around three broad issues:

- *Informing design*. At the end of each chapter we have produced a summary of the key issues for organising and discussing designs for museums and other public places. These design sensitivities are collated and extended in Chapter 6 and form a rolling or 'organic' document to be used and elaborated throughout the project life cycle.
- *Interactivity and Interaction*. Although designers sometimes discuss 'interaction' in

terms of engaging individual visitors with individual exhibits, here we aim to explore a broader notion of 'interaction'. In particular, we are concerned to identify and unpack a variety of forms of (co)participation in museums and galleries. Our concern is not solely in terms of how individuals interact with artefacts, but rather how they interact with artefacts *and* with others. Additionally we are not simply concerned with talk, but also with non-verbal and non-vocal forms of communication. This demands a detailed consideration of how participants are sensitive to others in their environment. Thus, all of the chapters in various ways attempt to explicate the socio-interactional organisation of the museum visit.

- *Assembly*. Whilst HCI and CSCW are often concerned with the design of an individual artefact, this document begins to chart the ways in which individuals encounter and constitute *assemblies* of artefacts. SHAPE is dedicated to producing assemblies in public environments and museums are intriguing in this regard as curators and museum managers are constantly concerned to develop assemblies or 'exhibitions' of artefacts. Thus each chapter begins, in different ways, to explore the designed association of objects and how those designs are experienced by individuals and groups in museums and galleries; i.e. how participants interact with and around assemblies of artefacts.

1.2 Museums and Public Places

Although social and technical work on SHAPE is concentrated primarily on museums and galleries at this stage, the project has longer term ambitions to reflect on the relevance of our studies for public places more generally. Nevertheless museums and galleries provide a useful domain in which to initiate this research trajectory as they have similar characteristics to a variety of other public places:

- Public places such as shopping malls, town centres, train stations and the like are increasingly being enhanced with physical and digital information devices and displays. Moreover, there is a growing trend to consider how these information displays could be inter-connected both with each other and also with various physical phenomena (e.g. the movement of trains, buses, queues, etc.).
- Museums like other public environments constitute spaces that will be more or less familiar to different individuals.
- Visitors are engaged in a range of activities with strong similarities with numerous public places: wayfinding, technology use, waiting, queuing, crowding, etc.
- Public places routinely feature various combinations of individuals with varying degrees of previous acquaintance - individuals, couples, etc. - that share the same spaces, encounter and inspect the same artefacts and so forth
- Relatedly, public spaces involve a variety of forms of verbal, non-vocal and tactile interaction between these collections of individuals. These range from interactions between companions (friends, colleagues, families, etc.) who are navigating and exploring a space together to interactions between individuals or groups who have no previous acquaintance and yet happen to be sharing the same space. This range of potential interactions will impact upon the ways in which exhibits and technologies are encountered, explored, used and understood.
- Museums and galleries provide unique opportunities to install technological devices to

be used by the public for study and testing. This provides research with the potential to design, deploy and evaluate 'prototypes' that will be used and encountered by the public in the course of their everyday affairs, rather than in artificial environments and scenarios.

1.3 Workpackage Activities

Although various activities will be reported in full in the course of the deliverable, here we outline the key activities that have been undertaken in developing this document.

Field Studies: Data Collection

At its onset, the project had at hand a range of video materials available for analysis by the SHAPE consortium. There was, for example, a collection of naturalistic data taken at the Chelsea Crafts Fair and focusing on an artefact produced prior to the project by craft-maker Jason Cleverly in collaboration with KCL. The analysis of these data was undertaken as part of the project and has been reported in Deliverable 4.1 (Chapter 2: 'Crafting Participation'). Also in advance of the onset of the project, the consortium had available in-depth field materials concerning the introduction of multimedia artefacts into a decorative arts museum, the National Museum of Ireland at Collins Barracks (Dublin). The availability of these materials once again facilitated early analytic work of relevance to SHAPE and was reported in depth in Deliverable 4.1 (Chapter 4: 'Designing Interactive Installations'). In addition there were video materials available from The Science Museum (London), The Victoria and Albert Museum (London), the Courtauld Gallery (London) and Green's Mill Science Centre (Nottingham). This provided the project with an initial corpus of video data of visitor behaviour around a diverse range of exhibits and exhibitions.

In the course of Task 2.1, additional field studies have been undertaken in a range of museums and galleries. Studies have been undertaken in Technorama, Tekniska Museet (Stockholm), King John's Castle (Limerick), Limerick City Museum, the Hunt Museum (Limerick), Castle Museum (Nottingham), The Science Museum (London), @Bristol Science Centre (Bristol), The National Portrait Gallery (London), The Victoria and Albert Museum (V & A, London), The Natural History Museum (London), The Serpentine Gallery (London) and The Transport Museum (London). Data collection has been designed to enable us to compare and contrast action and interaction in different types of exhibition space, involving different types of exhibits in different configurations, ranging from 'aesthetic' to 'applied', from interactive to non-interactive, and involving different types of visitor and visiting arrangement.

These field studies have included periods of participant observation in which researchers have visited museums, used exhibits and information technologies, explored exhibitions and observed people navigating and exploring the museum space.

In many cases this observational research has been augmented by the collection of photographic images and, more importantly for analytic purposes, video materials of visitor behaviour. Video recording has tended to focus on single exhibits, such as the cabinets of curiosity in the Hunt Museum, or the jumping skeleton in @Bristol. However, we have also been able to record 'handling sessions' at the Hunt Museum, where groups of visitors are encouraged to feel and manipulate artefacts from the collection and in the presence of a

museum docent. Furthermore, we have recordings of sessions at the V & A, where visitors bring artefacts in to have them assessed by curatorial staff.

In addition, we have conducted informal interviews with museum education officers, curators, content, exhibit and exhibition designers.

The collection of data in such a variety of museums and galleries has been designed to facilitate various forms of comparative analysis. Also, although our field studies have focused on museums and galleries, we have augmented these materials with additional small-scale studies of public places. The studies of interaction in public places have included areas such as train station concourses. This material has been collected with an eye to the longer-term concerns of the project with the issues surrounding the design and deployment of hybrid assemblies in public places more generally. Train station concourses are particularly fruitful because they usually feature a range of information, communication and other technologies while being densely populated.

Elements of this whole body of data have been distributed and discussed within the consortium as part of our first steps towards addressing Workpackage 2, Objective 1 ("To establish a data archive combining field notes, video recordings, documents, interview transcriptions and other empirical materials collected at a variety of real-world sites, which can serve as a project-wide resource.")

Field Studies: Access

The collection of data has been made possible by concerted efforts on behalf of the consortium to initiate and sustain access into a range of museums and galleries. Often this entails numerous meetings to discuss the nature of the data to be collected; how, where and when it will be analysed, presented and distributed; what feedback the museum will receive; what support the museum needs to provide; the information to be presented to staff and visitors; and so forth. Although the bulk of such effort is taken up in initial consultations, often changes to museum personnel can initiate new periods of consultation work to discuss access issues. As a consortium we are extremely grateful that we have had chance to work with a selection of individuals in the museums industry that have been interested in our work and who have provided us access to their institutions.

Field Studies: Data Analysis

The primary focus for work in Task 2.1 has concerned the analysis of these data collected. The key concern for the researchers has been to generate analytic themes and issues to shape design work undertaken in all SHAPE activities. Analysis has been conducted primarily by individual researchers. However, collaboration has been supported through data analysis workshops and regular meetings between the partners. Data analysis workshops in which data is presented and analysed are held regularly – within research groups, between occasional yet purposeful clusters of individuals in different research groups, and between research groups. These data analysis workshops also provide a forum for raising and addressing the practical implications of the research, both with regard to exhibit and exhibition design, and the use of video-based methods for practical evaluation.

The analysis of these materials has focused around:
- Different museum approaches to content delivery.

- Curatorial concerns.
- Exhibition lay-out and space design.
- Forms of visitor involvement and engagement with different types of artefact.
- Patterns of visitor discussion and collaboration over and around exhibits.

As a result, various analytic themes and issues have emerged; many of which will be discussed in more detail later in the document. However, it may be worth highlighting one or two issues at this stage.

First, there has been a concern with the design of the spaces in which interactive media are encountered. Our analyses have revealed how an understanding of the physical setting can help to understand why certain technological installations are problematic in terms of user acceptance and use. For example, we have seen how information kiosks in Collins Barracks, and elsewhere, have somehow 'separated' the visitor from the exhibit to which the information refers. This separation disrupts the abilities of visitors to seamlessly juxtapose the exhibit and ancillary information about the exhibit. Indeed, users are often unable to make the link, both physically and semantically, between the artefacts and the installations.

Second, our analyses have begun to explicate the various ways in which an individual's engagement with an exhibit is produced with regard to others within perceptual range. Their actions and activities at the 'exhibit-face' are not only tailored to the conduct of their companions, but also others who happen to be exploring the exhibition at the same time. The activities of those others can influence which exhibits an individual or group approaches; what they look at; how they touch, manipulate or otherwise interact with the exhibit and so forth. Indeed, we have been particularly struck by those moments in which seeming strangers strike up a conversation or interaction. Particular examples can be found in interaction observed around *Deus Oculi*, where the asymmetry of resources available to participants and the curiosity of the piece provide co-located individuals with opportunities to share their, and shape others', experience of the exhibit (see also Deliverable 4.1).

In addition to our analyses of museums and visitor behaviour, we have been using the availability of data from a variety of specialised work settings to explore the concept of 'hybridity' in various domains. These studies are aiming to provoke particular design directions and sensitivities. For example we are concerned to explore the interrelationships between and communication of different sensations *in interaction*. Most relevantly we are examining settings where 'touch' and 'perception' are notable and remarkable features of everyday working.

Design and Evaluation of Low Tech Prototypes

The field studies and focused analyses developed within Task 2.1 have provided a platform from which to initiate the design and evaluation of specific low tech prototypes. These have been developed to target particular issues or concerns drawn from the field studies. Our collaborations with museums, artists and craftmakers have provided a unique opportunity to conduct 'naturalistic experiments', in which we have placed our low tech interventions 'into the world', in museums and galleries, to be encountered by visitors as if they were any other piece in the gallery. This opportunity is extremely rare when dealing with workplace contexts, as the consequences of 'failure' there are potentially so high. However, in this regard museums and galleries are wonderful 'natural laboratories'.

This work has focused around two main collaborations with, first, The Hunt Museum and also The Interactive Crafts Group, University of Staffordshire, UK. These are discussed in more detail in Chapters 4 and 5 of this deliverable.

Literature and Exhibition Review

We have conducted literature review work to ascertain the state-of-the-art in a range of disciplines of key relevance to the design and evaluation of SHAPE studies and exhibits. Most notably, these include: visitor, museum and curatorial studies; studies of social interaction, particularly in public space; studies of the design and impact of built space; social scientific studies of the object; Human-Computer Interaction (HCI); Computer-Supported Co-operative Work (CSCW); Computer Support for Collaborative Learning (CSCL). In order to ascertain the nature of the most innovative and hi-tech exhibits in museums and galleries it has also been necessary to undertake extensive reviews of existing exhibitions in key contemporary museums and galleries.

Internal and In-Line Dissemination

As our studies have progressed we have informally disseminated findings within the consortium and during SHAPE constructional workshops in order to provide suggestive content and to encourage particular directions for development. In particular, and in reference to Deliverable 1.1, the assembly and deployment of the ToneTable (initially during the Second SHAPE Workshop hosted by KTH, see Deliverable 4.1) was concerned to address preliminary design sensitivities discussed in detail in Chapter 6; the content for Unearthing Virtual History drew on a small-scale field study of the Castle Museum in Nottingham; and part of the Plinth design was informed by design sensitivities discussed within this report. These connections between Tasks 1.1 and 2.1 are further brought out in Deliverable 1.1.

Dissemination as a Research Activity

Through our presentations to, and discussions with, museum professionals we have developed our understanding of curatorial concerns, visitor behaviour, and the practicalities of design for museum spaces. In this regard we have held a number of dissemination activities that feed directly into the fact-finding work of Task 2.1. These include:
- A SHAPE Day at University of Limerick, with attendance from university academics and museum professionals from Limerick museums
- Hunt workshop, with museum curators from the Hunt museum
- Plenary, International Conference for Education in Museums, London – with attendance from and contact with numerous museum professional and groups, including: Resource (The UK Council for Museums, Archives and Libraries), The British Museum, Sheffield Industrial Museum.
- Meetings with experts at The Science Museum (London), The V&A (London), Green's Mill, The Castle Museum (Nottingham) and numerous others.

Design Sensitivities for Hybrid Assemblies

Drawing on these various studies and approaches, we have produced a draft document

concerned with elucidating design sensitivities for developing and deploying hybrid assemblies in museum and gallery spaces. This is reported in full in Chapter 6, but will be treated as an organic document that will be elaborated and reported both formally and informally at different points within the project lifecycle. Although, it is not until Task 2.2, that we are due to develop a design framework for hybrid assemblies, the character of our studies has enabled preliminary work to this end. Indeed, the internal circulation of a preliminary version of our design sensitivities allowed work in Task 1.1 to react both with regard to how it has built its demonstrators but also in its work on design concepts and principles.

1.4 Deliverable Structure

This deliverable is structured as follows:

Following this introduction, Chapter 2 outlines some key aspects of social interaction in museums and galleries. It discusses some of the ways in which museums and galleries, most notably those collaborating with SHAPE, address their educational role. It also reviews key literature in the field of visitor studies and reveals the lack of understanding of embodied conduct (talk, visual and tactile) in museums and galleries. To begin to address this, the chapter provides an overview of the KCL studies of visitor conduct and interaction drawn from a wide-ranging body of video data from numerous museums and galleries.

Chapter 3 examines developments in the design of technologies for museums and public places more generally. It begins with a discussion of some of the key uses of new technologies in museums and galleries, including preliminary findings from a study of a room-sized video art installation. It then broadens the discussion to examine developments of a range of new technologies that aim to support work, interaction and activity in social and public spaces more generally. It forms a critical review of recent developments in HCI and CSCW. The chapter concludes by highlighting where SHAPE can learn from these developments and where it has the potential to innovate.

Chapters 4 and 5 describe project progress on the development and evaluation of low tech prototypes of object assemblies. Chapter 4 provides an account of UL's close collaboration with the Hunt museum in Limerick, their field studies and their development of design scenarios. Chapter 5 reports on two exhibits that KCL developed, deployed and analysed in collaboration with craft-maker Jason Cleverly. One, *Keepsake*, will be a permanent exhibit in the Beatrice Royal Arts and Crafts Gallery (Eastleigh, UK). The other, *Ghost Ship*, was exhibited at Sculpture Objects and Functional Art (SOFA) in Chicago (USA) in September 2001.

Drawing on findings from the work reported throughout the deliverable, the discussion chapter initiates an organic document that highlights a variety of SHAPE design sensitivities that will be used to inform project design discussions. It concludes with some immediate next steps in the work of Workpackage 2.

With respect to the project objectives, Chapters 2, 3, 4 and 5 all include materials that address Workpackage 2, Objective 2 ("Through methods of ethnographic and interaction analysis, to explicate the practices and procedures employed by visitors to public places such as museums and exploratoriums as they interact with exhibited artefacts and each other") and Objective 3 ("Through collaboration with the project's research sites, to develop an

understanding of the considerations museum and related personnel have in designing exhibits and exhibitions and managing their realisation."). Meanwhile Chapter 6 presents our first steps towards Objective 4 ("To produce a design framework for informing the development of hybrid digital-physical artefacts, and assemblies of them, on the basis of empirical analysis.").

2. Social Interaction in Museums and Galleries

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This chapter presents the SHAPE project activities in the context of recent developments in museums and galleries. In particular it highlights various ways in which curators, museum managers and indeed visitor studies researchers are considering different ways of addressing the educational role of museums and galleries. It demonstrates how studies of visitor behaviour tend to neglect the embodied conduct of participants. Our studies attempt to address this deficiency and thus the remainder of the chapter reviews some of the key issues emerging from these studies of embodied visitor interaction museums and galleries. These are organised as: Approaching Exhibits, Configuring Participation, Shaping Experience, Peripheral Awareness and Chance Encounters.

2.1 Introduction

Over the past decade or so, there has been a growing political commitment to enhancing museums and galleries and encouraging public access to both the arts and the sciences. Substantial public and private funding has been invested, major institutions have been transformed and new exhibition spaces have been created both in Europe and North America. Underlying these developments we find a burgeoning interest in redesigning collections and creating exhibitions and institutions which will serve to encourage new forms of participation and experience and contribute to public life and sociability. A key aspect of these developments has been a growing attempt amongst museums and galleries to enhance their educational role, in part to justify the increase in public funding. Indeed museums have been included "among our pre-eminent institutions for learning" (Leinhardt and Crowley, 1998: 2). Intriguingly however the standard distinction between formal learning in classrooms and informal learning in museums can be seen as rather problematic, for example it has been noted that "… most school classes that visit museums are restricted and structured" (Griffin and Symington 1997: 763).

A key element of these developments has been a growing concern to encourage a

transformation of the traditional role of 'interactive' exhibits. Rather than purely engender visitor interaction with the exhibit itself, museum spaces are increasingly being designed to encourage interaction between people with and around those exhibits. So, exhibit and exhibition designers are increasingly concerned to encourage visitors to discuss features of exhibits, collaborate on tasks and the like. The rationale for such a movement comes from studies, and indeed theories of informal learning, that suggest that observation, interaction, comment, discussion and debate between people promotes a more effective learning environment (Leichter et al. 1989; Stevenson 1977; Sakofs 1984; Calton 1998; Lave and Wenger 1991).

If this does indeed provide a motivation for the development of novel technologies to support the museum experience, it would seem critical that we have a sound understanding of the ways in which a variety of exhibits and exhibitions are currently encountered, explored and indeed 'used'. Such an approach is common in other areas of technological research and development for 'groups' of users, such as CSCW. Thus the aim of our studies of social interaction in museums and galleries is to develop our understanding of how visitors organise their actions and activities with and around exhibits. Before discussing those studies however, we will first put them in the context of the educational activities that occur in museums and galleries and contemporary research on visitor behaviour.

2.2 Educational Activities in Museums and Galleries

The educational role of museums and galleries is organised in a variety of ways, ranging from the more formal to the informal. Science museums and exploratoriums commonly display interactive educational installations as a fundamental part of the exhibits in order to teach adults but mostly children about science, technology and nature. In this specific kind of museums, the exhibits themselves are explicitly designed for encouraging learning and reflection (Caulton, 1998). Two of the museums currently collaborating within the SHAPE project belong to this category.

The Tekniska Museet in Stockholm offers visitors a very comprehensive view on the history of technology and technical innovation. Technorama, the 'educational wing' of Tekniska Museet, has its focus on participation and physical interaction, with the purpose of extending as much as possible children's sensorial experience and reflection. The exhibits provide children with multi-modal interactive installations about scientific and technical themes (e.g. physics, human perception, natural history, etc.). For example, there is one installation where children drop a ball into a conic device, which mimics the vortex force of a black hole. This is at least fun to use, and may prompt the child to understand momentum. There are also a number of exhibits, which are just intrinsically fun for visitors to explore together – e.g., the room of distorted mirrors. There is also a video-conferencing suite, combining telephone, Internet, mobile telephony, and videophone connectivity, where children can together explore the latest in telecommunications technology.

The experiences offered to visitors at the Green's Mill Science Centre in Nottingham (UK) focus on practical engagement with mathematics. For example, visitors can explore concepts relating magnetism and mathematics by using certain magnetic devices. There are also conundrums and games, e.g. Towers of Hanoi. The museum also offers an 'Under 5' section, where very young children are welcome to play and draw.

'Traditional' museums, where collections of objects, artworks and similar are on display, generally offer educational activities in addition to the exhibits (especially when these are not suitable for direct interaction) in order to facilitate appreciation, understanding and enjoyment by adults and children (Hooper-Greenhill, 1994).

Special guided tours for schools and families with young children are offered by many museums, as well as lectures on specific themes, storytelling sessions and sketching activities regarding objects on display or sections of the museum. Some institutions offer specific lecture series for teachers in order to suggest possible integration between the museum's themes and official school programs.

As well as these activities, many museums have developed educational programs including participatory workshops, where children are encouraged to reflect on what they saw during the visit to the museum and to develop original thoughts, representations or artefacts on the basis of their understanding of the museum. Such activities include art-making and craftwork in the galleries, dance, play and acting workshops, sessions of drawing or creative writing exercises. Another increasingly popular activity in decorative arts museum are 'handling sessions', where visitors are allowed to manipulate and closely observe objects taken from the collections.

Similar activities are offered by the museums currently involved in the SHAPE project. We closely observed some of the educational workshops organised by the Hunt Museum in Limerick. The 'Portrait Workshop' includes a focused visit to the Museum's portrait collection during which the children are invited to comment aloud on the pictures they see and express their opinions about them. Subsequently, the children are asked to draw their self-portrait (with the help of a mirror) and present it to the rest of the group. The 'Costume Workshop' is coupled with a tour of the museum focused on the study of different costumes, jewellery and hairstyles through time. The participants then attend the actual workshop, where a museum expert presents to them accurate replicas of eight outfits belonging to different periods that the visitors are also allowed to wear.

As well as these activities, the Hunt Museum offers an interesting 'Archaeology Workshop' for schools, following the visit to the archaeological section of the museum. We have conducted initial field studies of children digging together in simulated pits: three sandboxes (simulating archaeological sites from the Stone Age, the Bronze Age and the Middle Ages) contain hidden objects, replicas of real archaeological findings. The children are shown how to proceed to the excavation and are encouraged to document their findings with drawings and written descriptions. At the end of the excavation, the children are asked to present their findings and comment on them for the entire group.

One observation common at the start of all the studies we have completed so far is the eagerness among the children to find out what is underneath the sand. Besides introducing children to archaeology, digging in simulated pits can also help to develop their emotional knowledge: the excitement of direct involvement is something we observed in all the participants to the workshop. Children learn also empathy and other social skills, necessary for working co-operatively with others, from working with peers in simulated digs. A further significant benefit of simulated archaeology is that children have to unearth hidden artefacts, which generates significant curiosity and excitement, harnessing their intrinsic motivation to participate. However, by the same token, in the sessions we have observed, children have also learned some of the techniques of archaeology, and, after some direct instruction from peers, teachers, other educators, they generally take great care in methodically probing and scraping

the surface of the sand to seek out hidden artefacts underneath. Also, there is significant potential to expand children's sensorial experience with simulated archaeology – children are actually handling artefacts; turning them; feeling their texture; fingering them; and, at times, even testing them to guess the function they served. Children also gain some experience of the limitations of archaeology, how difficult it is to make faithful inferences about the past, based on its material residue, embodied in unearthed artefacts. Simulated archaeology illuminates the incompleteness of artefacts as clues to the past (Fairley, 1977).

2.3 Visitor Studies

In terms of the more direct interaction between visitors and exhibits, there is a substantial corpus of social science research concerned with the conduct of visitors in museums and galleries. The field, which has come to be known as 'visitor studies', emerged within North America in the late 1920s (e.g. Robinson 1928; Melton 1933) and focuses on the 'effectiveness' of exhibits and exhibitions (Shettel 1976; Screven 1976). Much of this work is concerned with practical ways of enhancing museum spaces and exhibits to promote learning and engender particular kinds of visitor responses. Until recently such research has been primarily concerned with the conduct and cognition of individual visitors and the ways in which they encounter and experience specific exhibits (e.g. Shettel 1976; Screven 1976; Bitgood and Patterson 1987; Bitgood 1994; for a critique, see Lawrence 1993).

However, in recent years there has been a growing recognition that people often visit museums with others and that their experience of exhibits and exhibitions is produced in and through interaction and discussion with companions, family members and others within a group (see for example, McManus 1987, 1988; Diamond 1986). Indeed, within visitor studies there is a growing call for more detailed studies of social interaction with, and around, exhibits (Leichter et al. 1989; Lawrence 1991, 1993).

In this regard, there is a developing body of research which has begun to examine interaction between people in museums and galleries and the ways in which exhibits are experienced through the collaboration of visitors. This research includes studies of how the different forms of group influence what a visitor sees and learns (e.g. McManus 1987, 1988; Blud 1990). Additionally studies that consider the discourse or language used often consider to types of questions, statements or other utterances produced when companions encounter an exhibit (Gilbert and Priest 1997; Rosenfeld and Terkel 1982). Furthermore, Leinhardt and Crowley argue that a good indicator for learning in museums is conversational elaboration. They suggest that if learning has been achieved in museums, then "… the kinds of conversations about a particular phenomenon … that occur before a museum visit would be impoverished and less detailed than after such a visit" (Leinhardt and Crowley 1998: 6).

Others have highlighted the benefits of particular kinds of interaction between museum 'staff' (docents, actors, etc.) and visitors. Studies of museum tours, for example, have demonstrated the import of engaging visitors in discussion and debate as opposed to lecturing at them. They suggest that stimulating dialogue with and between visitors engenders more engaged and inquisitive visitors (Sakofs 1984). Interestingly even the presence and activities of researchers can provoke visitors to reflect on their visit and the lessons to be learnt from an exhibition. The presence of researchers trying out a novel technology in one science museum encouraged visitors to re-explore and to see anew a particular exhibit. The technology became

a resource for educational intervention and dialogue (Stevens and Hall 1997). Indeed, even pre- and post-visit questionnaires by museum evaluators and researchers may promote similar processes of reflection and discovery.

These studies of visitor interaction have primarily focused on talk between visitors or between visitors and staff. Even where data is collected using video rather than audio-recordings (and field observation) researchers have disregarded the visual and bodily conduct of the visitors to a large extent. This is hardly surprising and of course reflects a wider trend within social science. Nevertheless, there is an emerging body of studies that is taking seriously the embodied activities in which participants engage as they explore museum exhibits (Hemmings et al. 2000; Büscher et al. 2001, Crabtree et al. 1999).

Intriguingly, however, whilst many museums and researchers call for exhibits that engender talk and interaction around exhibits, there remains relatively little research concerned with the moment-to-moment organisation of social interaction in exhibitions - how couples or groups navigate, encounter, share and experience exhibits together. If museums intend to design exhibits to promote flexible forms of co-participation, it would seem critical to develop our understanding of visitor participation with and around exhibits. Even a cursory glance at activities at the exhibit face reveals pointing gestures, iconic gestures, movements towards and away from exhibits, glances, demonstrations, descriptions, readings, button-pushing, lever-pulling, ball-rolling, mouse-pointing, object-lifting, and so on and so forth. It is our concern to explicate the ways in which visitors assemble such actions to organise action and interaction with and around exhibits. This is aimed towards developing a more 'embodied' understanding of the organisation of social interaction in museums and galleries and to use such findings to develop innovative assemblies of objects and technologies to engender novel forms of interaction and participation.

2.4 Video-Based Studies of Visitor Interaction

In this section we describe key findings from the KCL studies of visitor interaction in a variety of museums and galleries. The approach adopted within this work draws on the essays of Goffman (see for example 1963, 1981) and Kendon (1990), as well as the analytic orientation of ethnomethodology (Garfinkel 1967) and conversation analysis (Sacks 1992). More particularly, the approach arises in the light of the growing body of research concerned with the social and interactional organisation of visual, vocal and tactile aspects of human conduct (see for example Goodwin 1981; Goodwin and Goodwin 1996; Whalen 1995; Heath 1986; Heath and Luff 1992). The approach directs analytic attention towards the resources, the practices and reasoning on which participants rely in the production of social actions and activities and in making sense of the conduct of others. We focus in particular on the sequential character of the participants' conduct and the ways in which they accomplish their actions and activities in, and through, interaction with others, both those they are 'with' and others who happen to be within the 'same space'. Thus, our analytic orientation provides us with a vehicle to explicate the interactional and sequential organisation of the participants' conduct as it emerges through their bodily, tactile and spoken actions and activities.

For those with an interest in the conduct and interaction of museum visitors, video recordings, augmented by field observations, offer certain advantages over more conventional data. They provide an opportunity to capture versions of the participants' actions and

activities and subject them to repeated scrutiny, using slow-motion facilities and the like. They provide access to the fine details of human conduct and interaction, their talk and bodily conduct as it emerges moment by moment, details which are unavailable through more conventional data including materials gathered by interview or field observation. Video recordings also provide researchers with the opportunity, at least in public settings such as colloquia and conferences, to show and discuss analytic observations with regard to the data themselves.

Video recordings augmented by field observation, like all methods of data collection, are not without their problems and difficulties. Firstly, video recordings provide one version of the event and whilst having certain advantages over other observational techniques, cannot be accorded some ultimate objective status. Secondly, there is a long-standing concern with the reliability of the data, and in particular people's reaction to the camera (see the various contributions to Prosser 1998). In this regard it is worth raising one or two points. It is increasingly argued in the field of museum studies that video recording is less obtrusive than field observation and reduces the reactivity of observational methods (see for example Morrissey 1991; Phillips 1995). It is interesting to add that Goffman's powerful discussion of participation points to the inevitable significance of an individual within range of an event and in particular the persons contribution to the interaction (Goffman 1981). Both in undertaking field observation and video recording, we like other field researchers (see for example Goodwin 1981; Grimshaw 1982ab; Harper 1994; Prosser 1998) are highly sensitive to our part within, and influence on the scene. We take precautions to both reduce 'reactivity' and assess data for influence of the recording.

In our studies, the researcher physically separates the camera from the action by mounting it to a wall or attaching it to a tripod some distance from the exhibit itself. Once set up, the researcher leaves the camera to record the action only returning occasionally in order to change tapes. In our studies so far, very few visitors glanced at the camera and even fewer pulled faces, waved or otherwise observably responded to the camera (see also Hensel 1987 for similar findings). Maybe as CCTV begins to proliferate in public arenas, cameras are increasingly made at home in our everyday affairs.

A further important issue regarding visual data is a general ethical concern with the production and analysis of audio-visual recordings of members of the public. As a result, we discussed this issue at great length with the visitor studies managers and curators of the relevant museums. For the purpose of the study, notices were placed at all of the entrances to the galleries as well as near the exhibit(s), to warn, and secure the support of visitors. The notices explained the purpose of the project and that data would only be used for research and teaching purposes. We also provided visitors with the opportunity to refuse to be recorded and offered visitors the opportunity to have the recordings wiped if they were unhappy in any way. A number of visitors approached either the researcher or a member of the museum staff to discuss the nature of the project further, but no visitors refused to participate.

We have deliberately gathered materials from a wide-range of museums and galleries in an attempt to generate issues and findings of more generic relevance. Indeed, empirical visitor studies often restrict themselves to findings and also implications relevant only to single exhibits or exhibitions. We are interested in exploring conduct and interaction in different configurations of exhibition space, and with different sorts of exhibit - aesthetic, applied scientific, interactive, non-interactive and the like. Altogether we have collected so far approximately 300 hours of video data and a substantial corpus of field observations. We

have also had lengthy discussions with curators, museum managers, and with visitors themselves.

The thrust of the analysis has been developed with regard to the recorded data. We begin by reviewing all materials and logging events and activities of initial interest. As we undertake analysis we develop collection tapes, in which we gather together candidate instances of particular activities. The analysis proceeds 'case by case' and involves the detailed investigation of particular fragments of data. Ordinarily the analysis involves the transcription and mapping of conduct and interaction, and the detailed study of interactional or potential interactional character of particular actions and activities. We draw on the transcription system and techniques widely used in conversation analysis and cognate approaches to the study of social interaction (Goodwin 1981; Heath 1986; Kendon 1990). Through the detailed analysis of single instances, and comparing and contrasting characteristic actions and activities between various fragments, we begin to identify the patterns and organisation of conduct and interaction. In common with more traditional ethnography, these instances are selected as they provide interesting or particularly clear examples to reflect the more common themes that we explore.

For present purposes we have highlighted five key issues from our studies (including the study of *Deus Oculi* reported in Deliverable 4.1) that we believe have particular relevance to the SHAPE project. These have been critical to the development of the design sensitivities discussed in Chapter 6 of this deliverable. However they have also previously been informally disseminated within the project consortium to direct some of the design work in the SHAPE constructional workshops that are reported in Deliverable 1.1. These themes discussed here are: Approaching Exhibits; Configuring participation; Shaping Experience; Peripheral Awareness; Chance Encounters.

Approaching Exhibits

There is a long-standing tradition in research on visitor behaviour to assume that certain information is inherent in exhibits and that visitors are provided with clues to enable them to 'decode' the meaning and significance of particular objects and artefacts. In different ways, these presuppositions of embodied meaning permeate a diverse range of approaches to measuring exhibit success (e.g. stopping power, holding power, dwell time, etc.). These measurements refer to the ability of an exhibit to attract visitors to stop in front of it and the length of time it is able to hold them there. However, these measures fundamentally overlook the influence of visitors' companions when they are exploring an exhibition space.

Figure 2.1: Green's Mill Science Centre, Nottingham

A simple way in which the presence of others can influence a visitor's experience of a museum or gallery turns on what they choose to see. Indeed, in museums and galleries one person often takes it upon him or herself to encourage their companion to look at a particular exhibit. Visitors will not only be attracted to those exhibits by companions, but will also often *encounter* and *appreciate* the exhibit with regard to the way in which it has been introduced to them. For example, in terms of the question that has been asked of them (e.g. "what's this daddy?"; "do you remember do this at school") or the utterance that has been used to intrigue them (e.g. "wow", "eurgh") (see vom Lehn et al. 2000; Hindmarsh and Heath 2000).

Configuring Participation

When companions discuss and explore a specific exhibit together, they shape their respective actions and activities with and around the exhibit. Of course visitors to museums do not simply engage with exhibits, but also engage in general social conversation about their life and times. General conversation therefore is interleaved with museum exploration and action. Nevertheless, when exploring an exhibit with companions visitors coordinate their actions in viewing and manipulating aspects of the exhibit and indeed ongoingly establish particular forms of participation with the artefact (see vom Lehn et al. 2001). It is not solely the exhibit's attractiveness that keeps the visitors in its surrounding, but that visitors' access to and interaction with, an exhibit is shaped by their interaction with their companions through which they 'negotiate' their continued participation with that exhibit.

Figure 2.2: Green's Mill Science Centre, Nottingham

Goffman (1963) introduced the notions of focused and unfocused interaction as different forms through which two or more participants engage with each other. The two fragments discussed in this section have begun to demonstrate how participants transform and reshape such forms of interaction whilst varying their orientation to features of the material environment and their companions. The joint focus is renewed moment-by-moment and ongoingly constituted by the participants. Moreover in undertaking particular actions visitors constrain the possible actions of others: picking up an object may prevent another from holding that object at that time; offering an object to another may encourage them to engage in an activity that they might not have otherwise; standing in a particular way may constrain a companion s opportunities to participate; and looking in a particular direction may (be used to) encourage another to notice a particular phenomenon. Through the moment-to-moment organisation of action visitors continually organise the character of their involvement with the exhibit and in interaction and with each other.

Shaping Experience

A recurrent example of the ways in which companions 'negotiate' one another's participation in an exhibit, is through showing. Indeed, an individual's response to an exhibit may not simply consist of a direct personal reaction to the qualities and character of the piece. Rather, the very response, may be designed to facilitate and engender particular forms of co-participation, and to enable others to see and experience what you have seen in the ways that you saw it. The encounter with the work is not simply collaboratively accomplished, but rather the aesthetic response, within the very course of its production, is designed to display, and encourage, a way of seeing, of making sense, of experience by others.

Figure 2.3: i. Explore@Bristol, Bristol; ii. The Victoria & Albert, London

Participants may attempt to configure what is seen and experienced. So for example we have noted how in science museums, children sometimes exaggerate the operation of a particular process, by making sounds to accompany the movement of a liquid. In art galleries we have seen how the inscribed canvas of a painting is sometimes revealed through a series of 'exaggerated' or curvaceous gestures. In other cases, we have witnessed adults encouraging their children to follow a strict sequence to explore a science exhibit. In each case, visitors attempt to shape the ways in which their companion(s) encounter, experience and appreciate an exhibit (see also Deliverable 4.1).

Peripheral Awareness

Companions to an exhibition have profound effects on the ways in which each other navigates and explores that exhibition. However in exhibition spaces the copresence of a variety of visitors who do not have a prior history of social action together is an everyday phenomenon. It is rather odd therefore that the growing recognition of the importance of social interaction in museums and galleries has not been accompanied by studies of the impact of all those that 'interact' with an individual as they view an exhibit. Indeed, the ecology and design of these arenas not only allow individuals to inspect particular exhibits, but to witness the behaviour of others, some of whom will also be looking at particular exhibits.

Figure 2.4: The Science Museum, London

Individuals and groups are sensitive to others waiting to look at a painting or play with an interactive exhibit and often move on accordingly. They often organise their own movements towards and away from particular exhibits with regard to the activities and projected trajectories of others (see vom Lehn et al. 2001). Consider also how a crowd of people standing around an exhibit, possibly laughing or pointing, might intrigue others walking around the museum or gallery. Similarly, a simple question by one visitor can engender a particular kind of looking and inspecting of the exhibit by others overhearing the question. In other cases, the pressing of the buttons on the columns by one individual can encourage a stranger to turn to look for a button on a column near them. Therefore, visitors do not only notice features of exhibits, but their very use and experience of the exhibit is sensitive to the presence of others and their awareness of how others orient to the exhibit.

The museum experience not only arises, ongoingly, in, and through, the actions and activities of visitors, but is dependent on how visitors remain aware of, and sensitive to, the conduct of others who happen to be in perceptual range of the event (cf. Goffman 1981). The visual, vocal and tactile conduct of others provides resources for looking and seeing and for experiencing the various exhibits. Visitors awareness and monitoring of the actions of others infuses what exhibits they look at, how they negotiate access to exhibits with others, their looking, touching, and talking, and their very appreciation and understanding of the various objects and artefacts they confront. Consequently, actions and activities are produced not only in the light of accomplishments produced in the centre of one s own attention but also in the light of what is going on in the periphery . Of course, centre and periphery, foreground and background of actions and activities are ongoingly constituted and interlinked through participants activities.

Chance Encounters

Whilst much of the relationship between those who happen to share the exhibition space may be fleeting, subtle and often unnoticed, occasions do arise in which they may exchange glances or displays of recognition, strike up a conversation or even explore an exhibit together. The seemingly fluid boundaries of social interaction within public space are of

increasing practical relevance to museum curators and exhibition designers, and the growing interest in developing exhibits which facilitate and encourage co-participation and collaboration even amongst those who may simply happen to be in the presence of others.

Figure 2.5: *Deus Oculi*, Chelsea Crafts Fair, London.

Deus Oculi, an analysis of which is reported in detail in Deliverable 4.1, provided an intriguing set of examples in which seeming strangers began to interact more explicitly. The bizarre presentation of video images of others in a small, but clearly demarcated, assembly of artefacts provided a 'ticket for talk' (cf. Sacks 1992), where finding someone's image on public display was an opportunity, if not an obligation, to initiate discussion and debate. The moment of an action almost embodies the principle concerns of those interested in 'peripheral participation' and related matters. The transition point, from periphery into the principal strip of activity, hinges not on the spatial distribution of the participants, or even simply on the character of the conduct, but rather through the ways that actions are treated as sequentially responsive and prospectively relevant.

2.5 Discussion

This chapter has attempted to situate SHAPE project activities in the context of recent developments in studies of visitor behaviour. By extending the concerns of the analysis to incorporate an attention to the organisation of non-vocal conduct, we have been able to consider various ways in which collections of individuals, from companions to seeming strangers, peripherally and more explicitly organise their participation in and around exhibits.

These issues point towards concerns of contemporary relevance in the social sciences. In particular, the ways in which people who happen to be in the same space, especially third parties who witness the actions of others, progress from co-orientation into 'focussed interaction' remains largely unexplored in studies of visual communication despite its potential importance to our understanding of human sociality and interpersonal relations (see Sacks 1992 and Goffman 1971, 1981).

They also raise issues of concern for the design of SHAPE exhibits and artefacts. In particular, when we consider interaction and co-participation in and around museum exhibits, we might like to:
- For our Living Exhibitions, recognise the educational role of museums and consider

how to develop distinctive materials or activities to aid teachers in preparing and organising effective school visits;

- Recognise that interactivity need not, indeed should not, simply refer to interaction between individual and exhibit. Indeed there are multiple forms and types of interaction in museum spaces and SHAPE exhibits should recognise and design for them. These include different degrees and combinations of verbal, non-verbal and non-vocal conduct amongst individuals, groups, museum companions and strangers;
- Consider how to encourage people to interact with, and around, the exhibition. For example, this may involve a consideration of how to provide enhanced or variable functionality when participants interact with each other in and through the exhibit;
- Recognise and design for the fact that individuals often wish to show, introduce or shape exhibition phenomena for their museum companions and others. This may involve a consideration of different ways to allow participants themselves to time and design the 'effects' of an exhibit with regard to the actions and orientations of a companion;
- Consider how to, and the implications of, facilitating co-participation not only amongst museum companions, but also those who happen to be within the same space at the same time. In doing so, we should recognise that providing 'tickets to talk' or 'occasions for interaction' is different from simply enforcing strangers to talk to one another. As we shall see in Chapter 3, such an insensitive approach can lead to the failure of an exhibit.

With regard to the research process and our use of video-based methods, for our planned Living Exhibitions we may also like to consider the potential benefits of video itself in museums and galleries. For example, Stevens and Hall (1997) report on their own attempts to stimulate visitor interest and learning. Their system was called 'Video Traces' and they implemented it in a science museum. It provided visitors with an opportunity to watch themselves exploring an exhibit in a booth and reflect on their activities. Discussions of the video record provoked by the researcher enabled more extensive discussion amongst the visitors about the nature of the exhibit and its lessons. Indeed, it proved successful as a resource to encourage further exploration of the original exhibit and to promote more detailed understanding.

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3. Technologies in Public Places

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This chapter provides an overview of some key developments, evaluations and design concerns related to technologies for museums and public places more generally. In terms of museum technologies, the chapter examines issues associated with mobile information technologies, touch screens and other computer interactives and video-based contemporary artworks. The wider discussion of the design of technologies for public places considers media spaces, intelligent environments, intelligent roomware and wearables and personal technologies. The chapter concludes by summarising the key issues for SHAPE developments.

3.1 Introduction

> … when one introduces media into public exhibition spaces, the design rules for its production often must be reexamined. To design effective media experiences for exhibitions, one must understand the unique features of public spaces.
> Semper (1998: 119)

This chapter provides an overview of some key developments, evaluations and design concerns related to technologies for museums and indeed public places more generally. In terms of museum technologies, it is arguable that the major developments for museums have been in terms of web-based sites providing remote visitors with access to information about collections and exhibits. However, this chapter concentrates on three pertinent developments associated with technologies that aim to enhance, or otherwise feature in, visitors' on-site visits. The developments we consider are: mobile information technologies such as electronic guides; touch screens and computer interactives; and video-based contemporary artworks. However, museums are a very particular sort of public space and present unique features: they have a strong public role, display culturally relevant information, attract numerous types and groupings of visitors, and so forth. Therefore, the chapter continues by widening the discussion to consider other types of attempt to develop technologies for public places. The chapter concludes by highlighting the key points for SHAPE to consider when designing,

developing and deploying innovative technologically-mediated exhibits in public environments.

3.2 Mobile Guides: From audio guides to robots

Galleries and museums are increasingly providing visitors with portable electronic devices with which they can access information concerning exhibits. These include audio guides and, more experimentally, personal digital assistants and robotic tour guides. There are also various projects concerned with the ways in which mobile phones could be used in museums to provide information to visitors when they are exploring relevant buildings and areas outside of the museum itself (see for example the London Canal Museum).

   The National Portrait Gallery (London) introduced audio guides in the mid-1990s and have found them to be a very flexible educational resource (Saumarez Smith 2001). They use sound in innovative ways, for example to play music to visitors that appears on a musical score in a painting. In the museum of Alcatraz Jail (San Francisco), stories are told using interviews with ex-cons and prison wardens. Sounds of cells locking and bars rattling augment the rather dusty surround and are used to bring life back to the prison. More mundane audio guides will simply reproduce information available in catalogues or on labels, not exploring the full potential of the additional information channel. The National Portrait Gallery has also argued that audio guides can be useful for slowing down the time that visitors spend looking at a painting. They argue that "It has become common practice to take in paintings and visual images at speed, yet it requires a degree of mental discipline to concentrate on a painting, and anything that helps one to do this is a blessing" (Saumarez Smith 2001: 32).

   In many cases, audio guides demand that the user inputs a number associated with an individual exhibit. This selection will then trigger information about the associated exhibit. This allows the visitor freedom to explore the galleries in an unstructured and self-organised way. However, the devices provide information that is only accessible by individuals, through headphones or speakers that have to be held close to the ear. If information is received on individual devices and is unavailable in the course of its delivery/presentation to co-participants, then the ability to know what another may be looking at, how they are looking at it and why is undermined. Indeed, opportunities for interaction and collaborative exploration are impoverished. One relevant observational study (Walter 1996) focused on visitor behaviour before and after the introduction of audio guides into the Roman Baths Museum (Bath, UK). The study revealed how visitors became absorbed in using the guide itself rather than engaging with either the exhibits on show or their museum companions. For example they would search for numbers to input into their system, rather than inspecting the exhibits. Indeed, it is argued that the visitors spent less time at particular exhibits simply to find other numbers to use with their audio guide. There was also a marked change in the level of visitor noise in the museum, as Walter explains:

> *Before*, many visitors talked with each other, pointed out sights, discussed what they were looking at. It was really quite a noisy museum. *After*, almost everybody is silent as they listen to their electronic guide … As a colleague who had visited the baths many times said to me; 'Its like a morgue in there now'.
> Walter (1996: 242)

   Interestingly, we have found that more simplistic audio-guides can more effectively

support visitor collaboration and interaction. For example, consider those audio guides that produce a narrative that restricts the visitor to simply rewinding, fast forwarding or pausing their tape. In Alcatraz jail the audio guide draws people around different parts of each room, regularly encouraging people to turn from one view to a next (from one part of the assembly to the next), to inspect features in a particular way and so forth. As companions begin the tour together, they are always at roughly the same point in the story. Therefore, the physical movements of a companion can reveal exactly where in the story they are, what they are looking at and when might be an appropriate moment to comment on what has been heard. So, it is possible when using the guide to see at a glance where others are in the telling of the story. When someone begins to turn, visitors are able to see that the story is moving to a next topic or sub-topic. Therefore visitors often interject and discuss the ongoing story and the exhibits at just those points. Thus the simplistic structure of the audio guide has unanticipated benefits in supporting opportunities for collaboration and interaction between visitors. The information is made available to others by virtue of the bodily conduct that it encourages and thus co-participants have a resource with which to co-ordinate the timing and content of discussion and debate.

Although audio guides are relatively common, there are a series of more incipient technologies under exploration, such as combinations of PDAs and bar code readers in the San Francisco Exploratorium (Spasojevic and Kindberg 2001). One of the most intriguing developments has been the use of mobile robots to act as tour guides in museums (Schulz et al. 2000). The use of the robot in this case aims to provide a guide both for local, on-site visitors and also for remote web users who have logged in to the museum web site. The robot can be used simultaneously to guide local visitors and remote users around different parts of the museum. However, the large number of users, both local and remote, led to difficulties in satisfying the needs and interests of all visitors, as any individual had little control on what the robot did. Once a person (local or remote) has selected a 'tour' or an exhibit to view, the robot engages in that task until it is complete. Therefore, all of the other 'users' are relegated to the role of spectator.

3.3 'Interactives'

> The growth of hands-on museums and science centres has been one of the most remarkable features of the leisure industry in the last decade, with almost every new exhibition proposal today incorporating an interactive element for visitors.
> Calton (1998: viii)

As Calton suggests there has been a huge growth in museum 'interactives' and more recently many interactives have been focused on touch screen or other computer screen technologies. The successful design of these computing technologies has taken museum managers outside of more traditional forms of expertise and has demanded an integration of expertise from the museum world and the computing design world. In particular, the requirements of 'desktop' computing technologies in museum and gallery spaces demands a move beyond traditional HCI issues and has sparked a number of recommendation lists concerned with practical tips on designing such exhibits (Cutting 2001; Serrell and Raphling 1992; Gammon 1999). These focus heavily on basic visitor-oriented issues for museums, although some also include organisational information about managing the relationship between museums, developers and designers. One good example, listing requirements for

interactives more generally, is from Calton who uses particular theories of learning to suggest that it is desirable that interactives are designed which:

- Have direct and obvious actions and reactions.

- Have clear goals, expressed in terms of encouraging visitors to develop physical skills, to improve their knowledge or understanding, or to refine their feelings and opinions (i.e. psycho-motor, cognitive and affective outcomes).

- Are intuitive to use and require minimal label-reading.

- Work at multiple intellectual levels, for visitors of different ages and abilities.

- Encourage social interaction between friends and family members.

- Have open-ended, variable outcomes.

- Are founded upon research into the existing knowledge and understanding of targeted visitors, and which do not include confusing information.

- Are multi-sensory and employ a range of interpretative techniques appealing to visitors with a wide range of interests and learning styles.

- Are challenging but not threatening to visitors, and which help to build confidence.

- Provide enjoyment for visitors, and leave them feeling they have understood something more than they did previously.

- Are well-designed, safe, robust and easily maintained.
Calton (1998: 28)

Additionally Rosenfeld and Terkel (1982) argue that one of the main obstacles to successful interactives is the level of time and energy that visitors need to take to understand the instructions. The longer or more complex the instructions, the less attractive the exhibit. Moreover, Serrell and Raphling (1992: 181) argue that visitors "… don't have either the time or the patience for the kind or amount of detail that interactives try to give them". A related danger that Serrell and Raphling note is that whilst visitors often enjoy using or playing with computer interactives, they can often and easily overlook the key didactic messages. To combat these difficulties they argue that it is critical to understand how visitors behave in museums and galleries to produce "receiver-based" designs.

Often advanced technologies are demonstrated in science centres and museums before they are commonly used in order to provide a sense of the future possibilities for society. One example introduced into The Science Museum (London) was a media space system, which incorporated a video phone into a data display. Four interfaces to the system were spread around the museum. Whenever someone picked up a handset for the system, their face would appear on the other three screens. To demonstrate the potential of the system visitors were encouraged to collaborate on a problem-solving task. However, visitors were reluctant to talk to complete strangers and they found that they were able to complete the task without collaborating with others. Therefore, the communications element was rarely used.

Interestingly, in a more successful demonstration of media space technology at the San Jose Tech Museum, a news reporter noted that different problems emerged:

> Of course [visitors] could interact with their fellow patrons simply by turning around and talking to them, but apparently socializing in the future will frown on this sort of "direct interfacing," … The exhibit is meant to show how technology brings people together. It seems to demonstrate the opposite.
> Tom McNichol, Washington Post (cited in Perrin 1999)

Similar problems of constraining opportunities for interaction are relayed in an observational study of the use of touch screens in the Wellcome Wing and Explore@Bristol

(vom Lehn and Heath 2001). That study argues that touch screens can impoverish opportunities for co-participation by restricting hands-on access to the exhibit activities. The design and deployment of these systems is often focused on the individual and yet they are often encountered by couples, family groups and so forth. Although the exhibit encourages an individual to explore the digital domain and can be successful for them, it can constrain co-participants (or other overseers) to the role of spectator or at best instructor.

In museums that present art works, computers are sometimes deployed to present additional materials about a painting or an artist. However, terminals are often separated from the artefacts to which they refer. This can lead to the computer experience being a separate activity from the art appreciation.

3.4 Video Installations: A field study of a room-sized assembly

> We need to think beyond the 20" cathode-ray tube to large-screen projections, multiple image systems, and non-screen media, to create spatial media experiences that are integrated into the exhibit space.
> Semper (1998: 120)

Videos are increasingly featuring in contemporary installation artworks. Often these videos are projected onto the walls of rooms and these rooms usually form a separate room in a gallery. These provide interesting contrasts to the more traditional computer exhibits that tend to be presented on small PC screens. To explore the distinctive properties of these exhibits, KCL carried out a short field study of one video-based installation by the artist Doug Aitken. It was exhibited in the Serpentine Gallery in London during October and November 2001. Interestingly for SHAPE, the video installation, which was one part of his *new ocean* exhibition, was projected onto six screens that covered the walls of an entire circular room. A further projection surface hung on the ceiling, further surrounding the spectator. All of the video surfaces were back projected. The videos presented images of water droplets, the sea, waves, swimmers and the like to produce curious kaleidoscopic patterns. Visitor behaviour within the room-sized assembly raised particular issues for thinking about design for rooms in galleries and assemblies of artefacts.
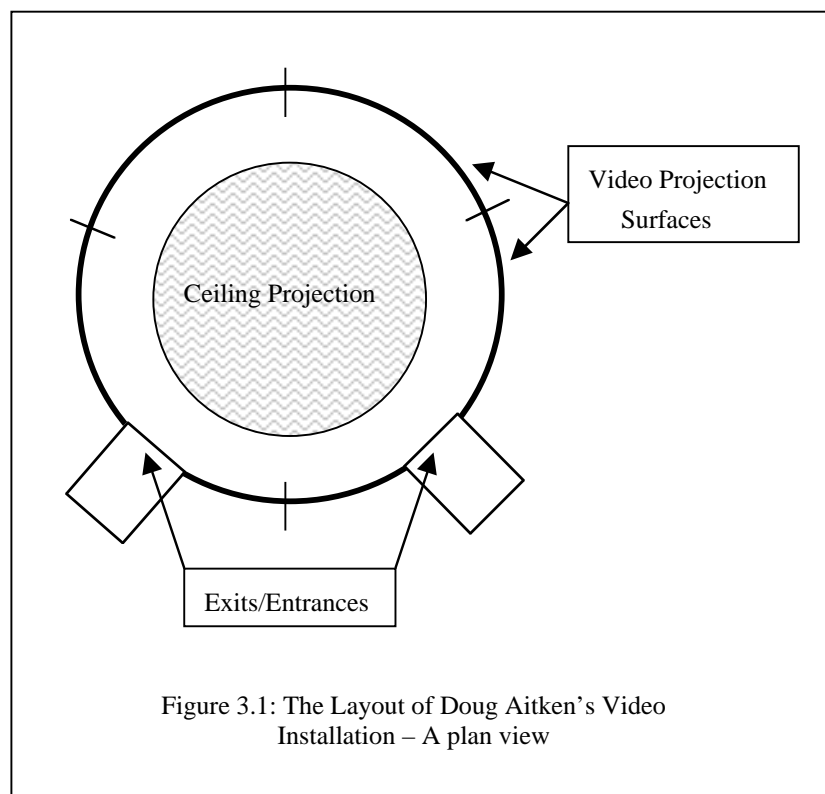
Co-ordinating a Line of Sight

Figure 3.1: The Layout of Doug Aitken's Video
Installation – A plan view

Given that the projection surfaces entirely surrounded the room, there was no one place from which all of the images could be seen simultaneously. Moreover, there were at times large numbers of people sharing the space and thus they could potentially block one another's line of sight or opportunities to inspect the different video displays. Nevertheless, groups of visitors, many of whom will have been unfamiliar to one another organised and ordered their spectatorship.

For example, it was evident that visitors would routinely order a common line of sight. As this was not designed into the piece in terms of a central screen or a screen depicting key actions, it interesting to consider the issues that informed this.

The room itself has entrances at one general 'end' (see Figure 3.1), therefore, the visitors usually encounter one set of screens first. The room itself structures a back and a front in some ways. Usually those entering the room would therefore sit against the wall between the two exits/entrances. Thus the design of the room itself was critical. Visitors in this position would face much of the room but would rarely turn behind them to see the surfaces there. As more and more people entered the room they would gradually fill up the walls at the same end of the room maintaining an orientation towards a 'front'. Indeed if people sat in the centre of the room they would generally still orient to a 'front'. So those inside the installation ongoingly produced and oriented to a 'front' and a 'back' even though this was not a 'designed-in' feature of the installation.

Visitors' sensitivity to others' line of sight was further highlighted with respect to the ceiling projection. Often it would go unnoticed. However, people noticed it often by virtue of noticing others notice it. When an individual saw someone looking up towards the ceiling, they would often do likewise and thereby discover the additional projection surface.

Spaces for Peripheral Participation

Not all visitors were committed to sit within the room. In fact, many who entered the room 'hung around' the doorways for some moments. They would stand either in the doorway, looking through it or just inside it. Therefore, there would often be clusters of people in and around the doorways. They would maintain the orientation to the 'front' and the 'back' of the video installation, but they would stand for a few moments before either moving to sit in the room or leave.

These clusters of people around the doorways had a particular impact on those newly entering the space. It would be difficult for them to enter, and they would often use touch rather than words to squeeze in through the crowds, but more importantly the cluster would sometimes demand that people enter into the room on an unusual trajectory. In order to find the space to enter they would not necessarily step into the back of the room by the wall, as people would if they entered uninhibited by others but would rather emerge in the centre of the room. This would then transform their possibilities for placing themselves out of the way of others.

Ecologies of participation are configured around all exhibits. As we have discussed, touch-screen interactives have a relatively constrained ecology of participation in that the opportunities for variable and flexible forms of engagement and interaction are restricted. This video installation however provides interesting potential for visitors to configure alternate arrangements of bodies and activities. Despite the circular room however, the placement of the doorways presents a 'front' to visitors and moreover their interaction with, and sensitivity to, others produces a common line of sight not intentionally designed into the piece. As the space is increasingly inhabited, the opportunities and possibilities for interacting with the installation are transformed such that individuals stepping into a crowded space encounter the exhibit and enter the room quite differently. The wide range of possible types of engagement with the piece are then ordered and organised in and through the interaction of strangers.

3.5 Advanced Technologies in Museums and Galleries

Most of the museum technologies that we have discussed so far have been technically rather mundane – tape and CD players, simple computer screens, and video projections. However, in recent years there has been a growing use and evaluation of advanced technologies in museums and galleries. Interestingly many of these developments have been supported, at least in part, by academic funding for technological inquiry. The limited financial and technical resources available to most artists, museums and galleries have prohibited the extensive use of advanced technologies. Thus possibilities to collaborate with experts in virtual reality and the like seem to have been very fruitful. It may be worth highlighting some of these collaborations to draw out some key evaluative remarks of relevance to SHAPE.

The Kahun Project (Ecomonou et al. 2000; Mitchell et al. 2000) was concerned to produce an educational Collaborative Virtual Environment to support Manchester Museum's Education Service and it focused on a collection of ancient Egyptian artefacts from the pyramid builder's town of Kahun. The project team built various web-based environments that enable children to explore the virtual town of Kahun and inspect different virtual artefacts. Evaluation of the system revealed how the children's experience was highly

structured by their interaction with, and instructions from, their teacher. The teacher would highlight and focus the relevance of the system with regard to the children's learning objectives. The researchers also note the complexity of design in education as it rests on a range of moral, political, cognitive, theoretical and practical assumptions.

Desert Rain (Koleva et al. 2000) is a professional touring mixed reality performance developed in collaboration with the EU's i3 project eRENA. It features a virtual world projected onto a fine water spray surface (called a 'rain curtain'). Six participants can simultaneously and independently navigate the world by each moving a footpad. A participants is able to talk to another via headphones when they encounter the other's avatar in the virtual world. One of the aims of exploring the world is to find specific digital characters in the world; these characters represent different people with stories to tell about the Gulf War. Finding them triggers one of the most dramatic moments of the performance – a real person steps through the rain curtain to confront the participant. In evaluating the piece, the researchers found that various techniques were required to 'orchestrate' or manage the participants' experience. More specifically, various 'behind the scenes' activities were required to successfully engage the participants. One example of this is that the performers would remotely control the participants' navigation activities. These 'virtual interactions' would be timed and designed in an attempt to conceal the performer's interventions. Avatars would be shifted subtly and movements would be co-ordinated with the bodily conduct of participants. Another example is that the performers who walked through the rain curtain had to time their movement with the players' actions in the virtual world. Therefore they would position themselves to be able to see various image changes on the rain curtain, whilst remaining invisible to participants until the very last moment. Similar findings regarding performance management have been discussed in regard to a subsequent virtual reality television experience (Drozd et al. 2001).

The Centre for Art and Media Technology (ZKM) in Karlsruhe, Germany is an environment that provides a unique exhibition space devoted to new media exhibits. A number of exhibits were studied by Monika Büscher and her colleagues (Büscher et al. 2001). For example, *Labyrinthos* is a collaborative networked game-playing environment which allows eight players to move through a virtual model of the exhibition space and 'shoot' each other. Each player sits at a different terminal positioned around a circular table. Büscher et al. found that to help players locate the position of others they would lean over to look at their screens rather than simply relying on their virtual views of the world. Seeing what part of the world the other could see helped them to track them down. The ability to see another's view of the virtual world of the game therefore could be used as a resource to interact 'in' that virtual world.

These hi-tech developments raise a range of interesting issues therefore with regard to the interactional and indeed physical contexts in which exhibits are encountered. We aim to explore more of these exhibits in future.

3.6 Technologies for Public Spaces: An overview

Turning away from the specifics of the museum context, a wide body of additional research is concerned with the development of technology-augmented and collaborative spaces, with particular interest with respect to the aspects of design for social and public spaces. The

literature we present is related to two domains: public spaces and workspaces.

Regarding public space in the strict sense (public parks, stations, etc.), there are not many pieces of work that attempt to design for these settings considering the specific issues of such of a context. A wide body of literature is concerned with the design of systems like public access terminals, information kiosks, etc., but this work is concerned in any way with the particular nature of the context, the structure of the space itself, the way people use it, etc.

However, a set of general concerns is related to technologies designed for public spaces:

- in making computers available to the public, problems of robustness, efficiency, size, etc. must be faced. A relevant example could be the case of personal digital assistants given to users (Rowley and Slack 1998);
- in designing public access terminals (e.g. ATM machines, ticket machines, etc.) the most immediate problem is 'designing for all', covering an extremely wide range of possible users (Kearsley 1994);
- designing and implementing efficient sensing networks (e.g. IR for alarms, automatic doors, and the like) in order to react to the user's behaviour in an appropriate fashion.

In the case of workspaces, different projects focused on this context and proposed interesting issues that are quite similar to the ones we feel relevant in the context of public spaces: an explicit concern on the nature of the setting, use of the structures of the space, movements within the space, collaboration amongst visitors, communication between different parts of the space or remote spaces, etc.

Workspaces cannot be considered as entirely private or public spaces: they are rather large working environments in which a wide number of different people happen to be, and where different areas are allocated to different purposes, and have different degrees of privacy (offices, meeting rooms, lounges, customer service desks, halls and corridors, etc.).

Many projects addressed environments such as social workspaces adopting different approaches to the design of technology to be introduced within them. The research areas mostly concerned with these issues are the ones of:

- Computer Supported Cooperative Work and cooperative buildings,
- wearables and personal technologies,
- Ubiquitous Computing.

Several projects with an interest on public and social spaces have been developed also in the fields of augmented and mixed reality (see particularly the research on Collaborative Virtual Environments), environmental technologies and ambient media.

We can essentially identify four general streams of work being conducted in various Universities and Research centres, within a number of different projects:

1. Research on the design of *Media Spaces* for connecting and supporting different physical workspaces (creation of a virtual space to overlap the workspace);
2. Research on the design of smart *environments*;
3. Research on the design of smart *appliances*, or technology-enriched everyday objects to furnish the environment (i.e. intelligent roomware);
4. Research on wearable computing and more in general *portable/mobile devices* (within the theoretical framework of ubiquitous computing).

Some interesting issues have also arisen in the area of virtual/3D environments design.

Considering the purely digital nature of the medium itself, and the issues for interaction design that are profoundly different from the case of a real space enriched by technology, this field of studies provided interesting reflections regarding the needs for space modelling, the problems of social aspects in interaction and information seeking, the sharing of resources, and the users' performance in the case of collaborative/shared environments.

Media Spaces

This body of research, initiated within of CSCW, has the goal of supporting collaboration, communication and awareness amongst groups of users, not necessarily co-located in the same physical space, by means of an architecture of media devices for sharing resources, exchanging information and monitoring remote workspaces. The approach is essentially one of endowing workspaces with technology in order to create a 'virtual workspace' co-existing with the physical one and overlapping it (video conferencing systems, real-time communication tools, information sharing, etc.) (Dourish, Adler, Bellotti and Henderson 1996).

The most relevant body of work is the one conducted at XeroxPARC and EuroPARC (in the '80s and early '90s) in projects like Media Spaces (where the actual term was introduced) (Stults, ed. 1986), RAVE; CAVECAT (in collaboration with the University of Toronto), Portholes (in collaboration with MIT) (Dourish and Bly 1992). In this work, attention is mostly towards the virtual space of collaboration and the way this is integrated into the different local (physical) spaces.

These projects developed extremely interesting studies on the use, perception and social sharing of virtual workspaces, and on the modalities in which they integrate with local physical spaces, both in the perceptions by users and the functionalities they provided. In particular, the issues of cultural and social understanding of the space have been thoroughly analysed. Visual connections, auditory connections, accessibility, connectedness amongst spaces, distinctiveness of different spaces are all issues considered in understanding the dynamics of work practice supported by collaborative technologies and conceptualised as critical features of Media Spaces.

Specifically, the notion of *place* is also proposed as a replacement to the one of space (and related spatial metaphors): place is considered as a more appropriate concept as it includes relevant dimensions in the use of a space, as understanding, culture and communication: "Place is a space which is *invested with understandings* of behavioural appropriateness, cultural expectations and so forth. We are *located* in 'space', but we *act* in 'place' " (Harrison and Dourish 1996).

Some Media Space projects have been explicitly concerned with public spaces. The Microsoft Research project Virtual Kitchens is aiming to faclitate informal interactions amongst researchers at Microsoft by means of an audio-video link among several public areas, in specific kitchens, located at different parts of the Microsoft Research building in Redmond (Jancke et al. 2000). The idea beneath the project is to take advantage of a video-conferencing system located in the informal setting of the kitchen to encourage the number of interactions amongst the different research groups that would not easily meet otherwise.

The projection screen is divided into four windows: one shows the picture of the actual physical space the user is in and that the system is going to transmit to the other kitchens, two show pictures from two other kitchens in the building, and the last one shows the CNN live

broadcast. The system is endowed with presence sensors to detect a user approaching the space, and there is an 'off' button to turn off the connection in case somebody does want a conversation to remain private.

In this case an informal space within the workplace was chosen, and the same researchers from Microsoft were intended to be the targeted users. Therefore the context is not really one of a public space, but rather the one of an informal area belonging to a workspace.

Several problems have arisen in this project: first of all the people involved in the observations recurrently expressed concerns as regards privacy and the effectiveness of the 'off' button as a mechanism to temporarily turn off the system. There is no actual way to avoid 'using' the system. A related problem concerned several attempts at sabotage, something of an irony for a system intended to promote remote contact.

In this project it is evident that moving the media space installation from the actual workspace to a semi-public area of it can cause problems in terms of disrupting practices of informal interaction (like gossiping, for example) instead of encouraging them. An example could be the fact that the designers had to increase the 'off' duration from 20 seconds to 180 seconds (the time after which normal operation resumed after somebody presses the 'off' button). The peculiar nature of such a space and of the kind of interaction taking place there has to be carefully considered.

The VideoCafe project developed jointly by the Centre for User-Oriented IT Design at KTH and the Ericsson MediaLab (both located in Stockholm) focused on enhancing the number of interactions among members of two research groups working together on a project (Tollmar et al. 1998). Similarly to Virtual Kitchens, this project is concerned with connecting people located in another workspace through a very advanced video-conferencing system, and the context is again a semi-public space within the workspace itself, and not an entirely public space. The target users are known as well and so is their overall goal (carrying on a joint research project). VideoCafe differs from Virtual Kitchens mainly because of the designers' awareness regarding the importance of understanding the location and its properties and of including space design into the system design process.

Both the projects made explicit reference to public spaces, but they actually address social areas within the workplace, trying to facilitate informal interaction. The outcomes of these projects demonstrate that the nature of the space and the nature of behaviour that takes place in a specific location must be carefully considered in designing a system that pervades social practices within groups. Moreover, these prototypes were set up in the research laboratories where their designers happened to work. It would be interesting to observe the use of such systems in different organisations or working environments.

Intelligent Environments

The key issue in this area of research is to ground technology within the space making the environment itself sensitive to different forms of human behaviour. The central aspect is the design and implementation of an adequate infrastructure in order to endow the space with sensors, input/output units and communication/networking devices.

The design of such spaces should ensure two levels of consistency:
- at a technical level, either the 'invisibility' of the infrastructure or its seamless integration with the physical space;
- at a 'surface' level, the appropriate system image constituted by the reactions of the

system and the way in which these are made perceptible to the users.

Some of the research centres involved in this field of studies are the Tangible Media Group and the Sociable Media Group at the MIT Media Lab, and TECO Laboratory at Karlsruhe University (Germany). One of the projects conducted by MIT Sociable Media Group is Community Portals: an example of environment-integrated technology ensuring community awareness of timely information and activity of others, in a variety of social settings and at different times of the day. The application consists of several shared community appliances (mainly digital walls endowed with sensors and displays), the interaction with the system takes place in a public context: in particular, in peripheral and transitional spaces within a workspace that are typically highly frequented but under-utilised (Sawhney, Wheeler, Schmandt 2000). This choice of context is similar to the one in the Virtual Kitchens and VideoCafe projects described above.

Other similar projects conducted by MIT Media Lab are Portholes, Piazza, and The Garden. In the design of The Garden (a casual workplace environment such as a lobby or a hall), the *casualness* of interaction is an essential element. Users' movements and proximity to the system are utilised as inputs for the peripheral interface. In particular, the user's proximity to the appliance is a trigger for the system's response, and the user's persistence is considered as an implicit request for further information by the system. For example, the Walls of the Garden display the news of the day. Somebody is attracted by a headline and gets closer to that section of the wall to read it. The wall recognises the presence of somebody in that area and displays the full article which the headline refers to, as well as a series of pictures showing who has read the same piece before, in order to encourage the user to discuss the article with them.

A very evident limit is that this architecture does not take into account what happens in case of specific task-driven behaviour and users' performance towards a very well specified set of goals. However, the idea of peripheral interfaces and use of physical movement as an input is potentially very interesting as it does not require explicit modelling of the user's preferences and it could be used for a large number of informal settings as public transitional spaces.

Within industrial research, Jun Rekimoto's work at the Sony Computer Science Lab. in Tokyo is very relevant especially in terms of infrastructures and prototypes development. The Pick and Drop project (Rekimoto 1998) aims to design an infrastructure and propose new interaction techniques for transferring digital information in a physical environment. In particular, Rekimoto's work focuses on the case of multiple computer appliances in the working context and their inter-communication and data interchange. The project produced an interesting prototype: the 'data picking wand' that allows the users to pick up elements from the real world to be transferred into digital format, by means of physical interaction. It is interesting for public spaces as it is a large-scale infrastructure that could connect a number of terminals located in the same large space or in remote spaces. The interfacing tool, the wand, is interesting as a quite natural interface that even novice users could use straight away for performing the task of transferring data from the physical to the virtual world.

A series of problems and research issues are related to this stream of studies: is an environment "smart" enough to understand and support the user's behaviour? What is the model of the user in this case? And what sort of image of the space the user will develop? What are the principles for designing the environment? Very often, the prototypes do not

include adequate consideration of the real context in which an activity can be performed (including factors as nuisance, distractions, cultural elements), and they do foresee no model of the space nor of the users to be included in the system.

As an example, the "Ambient Room" developed within MIT "Tangible Bits" project presents room-sized prototypes of working environments endowed with subsumed form of ambient technology as lights and auditory background without fully considering the real contextual conditions for the performance (e.g. presence of natural light, common noises in the workplace) and without carrying out any evaluation involving users in the workplace.

Another important issue to be considered is the case of the environment being "too responsive" and potentially overwhelming the users with too much information or too many "actions". This raises important design implications in terms of control, freedom and feedback. Despite the large of number of projects and the several concerns related to this approach, there are not many theoretical reflections on these issues. In this respect, some of David Kirsh's work envisions the theoretical side of the problem, in terms of distributed cognition and cognitive workflow analysis (Kirsh, 1995; Kirsh, 2001). Kirsh's work is relevant as he is concerned with describing the dynamics of interaction between a human actor and the space features. He also proposes a new view on architecture for large scale public buildings endowed with technology from a cognitive perspective, trying to define specifically what the properties of the workspace are that ensure a positive interaction between people, technology and the built environment.

Intelligent Roomware

The central issue in this area is making everyday objects "smart", in particular designing roomware endowed with technology and grounding technology to the everyday objects present in the physical environment. The key aspect of this stream of work is consequently how to enrich the objects with digital systems and miniaturised appliances.

Some research centres investigating in this area are the GMD-IPSI "Ambiente" group and Tangible Media Group at the MIT Media Lab.

The work conducted by Norbert Streitz's group at GMD-IPSI is focused on the concepts of "cooperative buildings" and "Roomware®" in the context of integrated design of real, physical spaces and digital information spaces. Several spatial layers are considered for the design of such appliances: cognitive space, social space, physical space, information space (Streitz, Geißler and Holmer, 1998).

The spatial layers are proposed in describing the construction of roomware prototypes, but they are not described in detail and the rationale for individuating and applying them is never fully discussed. They recognise these different concerns and propose general reflection on them at a conceptual level, but the prototypes do not show to be designed with consideration of anyone but the information space. The risk in this case is that in the Roomware prototypes the traditional computer is only moved from the desktop to some other physical surface (chair, coffee table, whiteboard, etc.). The goal of seamlessly integrating the spatial layers and of creating tools for supportive collaborative work practice and sharing of information could not be achieved by means of such devices if they do not really change the users interaction with the traditionally shaped computer.

Moreover, in this body of work there is no analytical reflection related to interaction design, activity performance, cooperation issues, context modeling. The approach is

essentially based on the introduction of specific working prototypes endowed with technology (see the I-LAND project; Streitz, 1998).

These projects achieve a number of interesting results: in particular the technological development of appliances that are able to be fitted into furniture, and the introduction of a specific software ("Passage") that allows the transition of data from the physical to the virtual space.

Several other issues deriving from these previous projects have been proposed for analysis and further development in the recent Disappearing Computer project, Ambient Agoras: the major concern of studying situated interaction considering different design spaces, i.e. the analysis of the physical space in terms of "building's language of implicit communication" (Halkia and Streitz, 2000) is introduced, whereby the physical envelope of the interaction episodes is understood as an interface: in this project, the three layers of "space" introduced in Roomware are being investigated more thoroughly towards their integration into design.

Wearables and personal technologies

The major goal of this approach is making the users "technology-enriched", providing them with appliances to be carried or worn constantly. The key challenge in this case is effectively developing ultra-light mobile devices or endowing the user with sensors.

The TECO Laboratory at the University of Karlsruhe is one of the leading groups in this field. Their approach is very much linked with the theoretical framework of Ubiquitous Computing (Weiser, 1998). The projects they developed focus on personal technologies and wearables endowed with sensors in order to extract meaningful information about context (see projects as "Media Cup", "Smart Tie" and "TEA").

TECO researchers are also trying to develop a new conceptual approach to HCI through contextual data, assuming that a set of environmental sensors can collect enough relevant information to adequately support human interaction (Schmidt, 1999). Such devices could operate a shift in HCI from explicit interaction towards a more implicit interaction based on situational context and corresponding behaviour (Schmidt, Beigl, Gellersen, 1999). Context-aware applications are implemented to support users in this respect.

The idea is quite interesting, but the design of technologies is clearly not enough effective at this stage to capture sufficient contextual information and, most of all, the richness of interaction within physical environments and of situational behaviour: the sensors in fact can only detect a series of quantitative variables (Gellersen, Beigl, Schmidt, 2000) that are not able to cover all the relevant aspects of human behaviour and task performance.

It is also not clear whether and how this technology affects performance and the situations' development: in fact a major problem is that these applications do not include any consideration of the user's features, goals, decisions, etc. It is important to interpret the user's behaviour in that context, because as the actual situation can affect the user, people have also their own strategies of action, preferences and culture and they can behave differently in the very same contextual conditions. Analysing the activity only on the basis of context is therefore limited. The TECO research team proposed interesting issues: awareness technology embedded in everyday things, the use of everyday things in our activities is a source of contextual information; development of artefacts to be used within technology-endowed environments designed to take advantage of physical behaviour (Beigl, 1999; Beigl, 2000). Several of these issues are currently being investigated within the new Disappearing

Computer project "Smart-Its".

3.7 Discussion

This chapter has outlined a variety of technological developments and their abilities to support interaction and participation in public environments. With regard to the museum technologies, there is a danger that many new developments are restricting opportunities for visitors to interact. Therefore, a consideration of how an individual's experiences can be made public to facilitate debate and discussion is critical to the design process. Also, it would seem that the interactional material and spatial contexts in which the exhibit is encountered impact on the way in which visitors engage with it.

 In addition, Robert Semper (1998: 120-121) describes four aspects of public spaces that should inform the design of new media experiences in museums and galleries:

- *The public space experience happens in a real place*, so technology design should be tailored to the character of the museum in which it is situated.
- *The public space experience is profoundly social*, and in SHAPE we are engaged in unpacking the character of the social in public places.
- *The public space experience is non-linear*, so attempting to enforce a serial order on the exploration of an assembly can prove highly problematic.
- *In public space environments learning is supported by the ability to make meaningful choices*, and thus good design will provide the resources for visitors to quickly 'play' or explore the unwritten possibilities of an exhibit. Organising tools are often called for, rather than highly structured instructions.

The body of literature specifically regarding the introduction of technology into public and social spaces offers a very wide range of systems, settings and related issues. The existing literature on technology for entirely public spaces offers a set of general concerns for the design of technology that is made available to public use. There is, however, a notable gap in analysing and understanding the features of such a context and the peculiarities of human behaviour within it.

On the other hand, workspaces are a context in which many projects with a concern on space dynamics have been conducted. In specific, the possible transitions in between physical and digital worlds have been explored and this favoured the process of technological exploration: the *loci* of transition have been identified in different dimensions of the space such as infrastructures, furniture, inhabitants, etc.

SHAPE can learn from these results: picturing the nature of boundaries between physical and digital, facing the problem of grasping aspects of human behaviour, and gaining useful insights on several examples of room-sized installations providing a linkage between physical and digital spaces.

On the other hand, the limits of the existing research are mostly concerned with the understanding of human activity and of aspects of social, interpersonal behaviour that occurs in such settings. In many cases, the technology is not adequate to picture the complexity of the situation of use. SHAPE could offer a relevant contribution to these issues, through gaining a thorough understanding of interaction in the peculiar context of public spaces, and integrating different aspects such as physical space features, social and cultural features within the scenario of a public space. As well as these contributions, the development of a

conceptual framework defining hybrid objects and their assemblies is aiming to propose an innovative perspective on physical-digital boundaries, transitional elements of the space and the way users relate towards them.

In terms of developing considerations and recommendations for design, this chapter suggest that SHAPE developments should:

- Recognise that new technologies in museums and galleries are often designed to augment and support a 'collection' of artefacts. Also they can be deployed to enhance opportunities for visitor learning. The danger, as we have seen with the electronic guides in the Roman Baths and with the touch screens in some science centres, is that they become the topic of interest rather than encouraging the visitor to focus on the collection or to some didactic message. With the advanced technologies in SHAPE, attempting to make the technology 'transparent' will be a key challenge;
- Be wary of 'individualising' the experiences of visitors as audio guides and touch screens tend to do. Rather SHAPE might like to consider how to make experiences and activities publicly visible and sharable;
- Recognise and design for the shape of the space in which our exhibits will be deployed. As we saw with Doug Aitken's work, even the entrance to the space can impact on the way it is used and experienced;
- Recognise and design with regard to possible ecologies of participation;
- Do not assume that participants need to see and experience the exhibition in the same way at the same time; however consider how we can encourage participants to interweave their experience of different aspects/parts of the exhibition;
- Tailor the design of technologies to the *character* of the museum space in which it is situated;
- Recognise and design for public places as social spaces, which people use with more or less familiarity, with more or less confidence and the like;
- Ensure that early analysis of social interaction and human experience of prototypes and exhibits is incorporated as a valuable and informative component of the design process.

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4. Explorations of Visitor Behaviour around Exhibits in the Hunt Museum

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This chapter of the deliverable details a major aspect of the work being done on the SHAPE project by the Interaction Design Centre, Limerick. Specifically, it provides an introduction and overview of the Hunt Museum in Limerick where we have carried out a series of observational studies of visitor behaviour, including observation of special events such as educational school visits, and object handling sessions, coupled with interviews with Museum personnel, and other Museum experts. We pay particular attention to some of the unique features of this Museum, which make it a distinctive user experience – specifically the homely nature of the environment, the minimal use of signage, and the extensive use of a volunteer system of 'human help' – the Docent programme. The chapter provides several examples of interesting features of the exhibits, and how they engage visitors. We are currently examining some of these interaction episodes in greater depth, with a view to identifying and classifying specific features of the exhibits, and the interaction sequences we observed. We are also examining the footage from the object handling sessions, and present a preliminary analysis of some of the user's actions and commentary from these sessions. With these episodes as guides, we have begun to outline scenarios for augmented reality environments that we will prototype and test in the coming year.

4.1 Introduction

The 'Studies of Interaction in Public Spaces' started from the analysis of human behaviour in the museum space and of the physical and perceptual properties of the museum environs in order to develop the rationale of a prototype for a possible SHAPE 2nd Living Exhibition, the conceptual and technical design of which is now underway. This contrasts with the earlier SHAPE constructional workshops which focused more on technology exploration, problems of technical feasibility and, subsequently, on the orchestration of users' experience.

The two streams of work progressing in SHAPE are intended to integrate, inform and inspire each other, taking advantage of the different expertise and skills of the members of the consortium. The work within Workpackage 1, exploring hybrid-digital artefacts and testing demonstrators with the public, is providing valuable input to the conceptual development of SHAPE design sensitivities together with the empirical data emerging from our field studies.

Also, as already discussed in Deliverable 4.1, we believe it is extremely important to

design museum exhibits with a deep understanding of the exhibition spaces and of the visitors' behaviour within them, or else the introduction of technology can be ineffective or, even worse, obtrusive.

The Interaction Design Centre at the University of Limerick has a strong role to play in the SHAPE project due to its extensive experience in both the observation and evaluation of user experiences with technology, on the one hand, and its work on concept design, storyboarding, and, on occasions, its actual technical prototype implementation work, on the other. Our contributions within the first year of the project have thus consisted of a variety of activities, including:

- support for the constructional workshops in terms of providing useful content material;
- technical support for specific audio prototypes;
- general requirements information regarding Museum spaces and Museum exhibits;
- contributions to several scenario development projects;
- detailed video footage of visitor behaviour;
- analysis and interpretation work based on observational data;
- complementary interviews and recordings of Museum personnel and their activities.

This chapter specifically documents the work we conducted in the first eleven months of the SHAPE project in collaboration with the Hunt Museum, consisting of both field studies and analytical work. As stated in the project Annex, SHAPE is devoted to gaining a thorough understanding of human behaviour within public spaces. Research Challenge 3 states our commitment to "(…) analyse how people engage with artefacts, display their engagement with others, produce understandings of artefacts through interaction with them and through discussion with others". As stated in the Annex, "we treat the physical and the digital worlds in an integrated manner" to discover the dynamics of the physical space that the technology is going to enhance. We also believe our work provides an important contribution to the Objective 3 of Workpackage 2 to "(…) develop an understanding of the considerations museum curators and related personnel have in designing exhibits and exhibitions and managing their realisation (…)", as we obtained useful information from several museums of interest for SHAPE, apart from that of our main museum site.

The first phase of our work at our museum site was devoted to gaining a thorough knowledge of the Hunt Museum and of the overall structure of the collection and exhibition policies. Consequently, we focused on the analysis of interesting features of the collection, the way it is displayed, and on interesting related activities, e.g. educational workshops for adults and children. Finally, a design phase commenced integrating the results of data analysis and interviews with museum experts; some future possible scenarios for technological installations are currently taking shape.

This chapter documents these three phases of our work at the Hunt Museum: section 2 presents a detailed description of the field site, the Hunt Museum, including features of the collection, exhibition spaces, information resources and the Museum's management policies regarding the exhibition and its communication to the public.

Section 3 is the heart of the paper, and documents data we gathered during several observation sessions in the Museum, focused on particularly relevant features, exhibits and related activities. As an example, it presents data from field studies around the 'Cabinet of Curiosities', particularly relevant in the context of SHAPE as offering a notable example of a room-sized interactive exhibit that could be replicated in a mixed reality installation. This

section also provides details of the 'handling sessions' and our analysis of sequences of users' activity and conversation around the artefacts.

Finally, in the concluding section we outline briefly some initial scenarios for a mixed reality installation in the Hunt Museum that will constitute the next phase of technology exploration and conceptual design on the SHAPE project.

Before introducing the Hunt Museum, we wish to note that we engaged in a number of information gathering exercises that involved visits to a number of other museums. The purpose of these visits was to provide a frame for our understanding of the variety of museum layouts, spaces, exhibit presentation styles, visitor feedback facilities, visitor supports, use of signage, human help, and general presentational details. We conducted informal observation sessions and interviews with personnel in museums in Sweden (Tekniska Museet and Technorama Science Centre), England (Nottingham Castle Museum, Green's Mill Science Centre) and Ireland (Limerick City Museum, The Hunt Museum, King John's Castle-Limerick). While we have not specifically included material from this study phase in this document, the experiences obtained were important for our research, in clarifying different museums' exhibition policies, curatorial concerns and educational programmes.

4.2 The Hunt Museum: the collection, the space, visitor information.

In this section we provide background information on the Hunt Museum, noting the very personal nature of the collection, the distinctive building in which it is housed and the spaces comprising it, and specific features of the displays, signage and other visitor support structures that are in place. Finally, under the heading 'Access', we document our work in obtaining access to the Museum, and the ongoing relationships that we are developing in order to continue our work within the Museum.

The Hunt Collection

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.

Figure 4.1: Statue of *Apollo – Genius of the Arts* in the Medieval section

One of the strengths of the Hunt Collection is its medieval material. Its range covers

objects commissioned and used by both ecclesiastical and lay patrons, and includes statues in stone, bronze and wood (see Figure 4.1), crucifixes, panel paintings, metalwork, jewellery, enamels, ceramics and crystal. The importance of the collection is such that some items have been on loan to the British Museum and the Victoria & Albert Museum in London, while others have been shown in international exhibitions.

Besides the medieval, there is a wealth of other material ranging from Egyptian, Greek and Roman items through to the 19th century metalwork and ceramics.

Figure 4.2: Some Greek pieces in the Archaeology section

There is also an important collection of Irish archaeological material ranging from Neolithic flints, through Bronze Age gold, the unique 8th century Antrim Cross, hand pins, pennanular brooches, down to penal crucifixes of the 18th and 19th century. Irish decorative arts are represented too in a range of items including Irish delft, Belleek porcelain, 18th century Dublin tapestries as well as ecclesiastical and domestic silver.

Figure 4.3: The Bronze Age section

The nucleus of the collection has been on display in the University of Limerick since 1976. Subsequently, after the return of Hunt Museum items from the British Museum, Victoria & Albert Museum and the National Gallery of Ireland, and the presentation of a further collection of medieval items by John Hunt Jr. and Trudy Hunt, the children of John and Gertrude Hunt, the Hunt Museum transferred its headquarters to the Old Custom House Limerick in 1996.

Figure 4.4: The entrance to the Hunt Museum at the back of the Custom House

The Hunt Museum Building – The Old Custom House

Described by The Knight of Glin as "Limerick's most distinguished piece of 18th century architecture" the Old Custom House was designed by Davis Duckart in 1765 and built under the supervision of Christopher Colles, a Kilkenny man. The Custom House took four years (1765-69) and £8,000 to build. An administrative centre for the Revenue, it was also the home of the Collector. Over the years, the Office of Public Works ensured the survival of the building. In 1968 they undertook a major restoration programme that has left the building with strong floors.

Figure 4.5: The Custom House façade facing the river Shannon

The collection is arranged on three floors of the building, other museum facilities, such as a temporary exhibitions gallery, a restaurant, administrative offices, a shop, an educational area, et cetera, occupy other rooms and spaces on the ground, lower ground and first floor of the building (see Figure 4.7).

The spaces in which the collection is arranged are relatively small, and allow only a limited number of people to stand in front of a cabinet. The largest room of the museum is the 'Captain's Room', where one of the most important pieces of the collection, the Leonardo Horse, is located (see Figure 4.6). Some rooms have benches where visitors can sit down.

Figure 4.6: The Leonardo Horse exhibition in the Captain's Room

The visitors are encouraged to start the visit from the first floor, then go to the second floor and finally on the basement, where the 'treasury', including several pieces of religious art, is contained. The succession of rooms is intended to be a path of discovery into the collection and the collector - the Hunt family.
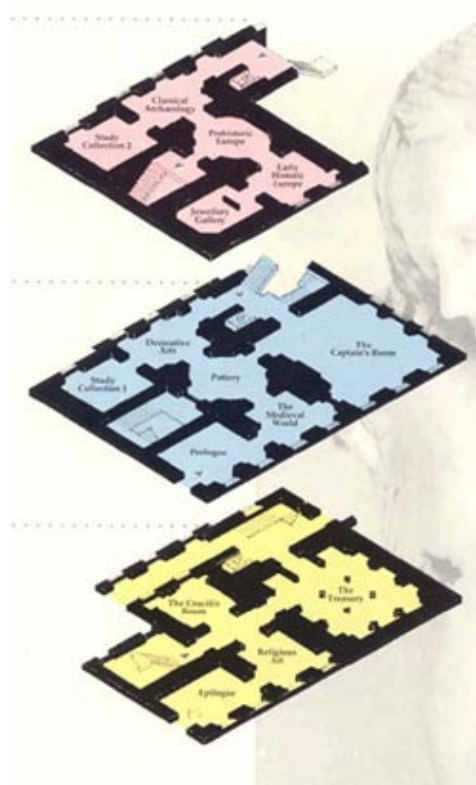

Figure 4.7: The Hunt Museum floorplan

The first room of the exhibit is called 'Prologue' and is supposed to introduce the visitor to the main themes of the Hunt exhibition: a cabinet of curiosities, a piece of antique furniture and several wall panels introducing the Hunt family and the building itself, the Custom House. This space has a direct linkage with the last room of the collection, the Epilogue, where John Hunt Jr. himself selected a number of objects, particularly dear and beloved by the family, to be exhibited as a final tribute to his parents (see Figure 4.8).

Figure 4.8: The Epilogue

The whole collection is presented in a way that highlights the *personality* of the owners: for example, a wall panel shows a picture of the Hunt Family's kitchen where is possible to see a number of objects now on display in the museum in their original location. 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 and that was used for the same purposes by the Hunt family's kitchen! (see Figure 4.9)

Figure 4.9: The Picasso's painting was 'exhibited' by the Hunts beside the dresser in their kitchen at Lough Gur, County Limerick

Similarly with the archaeological pieces that John Hunt found himself during his excavation work of a Bronze Age settlement at Lough Gur (County Limerick), and with an Egyptian urn, almost 5000 years old that Gertrude Hunt used to display fresh flowers in the living room. The history behind the objects and the related anecdotes are strongly emphasized.

Signage, Documentation, and Visitor Support

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.
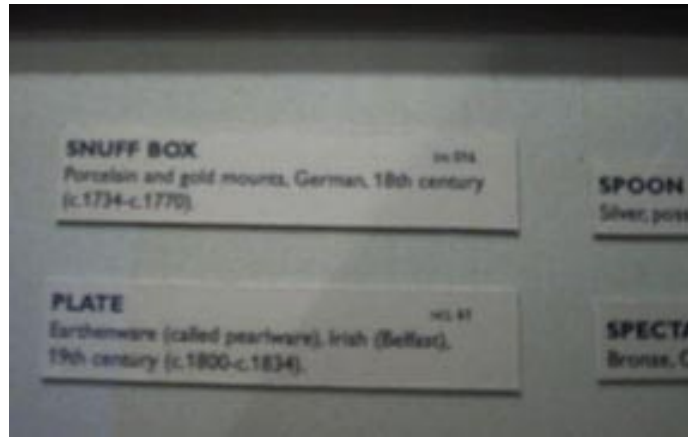

Figure 4.10: Example of informative labels

This is intentionally done by the museum management as they wish to encourage personal discovery and person-to-person communication, and mediation of information through experts in the 'Docent program' discussed below. Panels presenting more general information about the collection are displayed on the walls through the whole of the exhibit. 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.).

Figure 4.11: Example of informative panel

The Docent Programme – unique 'human help' for visitors

As we already mentioned, the museum management initiated the 'Docents program' in order to assist visitors to understand the provenance and value of the museum items through the mediation of a number of volunteer guides that are always on-site and can provide information, stories and context for visitors on an 'as needed' basis. The Docents are volunteers, spanning a range of ages and expertise, but experts in one or more fields related to the Hunt collection: history of art in general, glassware, earthenware, jewellery, sculpture, decorative arts, et cetera. They also have a thorough knowledge of the history of the collection and of the Hunt family.

Two or three docents are usually present during opening hours on the three floors of the Hunt museum, and they are available to the visitors who wish to have information on the objects on display, on the Custom House or on the collection in general.

The Docents are volunteers and they are not paid by the museum for their work, they are *connoisseurs*, art experts, art teachers, or simply people with a keen interest on some of the sections, or objects displayed in the museum.

Figure 4.12: A Docent guiding a small group of visitors

The Docents decide the mode, time and duration of their contribution to the museum, according to availability and work or personal commitments. Their personal enthusiasm and involvement in the Hunt and the personalised, unique style of each Docent in presenting the collection are very positively perceived by the visitors. Docents are not simply tour guides, and they do not deliver 'conventional' portions of information, but rather they are able to integrate historical and artistic description of objects with, for example, anecdotes, curious details, references to the history of the Hunt Family, of the City, et cetera. It is this contextualising of information, and the narrative style, that visitors find so beguiling.

The Docents are also in charge of guiding tours for small groups of people through the museum. The curators intend the role of the Docents as being as their *delegates* in communicating and interpreting the collection, and in presenting it to the visitors. The Hunt Museum management organise every year an 'Open Day', that generally all the Docents attend. In every section of the Museum, visitors can find one or more docents, experts on that particular section, and listen to their explanations of objects or ask them questions. During the 'Open Day' the admission to the Museum is free of charge, so to encourage people to come

and visit. The visitors (even occasional visitors who never been to the Hunt before, and that are generally not regular museums visitors) have the possibility of having a taste of the collection and to appreciate the Docents' knowledge and their role in the life of the Museum.

Figure 4.13: A docent discusses the Renoir watercolour in the Study Collection room

Access Issues

One of the most difficult, and usually most invisible, aspect of any field study project is the initiation of the project, negotiating access, and maintaining relationships with key site personnel so as to ensure the smooth conduct of the enquiry. As we aim to be involved with the Hunt Museum for several years, it was essential that we develop a good working relationship. We have been helped in creating this positive working atmosphere by the fact that some of the SHAPE researchers have close connections to the Hunt Museum, and the museum personnel, thus providing a point of entry. We have received very positive support for the aims of our work from senior management and all levels of staff in the Museum. The Museum management granted us full access to the exhibition areas, allowing us to use video-recording equipment. We have discussed the issue of visitor privacy and inform all visitors as to where filming is taking place, the rationale for the study, and the option to be removed from the video. We have also kept the Museum management constantly informed of our field study plan. The Museum have also allowed us to participate in several educational activities involving adults and children, subject to agreement with the Hunt Museum Education Leader, who has been a terrific support for our project. We believe that this close connection is vital, not only in allowing us to proceed with our field work, but also in helping the research team become more oriented to the concerns of the curators in designing and communicating the exhibits to the public, and we, in turn, can provide useful advice, based on our research, to the curators as to visitor experiences of their exhibitions.

4.3 Field Studies: observing visitors at the Hunt Museum

The initial observation sessions in the museum (conducted in February 2001) explored the different spaces and what objects are displayed in each, studying how visitors move through them and approach the exhibits. Subsequent to this, we tried to localise which specific areas and features of the exhibition were favoured by the visitors, and note any interesting patterns of interaction between visitors. We presented and discussed footage from this initial session with the Consortium, during the Third SHAPE Workshop held at the University of Limerick in March 2001. As well as the general rationale of the exhibit and its major features, we also focused on the nature and history of objects and their mutual relationships (ownership, acquisition, history, materials, use, etc.), with respect to the space in which they are located within the Hunt Museum.

As a result from these initial sessions we focused on specific areas of the museum, that offer to the visitors the possibility to discover and closely look at assemblies of objects. We found out that the three 'cabinets of curiosities' on display had very interesting features.

The cabinet can be considered as an 'assembly' of objects/artefacts leading to complex dynamics of understanding and sharing knowledge amongst the visitors of the museum (Pearce 1994). During the first phase of our work, where we conducted 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. As collecting has been compared to developing a narrative, exhibiting the collection can be read as enactment of the web of relationships amongst different objects and their own features (Bal 1994). 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'. Let us examine this issue of 'cabinets of curiosities' in more detail.

Cabinets of Curiosities

Like the Hunt Museum, major art museums around the world are based on private collections that were assembled long before these public institutions came into being (Francesco De' Medici's holdings being the core of the Uffizi Gallery in Florence is a notable example), and the grouping together of precious objects by individuals has gone on since antiquity. The cabinet of curiosities, or *Wanderkammer* in the original German word, was a room in the collector's house whose walls and ceilings, cupboards and drawers, housed collections that included a bizarre spectrum of natural curiosities as well as art objects. These cabinets were intended to entertain and amuse, and secondarily to instruct or uplift (Newhouse 1998), they have been extremely popular from the end of the Middle Ages to the mid 18th century, when they were partially replaced by private art collections.

Different cabinets followed different models of organisations and included different categories of objects, in particular cabinets were usually arranged following the distinction between 'natural curiosities' opposed to 'artificial curiosities': decorative objects, crafts, everyday objects coming from remote parts of the world as Africa or Asia were all included in the second category (Elsner and Cardinal 1994). The cabinet of artificial curiosities then evolved in *Kunstkammer*, room of art, then the private collection and, finally, the museum (Pearce 1992).

The Hunt Museum has three 'cabinets of curiosities' exhibits: they are wooden closets where objects are arranged both on the upper shelves and in the drawers that the visitors can open if they wish. The objects are protected by a glass on the top of each drawer. The nature of the objects contained in the cabinets is different: ivory pieces, tapestry, drawings, coins, et cetera (see Figure 4.14).

We conducted numerous observations on the behaviour of people in the 'Study Collection' room, where one of the most important cabinet of curiosities is located. We were interested in understanding the way visitors relate themselves to the exhibit, their interaction with the drawers and the processes of creating connections amongst the objects in interpreting the display.

Figure 4.14: Drawers in the Study Collection Room, 2nd floor

Figure 4.15: The two visitors are exploring one each side of the cabinet

We then proceed to the analysis and subsequent discussion of video material, both internally at the Interaction Design Centre and within the Consortium during the constructional SHAPE workshop held at Nottingham in May 2001.

The corpus of data we gathered revealed interesting visitor behaviours. An immediate finding we noticed is that people tend to interact with the drawers basically in two ways: they

open either a few drawers or all of them in sequence. Those who cannot resist opening all the drawers usually spend a longer time on each, and tend to comment more on the objects with their companions.

In the case of couples visiting the exhibit, each person takes control of one side of the cabinet, resulting in two drawers open at the same time (see Figure 4.15).

This pattern of interaction facilitates exchange of opinions and comments between the two visitors, usually comparing the contents of the respective drawer. Gestures highlight this collaborative process of interpretation, as visitors point to features of their own and their companion's drawer, and possibly to some of the objects displayed on the upper shelves. The gestures accompany verbal comments on objects' similarities, possible correlations, visual features, et cetera.

The glass surface on top of each drawer is often used for sketching or taking notes: especially children spend time in taking notes and drawing sketches of the objects contained in the drawer, using the drawer itself as support (see Figure 4.16). The Hunt Museum also organises specific educational activities in collaboration with schools where children have to find specific pieces of the collection and document them.

Figure 4.16: Children taking advantage of the drawer's surface to take notes

Some people think that it is not possible to touch or open the drawers and they might try to open one only after seeing somebody else doing it, and in this way being reassured they are actually allowed to interact with the exhibit (see Figure 4.17).

Figure 4.17: Some visitors think they are not allowed to open the drawers

Even if one of the drawers is left slightly open to suggest its real use, these visitors did not seem to investigate further, assuming this was due to some work being done by museum

personnel (see Figure 4.17).

Closed drawers are indeed an unusual location for displaying objects in a museum, unless strong clues are given as to the storage of material in the drawers and encouragement is given to visitors to explore them, and not all the visitors even realised that they are actually part of the display thus missing a remarkable part of the collection.

When they proceed to open the drawers and discover what they contain, all visitors express their surprise, especially on finding extremely important pieces of the collection, as, for example, the Renoir watercolour located in a drawer in the Study Collection room on the first floor. (It is, admittedly, a somewhat unusual location for a painting!)

Unlike couples, members of larger groups of visitors cannot simultaneously open the drawers: usually, two people act as 'openers' on the two sides of the cabinet, but all the people in the group comment on the objects and tend to draw each other's attention to what has been discovered.

Figure 4.18: A group of visitors are collaboratively discussing the artefacts

In general, these displays are particularly appreciated by the visitors. The potential of drawers, chests and boxes to stimulate curiosity and exploration is well known: containers usually accessible only to their owners suggest the presence of secrets and of non-ordinary objects (Elsner and Cardinal 1994), or of objects that have some kind of symbolic relevance for being sheltered from the eyes of the public (Bachelard 1969). Removing the secrecy and discovering the precious, hidden content is perceived as very rewarding by the visitors, considering also that this sort of activity is usually forbidden in 'traditional' museums.

Figure 4.19: A child is leading his parents through the exploration of the cabinet

Children in particular show great enjoyment and surprise in discovering the content of the drawers. In many cases, we observed children visiting the Study Collection with their parents, and literally take the lead in discovering the content of the drawers and commenting it with their parents (see Figure 4.19).

Children enjoy the possibility of being active during the visit to the museum and of getting a closer look on the object than in those museums where distance from the exhibits must be kept. Curiosity and expectations act as facilitators of the process of making sense of the objects and of learning through active discovery: "Curiosity (…) is driven by the need for stimulation. (…) Curiosity is a major factor in determining whether environments are appealing. Environments that have 'mystery', provide a moderate sense of unknown, are complex, and invite exploration are far more desirable than those without such qualities" (Falk and Dierking 2000: 115). Through stimulating their curiosity, the Study Collection room seems to encourage children to reflection and to create in them a sense of involvement. We are keen to extend our investigations into these issues in the coming year.

Figure 20. Mother and daughter are taking some time to discuss the content of the drawer

Handling Sessions: towards an interactive experience of objects.

As we described in the previous section, we paid particular attention to observing people interacting with drawers, their gestures and verbal comments in the discovery of objects. The close observation of objects and their peculiarities concurs in revealing the stories behind them and related to different aspects of the objects itself: crafting, owners, acquisition, geographical origin, anecdotes, etc.

The only element currently missing in the process of interaction with the cabinet and its objects is the 'physical' one: what if the visitors could handle the objects and explore them directly?

Falk and Dierking (Falk and Dierking 1992), in their analysis of the museum physical context as 'shaper' of the visitor experience, point out the crucial role of the object on display as physical, mundane entities. "Objects are the essence of a museum" (Falk and Dierking, 1992: 77), and experiencing the exhibit has a physical nature as well as reflective:

"Exhibits - whether of artifacts, science demonstrations, animal habitats, or paintings - allow people to see, touch, taste, feel, and hear real things from the real world.

"Observation of visitors confirms this idea. Visitors devote most of their time to looking, touching, smelling, and listening, not to reading. Visitors tend to be very attentive to objects, and only occasionally attentive to labels." (Falk and Dierking, 1992: 78)

As emerged in our series of observations, interaction among visitors, collaborative content

discussion and discovery all happen *around* the objects. The cabinet as it is does not provide a way to experience the importance of features as look and feel of the surface of an object, the lights and shadows it presents, the shape, texture, et cetera.

Following the data analysis sessions and a phase of reflection on the work conducted, the scenario of a possible installation for the Hunt Museum took shape: an augmented reality Study Collection room, where visitors could explore a cabinet of curiosities as the ones already on display at the Hunt, where replicas of objects can be manipulated and explored thus providing visitors with relevant information.

As a first step, our interest was in the way people would physically interact with ancient objects handed out to them in the context of the museum. In which ways would they explore the objects? What sort of gestures would be performed on the objects? What verbal comments would accompany the handling?

Figure 4.21: The group participating in the handling session

In order to appreciate visitors' physical experience of ancient artefacts, we conducted field studies during a 'handling session' organised by the Hunt Museum education department and involving school teachers: a member of the museum staff guides the users in handling objects from the collection and pointing out their most distinctive features.

Handling session are increasingly popular educational activities organised by numerous museums mainly in the UK, Ireland and the USA. Some of the European museums organising handling sessions are: Norfolk Museum and Archive Service (NMAS); Museum of St. Albans, Hertfordshire; the Science Museum, London; Natural History Museum, London; The Bruce Castle Museum, Haringey, London; the National Museum of Ireland, Dublin.

In the Hunt Museum, two members of staff prepared the session we attended involving 15 participants (school teachers). One of the Hunt education officers handled the first piece and pointed out its features, encouraging the participants to do the same with all the objects presented (see Figure 4.22).

Padded trays containing two or three pieces are then passed around the table. When everybody handled all the objects, new pieces are posed on the trays. Bubblewrap is laid on the table to avoid damage to the objects in case they are accidentally dropped (see Figure 4.21).

Figure 4.22: A member of the Hunt Museum staff explains how to handle a piece

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. This is particularly relevant in understanding the value of this activity, as the importance of the emotional value of the experience influences the strength of the memory associated with that experience (Falk and Dierking 2000).

Figure 4.23: Participants commenting the pieces

The social aspect of the experience plays also a significant role: the pleasure of discussing and enjoying objects together is strongly felt by the participants to the session. Nearly all of them gathered in small groups of two or three people and commented aloud their impressions and opinion on the objects.

The participants experienced a real sense of discovery and excitement (e.g. "Are they 'actual' Bronze Age artefacts?"), and communicated it to their companions and to the Hunt personnel leading the session. The emotional reaction associated to the experience is also quite strong, and we observed people making emotionally connotated comments on the objects as well as more "technical" ones: e.g. "The carvings are so fantastic…Unbelievable!".

Experiences triggering emotional responses are better remembered and the levels of

learning associated with them are higher. The handling session is, therefore, valuable as both an educational and entertaining activity.

Aside from these general observations on the experience, we observed certain recurrent patterns of activities and gestures performed on the various objects by most of the participants at the session:

a. feeling the texture/material of the object
b. trying to 'use' the object (e.g. ring the bell; prove the sharpness of spearhead, fitting the ivory head on the pedestal)
c. touching/feeling the details (carvings, decorations, inscriptions, etc.)
d. turning the object upside down (when possible)
e. putting fingers into holes (spearhead's base, rings, cavities, jug, etc.).

We will illustrate these points with examples taken from the session video footage.

Figure 4.24: Example 1: handling the ivory bust

Example 1: the participant is handling the bust of the sculpture to observe the face, and is touching the details. She is then showing them to her neighbours, and is turning the object upside-down to find out hidden details or inscriptions (see Figure 4.24).

Figure 4.25: Example 2: the Bronze Age axehead

Example 2: in this example, the participant puts his finger in the cavity so as to check the base of the spearhead. He is feeling the texture and the details of the surface and also verifying the sharpness of the object.
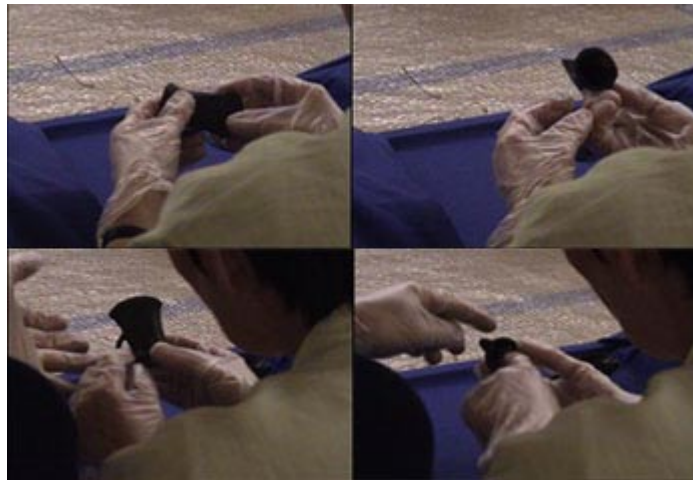

Figure 4.26: Example 3: the Bronze Age spearhead

Example 3: the participant is feeling the texture of the object, and then she turns it upside down, exploring the details so as to use it while putting a finger into the cavities (see Figure 4.26).

Figure 4.27: Example 4: the Bronze Age spearhead

Example 4: in this other example, the participant 'tests' the sharpness so as to use the object, and puts a finger into the cavity, feeling the texture with the other hand's fingertips.

In particular, the gesture of putting fingers into the cavities of objects is very recurrent, even handling objects that are not explicitly made for this use. People greatly enjoy this, it is like feeling the object is literally in their hands, part of their clothes and personal accessories.

An example is the Bronze Age carving tool in Example 5 that is 'worn' by the participant as a thimble (see Figure 4.28).

Figure 4.28: Example 5: a Bronze Age scraper worn as a thimble

Example 6: similarly, the Bronze Age rings were not crafted as jewels, but as supports for hanging tools and ropes. Anyhow, these participants could not resist wearing them.
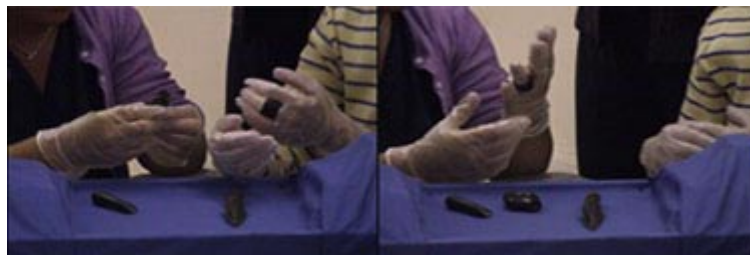

Figure 4.29: Example 6: the Bronze Age rings

In the case of objects with elaborate surfaces, the participants spend time in exploring with their fingers the carvings and decorations. In Example 7, the participant is exploring the surface of the 18th Century bell, taking a closer look at the décor, and finally turning the object upside-down, and putting a finger into the cavity.

Figure 4.30: Example 7: the 18th Century bell

A similar sequence of gesture characterised Example 8, the handling of a 17th Century jug pictured in Figure 4.31. The participants are exploring the details of the carved surface, then they turn the jug upside down and start commenting on the inscription they found on the bottom.

Figure 4.31: Example 8: the 17th Century jug

The participants expressed their enjoyment of the physical experience of objects: the verbal comments were related to the sensations felt and to the unusual details discovered as well as the historical information that the Hunt education officer provided through the session. They actually enjoyed verifying personally the presence of some specific detail (e.g. "Oooh…here's the where the pedestal should have gone…").

Future Work

As well as planning a forthcoming observation session focused on people's interaction around the drawers and their comments about them, we are planning sessions with Docents concerning the way in which they engage visitors, and how they contextualise the artefacts. We are also continuing to amass more background information on the collection and on potential narrative tracks associated to the artefacts. We have already interviewed Patrick Doran, Emeritus Professor of Humanities at the University of Limerick and expert on the history of the Hunt family. Professor Doran provided us with very valuable information about the history of the collection and the way the Hunts were particularly attached to particular objects. He also described the way they physically explored, sensed and touched the objects, and how this was the privileged way of acquiring new pieces, especially by Gertrude Hunt.

We have also started a new series of field studies observing educational activities that the Hunt offers to school children. These activities are intended to support the understanding and interpretation of the collection (or parts of it) by means of engaging workshops. One of the most interesting examples is the 'Archaeology workshop' for schools that follows the visit to the archaeological section of the museum and allows the children to dig together as practising archaeologists in simulated pits: three sandboxes (simulating archaeological sites from the Stone Age, the Bronze Age and the Middle Age) are placed for this purpose in the Hunt educational wing, containing hidden objects, replicas of real archaeological findings. More details of the objects and activities are given elsewhere in this report (cf. Chapter 2, Section

2.2).

4.4 Concluding Remarks

The field studies conducted at the Hunt Museum have provided a useful corpus of material concerning the nature of exhibits, and visitor interaction around these exhibits, that is still under analysis. We have also been able to select certain themes for our next stage of development within SHAPE, and have begun the process of developing scenarios to guide this further development. One major theme is an elaboration of the 'cabinet of curiosities' as discussed above, where we wish to augment these physical cabinets in a variety of ways with new technologies. Outline scenarios include cabinets where people can actually handle replicas of the real objects and experience some of the characteristics of these real objects. Our interest in this scenario has been driven by analyses of visitor engagement and interactions during the specific 'handling sessions' supervised by museum personnel that we have described above.

This scenario, in which the objects themselves are envisioned as interfaces through which visitors can make sense of them, of their history and their multiple relationships and features, pose a challenge for designers. Several projects are underway regarding the design of graspable interfaces and physical icons instead of GUIs (Ishii and Ullmer 1997), but usually the object itself is not 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 physical representation of surface interface elements such as icons and pointers. Thus our approach would be 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 are also very keen to develop a scenario that augments the 'virtual archaeology' sandbox currently being used in the Hunt Museum, as again, it builds on the themes of exploration, and discovery that people find so engaging (see a short description of this demonstration in Chapter 2, Section 2.2).

Work at the Interaction Design Centre in the coming months will involve further exploration of a variety of technical devices and platforms that may assist us in achieving some of our objectives for the prototypes, such as RFID tags, use of accelerometers and potentiometers for sensors, projection surfaces, webcam tracking et cetera. We would hope to have an initial low-tech prototype available for study by Easter 2002.

Acknowledgements

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5. Visitor Co-participation in Low Tech, Room-Sized Assemblies

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This chapter discusses the development of KCL's collaborative work with the craft-maker Jason Cleverly. Following the success of *Deus Oculi*, various analytic issues reported in SHAPE Deliverable 4.1 have been pursued through the design, deployment and preliminary evaluation of two further craft exhibits. As with *Deus Oculi*, both of the new exhibits use a combination of traditional art and craft objects, combined with video cameras and monitors. The cameras and monitors are used in different ways to transform visitor behaviour into a public phenomenon, in an attempt to encourage interaction between visitors. Both pieces were designed in an attempt to explore ways of supporting flexible and innovative forms of co-participation in room-sized low tech assemblies. *Keepsake* is being installed as a permanent exhibit in the Beatrice Royal Arts and Crafts Gallery (Eastleigh, U.K.) and *Ghost Ship* was exhibited at the Sculpture Object and Functional Art (SOFA) exhibition in Chicago, September 2001.

5.1 Introduction

It has long been recognised that art galleries provide a 'natural laboratory' for the study of human conduct in that they provide the opportunity, as Melton did in the 1930s, to make small changes to the environment to measure the effects on the behaviour of visitors (see Melton 1972). As part of the SHAPE consortium we are in an unprecedented opportunity to exploit this potential. Although we initially aimed to develop low tech *prototypes* as part of Workpackage 2, our involvement with museums, galleries, artists, designers, craft-makers and the like has given us the opportunity to deploy *actual exhibits* in public places for use by the public. This is rather unique in that in workplace research we are rarely in a position to deploy 'prototypes' in real-world work settings for use as part of everyday work practice. In contrast, in museums actual visitors encounter our designs as part of their visit. Thus our evaluations of our low tech assemblies are based on naturalistic analyses of the ways in which they are encountered and used by the public in the course of their visit to a museum or gallery.

   This chapter reports early findings from exploratory studies of two such low tech exhibits. These works follow-up from a previous collaboration between KCL and the craft-maker Jason Cleverly, namely *Deus Oculi*. Each exhibit developed as part of the collaboration attempts to

balance the aesthetic and artistic concerns of Cleverly with the social scientific interests of the KCL researchers. Exhibiting in the Beatrice Royal Gallery and at SOFA provided opportunities to design for relatively large, indeed room-sized, spaces. Thus, although we are not due to start work on room-sized interaction until later in the project life cycle, we have been able to significantly accelerate this activity. This is particularly opportune as it provides us with the ability for early input on issues of room-sized interaction and co-participation in good time for the 1st Living Exhibition.

   This chapter proceeds by discussing the rationale for the development of the two new exhibits. It then takes each exhibit in turn and describes both their design and also the preliminary implications for SHAPE that can be drawn from their development and deployment.

5.2 Background: Critically reviewing *Deus Oculi*

Following our previous collaboration with Jason Cleverly (*Deus Oculi*, exhibited at Chelsea Crafts Fair) we had video materials available to begin an analysis of visitor interaction at the onset of the SHAPE project. *Deus Oculi* is based on the use of re-cycled imagery. It consists of three parts: a main picture which displays a tranquil Renaissance scene and two fake 'mirrors' (see Figure 5.1). The picture, which is framed by a wooden box, includes the faces of two individuals, a man to the right and a woman to the left. Each face is on a little door that can be opened up to reveal a small CCTV monitor. The hand-held mirrors to either side of the picture each contain a CCTV camera. Indeed, although they are designed to imitate the general form (if not scale) of a hand-mirror, they actually display a painting of an eye, behind which the hidden CCTV camera is located. The image from the left mirror appears on the right monitor behind the woman's face, and the image from the camera in the right mirror appears on the monitor behind the man's face. The three pieces are connected by wires. Thus, if a door is opened and someone is standing next to the mirror or holding the mirror up to their face, their image will appear embedded in the picture. The aim of the piece is to provoke curiosity, surprise and amusement, and it has certain similarities to cut-out pictures found at the seaside or at fairs. But in this case visitors are momentarily immersed in the painting, thus shifting the spectator into the work.

Figure 5.1: *Deus Oculi* at the Chelsea Crafts Fair

We devoted early project effort to drawing out key issues from those materials that could form the basis for further work and exploration. These issues are discussed at length in SHAPE Deliverable 4.1, but it might be worth summarising them:

- Rather counter-intuitively, the success of the *Deus Oculi* as a 'puzzle' to be explored through collaboration between 'novice' users in part rested on the *asymmetrical* nature of the resources distributed across the local ecology. Images of individuals in different spaces were displayed a few feet away, thereby connecting people, spaces and activities. This also enabled individuals to discover how the exhibit worked, and then animate the exhibit for others. The asymmetrical access to information thereby encouraged co-participation.

- The design of collaborative exhibits or technologies in public arenas should consider the various relationships between individuals navigating and exploring a space. Rather than simply designing for the individual or even the group, artefacts can be designed to encourage interaction and collaboration between people who happen to be close-by. *Deus Oculi* enables individuals to see both the details on the exhibit and the response of those using it 'at a glance', thus enhancing overseers' ability to participate. So for public arenas the design of an artefact could include a consideration of how to provide strangers with an occasion to engage in interaction and conversation with others.

- *Deus Oculi* powerfully demonstrates the relevance of considering the positioning of artefacts in social and material ecologies. Moreover, it suggests ways of designing ecologies to enrich the sense and significance of individual objects or collections of objects within the assembly. This demands sensitivity not only to the design of individual artefacts and the placement of those with regard to one another, but also the ways in which such placements may help to order individuals and their activities within the ecology.

5.3 Enhancing Interaction as a Public Phenomenon

We pursued two avenues to further explore these issues in partnership with Jason Cleverly. Firstly, Cleverly and ourselves responded to a call from the Beatrice Royal Arts and Crafts Gallery (http://www.beatriceroyal.com/index.htm) for a new permanent exhibit. This provided a small amount of funding which could be coupled with resources from the SHAPE project to allow us to develop a fairly ambitious piece which we aimed to install in the Summer of 2001. Secondly, Cleverly and ourselves were approached by the British Crafts Council to represent British contemporary craft in a major U.S. exhibition. This exhibition, Sculpture Objects and Functional Art (SOFA) was held in Chicago in September 2001 (http://www.sofaexpo.com/chicago/special.htm).

These activities provided us with the opportunity to develop two distinct pieces that could be used to pursue key issues derived from our earlier study in different ways. The core concerns that we were able to design in to the works can be summarised as follows:

- To provide more opportunity to engender curiosity with the artworks. To develop our abilities to surprise visitors and to allow them to surprise others and shape the experience of the artwork for others. Thus we decided to continue to focus on the idea of presenting a 'puzzle' to visitors;
- To use the opportunities afforded by larger exhibition spaces to develop a low tech *assembly*, rather than an individual piece. This would bring to the fore the issues surrounding the placement and arrangement of independent elements of the assembly;
- To consider how we could develop ways of interconnecting more remote spaces within a single museum or gallery. Thus, rather than providing opportunities for collaboration and interaction between people who are standing beside one another, we would attempt to engender interaction between people in different parts of a room or, perhaps, in adjoining rooms;
- To explore the use of a video link as a resource for local interaction. Usually video links are deployed to connect remote people and spaces and a great deal of research in CSCW and HCI as been concerned to develop video-based systems that can provide adequate support for remote interaction (see Kuzuoka et al. 1994; Ishii et al. 1992; Tang et al. 1994; Gaver et al. 1993; Heath et al. 1997). Based on our findings in *Deus Oculi* we were intrigued to see how the use of video images linking proximate spaces could engender or encourage interaction.

5.4 *Keepsake*, Exhibited in the Beatrice Royal Arts and Crafts Gallery, Eastleigh (U.K.)

We submitted a proposal, highlighting the SHAPE collaboration, to an open call by the Beatrice Royal Arts and Crafts Gallery for a new permanent exhibit. In our meetings with the gallery management team, they expressed a number of requirements for the piece. The gallery is a non-profit making organisation aiming to promote the wider appreciation and ownership of contemporary art. Therefore, one of their key requirements for a new work of art was that it should encourage visitors to donate to the gallery – either by taking the form of a donations box or in more subtle ways. Related to their non-profit making status, we were given a relatively modest budget to work with. Also, the gallery wants to exhibit the piece for three

years or more and thus demanded a piece robust enough and reliable enough to be on show to the public for that length of time. Another major issue is that the gallery was keen to introduce a piece that might encourage visitors to explore the more remote parts of the site. The layout of, and connections between, the various rooms in the gallery can result in visitors strolling through without noticing and therefore entering particular exhibition areas.

So, the work provided us with a unique opportunity to extend and explore our interests and findings from the *Deus Oculi* piece; to work within the constraints imposed by funding restrictions and also to consider the practical requirements of a permanent exhibit for an arts and crafts gallery. This intriguing mix of interests and concerns led us to the following design.

One aim of the piece is to create and disseminate curious images of human behaviour around the gallery. We created a series of craft objects that would fit in with the character of Beatrice Royal – a large pot, a large imitation watch fob and two portrait paintings. We paired up the objects and placed a camera on each object to transmit images from one artefact to its pair. So, an image from the bottom of the pot is beamed into the watch face and vice versa. Thus, those looking at the giant fob watch are confronted by an image of people looking and even reaching out upside down. They are unaware that this image is taken from the bottom of a pot. Meanwhile the cameras mounted on the two portrait paintings capture images of visitors' eyes which are then displayed out of the eyes of the other portrait. This creates an effect common to some crime movies, where the eyes in a painting are removed for someone to spy on people in a room. When you look at the portrait, therefore, you see moving eyes in a static, painted face. Thus, visitors encounter various sorts of curious images emerging from bizarre artefacts. However the provenance of the images is not revealed. Thus, the design aims to encourage visitors to discover where the action is.

i.   ii.

Figure 5.2: One of *Keepsake's* video connected pairs – i. pot and ii. fob-watch

Keepsake: Issues and considerations

At the time of writing, the principal issues that arose in connection to the development and

deployment of *Keepsake* are practical and organisational in nature.

The KCL research group has been involved in the development of exhibits before, but never permanent exhibits. The pieces that we have contributed to have always been displayed or 'performed' for a limited period only. The challenges of the 'permanent exhibit' are particularly acute with respect to the demand for 'robustness'. With limited period installations, the design team are usually on hand to maintain the piece and support visitor involvement. Clearly this is not feasible for more permanent exhibits and thus there is more of a need to develop robust exhibits. In museums and galleries, the numbers of visitors and the types of visitors (e.g. children) present additional problems in developing robust exhibits.

Whilst the craft-maker and the research team at KCL were pre-occupied by developing an assembly of interconnected objects that might facilitate, indeed engender collaboration across fairly remote spaces in a gallery, the gallery staff were not. A prime concern for them was to build in a 'hook' that would encourage visitors to donate to the gallery. Relatively early on the craft-maker mentioned the possibility of automatically producing still images of visitors that they could subsequently purchase at a low cost, but nevertheless at a cost that would include a small profit margin for the gallery. This was seen as a promising idea and the artist set to work on attaching a mechanism for producing images. Unfortunately, the computerised solution proved too clumsy for three key reasons: i. the gallery staff had little time to oversee the system; ii. the operability of the system was too confusing for staff; iii. the computer system was not robust enough to guarantee continual use without frequent crashes. As a result, neither the gallery staff nor the craft-maker were happy with the installed solution: the gallery staff, because it was seen to be too time-consuming and cumbersome; the craft-maker because he would be contracted for three years to maintain the system and was concerned about the burden of maintaining a fragile computer system.

The two issues raised above have led to a significant delay in undertaking studies of visitor behaviour with and around *Keepsake*. Whilst we had envisaged successful deployment in the Summer with studies to follow in early Autumn, the additional concerns of the gallery and the artist have led to a delay in the installation 'going live'. The gallery are naturally reticent about turning the piece on, when for them it lacks a critical part of the functionality, namely the image capture to encourage visitor donations. Meanwhile the craft-maker seeks more robust mechanisms for capturing visitor images. This highlights some of the difficulties of developing and then adequately deploying *permanent* exhibits within gallery spaces.

5.5 *Ghost Ship*, Exhibited at SOFA, Chicago (U.S.A.)

Ghost Ship is also an interactive piece in which visitors walk around and explore a museum space. As with *Keepsake*, whilst visitors explore, they are captured on video and their image is presented elsewhere within the installation. However, *Ghost Ship* is on a different scale to *Keepsake*. Whereas elements of *Keepsake* are distributed amongst other exhibits in specific rooms in the Beatrice Royal gallery, the sheer size of *Ghost Ship* means that it was more distant to other exhibits also on display at SOFA. Indeed, in many ways it occupied its own large space.

Figure 5.3: *Ghost Ship*

The installation is composed of various elements within this space – the scene of a cruise liner at sea painted onto a wooden façade to one side and a simulated deck area with railings on the other side. Life-like wooden figures were used to inhabit the space – one a ship's captain, the other a waving mother and child. Looking at Figure 5.3, the ship is to the right, the deck to the left. To the very left of the image you can see a space which represents the inside of the ship. It has two 'windows' that look through to the ship on one wall and a series of paintings on the other walls that are designed to give the impression of looking through windows to view the sea.

The use of video cameras and monitors is designed to allow spectators to involve themselves in the very piece that they are inspecting. So, images captured by cameras mounted around the exhibition space are displayed elsewhere within the assembly (see Figure 5.4).
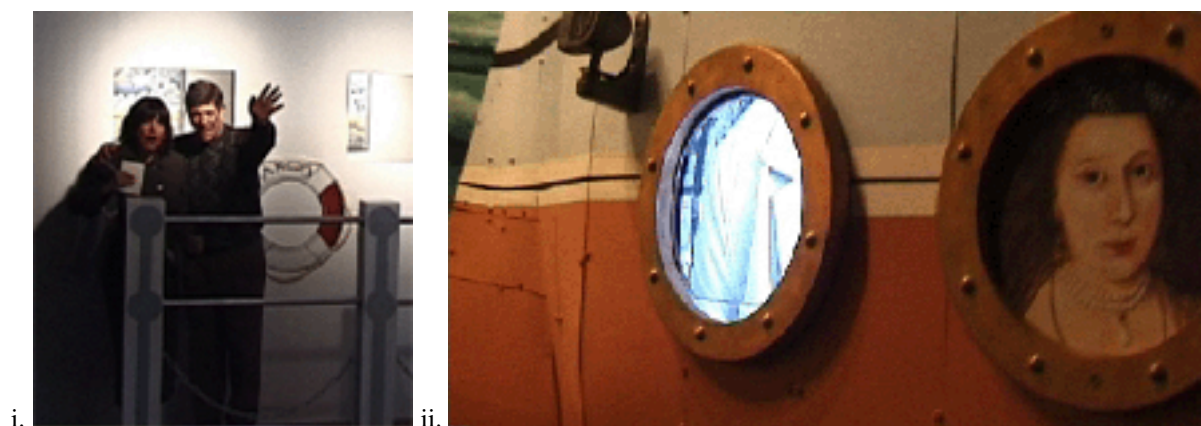

Figure 5.4: i. Waving 'on deck' is beamed onto the large screen on the Ship and ii. People standing close to the ship can see themselves in the portholes.

An image of individuals standing on the deck area is beamed onto a large public display positioned on top of the on the painted ship. It gives the visual impression of people standing on the ship's deck. Therefore, people will often wave to produce an image of them waving on

a moving ship.

Visitors standing directly in front the ship are displayed on monitors located in three of the ship's 'portholes' (see Figure 5.4). These images stand alongside traditional paintings that appear in another two portholes that lie between them. The camera by the central porthole displays an image into the central porthole. However, cameras alongside the bow and stern portholes display their images at the opposite ends of the ship. They swap images in effect.

Due to the positioning of cameras around the space, often one individual can appear in multiple images. For example, visitors who stand between the ship and the deck can appear on the large display *and* on one or more portholes. So, in Figure 5.5, the visitor appears both on the large display and in the stern of the ship.
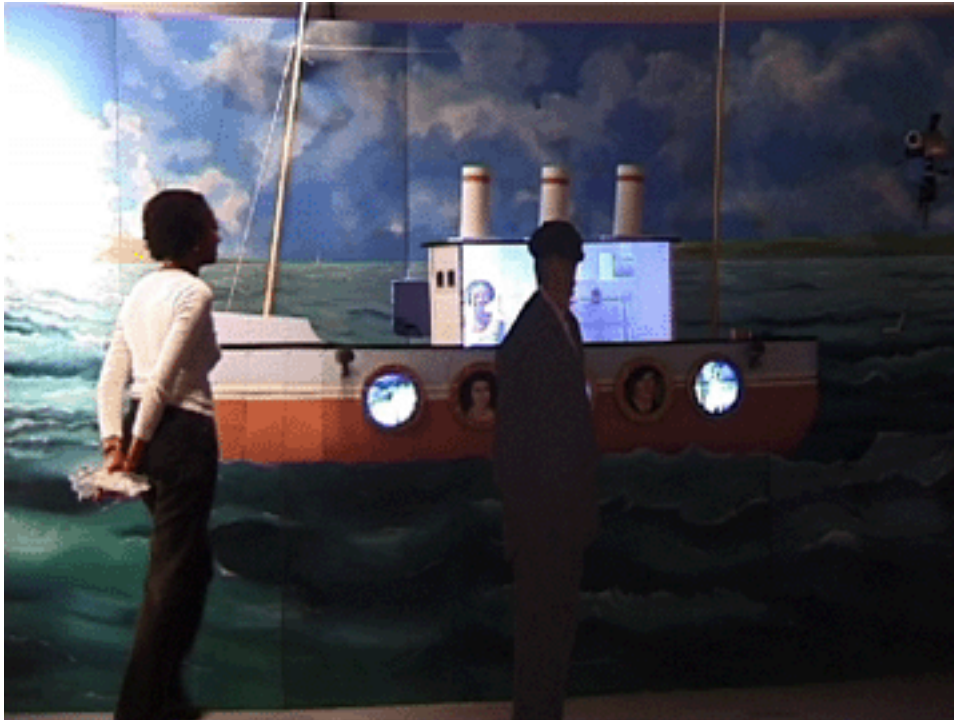

Figure 5.5: *Ghost Ship* – The visitor's face is displayed on the larger screen

Ghost Ship: Issues and considerations

The deployment of *Ghost Ship* for the duration of the SOFA exhibition in Chicago, facilitated extensive data collection of visitor interaction with and around the piece. Video recordings were taken from a position that allowed the analyst to view the whole space of the exhibit: 'ship' and 'deck'. Meanwhile a microphone was placed by the ship, so that sound could be captured from those near to the video 'portholes'. From the preliminary analysis of these materials, there are four key issues that seem of particular relevance to SHAPE developments and concerns. It should be noted that this section provides very much a preliminary analysis of the key issues and we hope to develop them in due course.

Complexity in Ecologies of Participation

As we discussed in reference to Doug Aitken's exhibition at the Serpentine Gallery (Chapter 3), large scale or room-sized assemblies develop complex *ecologies of participation*. Congregations of individuals emerge at particular points within Doug Aitken's video room at

the Serpentine, and as individuals enter they tend to organise their activities with regard to emerging patterns of conduct, lines of sight, and so forth. *Ghost Ship* is a more interactive piece, and thus the ecology of participation that emerges is maybe a little more complex. It is more interactive in that individuals are able to position themselves not only to see phenomena displayed on video, but also in order to make their own image appear on screen. Indeed, once on screen they can further shape and organise their bodies to (re)configure and 'play' with the image produced. Additionally, the ability for visitors to make sense of the portholes is enhanced if they inspect them at a fairly proximate distance. The portholes even encourage adults to bend down towards them and look between to compare them. Thus compared with the Serpentine exhibit, this piece provides more opportunities for action and interaction in the assembly – more 'things to do' as it were.

Even a brief glance at the piece revealed that different spaces were used for different kinds of activity and engagement with *Ghost Ship*. For example, it was noticeable that people walking by often stopped on the periphery without actually entering the exhibit space. They would use the peripheral area between exhibits to consider or examine it, to watch visitors' behaviour within it and yet they remained uncommitted to any more serious interest or to more immediate engagement with the piece. Once within the space of *Ghost Ship* there are further areas that people used to watch what others are doing, without engaging in the piece more directly. More interestingly in some ways as the exhibit is an interconnected assembly of related objects, it enables multiple participants in different but nearby locales to simultaneously engage with the piece in different ways. The portholes afford particular types of engagement, the deck affords others and so forth, and yet these kinds of engagement are possible at one and the same time (see Figure 5.6).

Figure 5.6: One congregation of visitors inhabiting *Ghost Ship*

Intriguingly this multi-interactive space is in some ways corrupted or distorted by beaming bodies and images into the locale of the ship. The right and left porthole images are swapped and simply standing near the deck sends you onto the ship's public display. So, when we discuss ecologies of participation, we do not have a static notion, where particular spaces are straightforwardly associated with specific actions and activities. Rather, we are intrigued by the *organic* character of these kinds of ecologies. They are ordered and yet *dynamically organised* by the participants that inhabit, manage and constitute them.

Thus, a brief glance at *Ghost Ship* reveals how it supports multiple and simultaneous forms of action and interaction. This stands in stark contrast to the discussion of many new museum technologies that we discussed in Chapter 3, where the opportunities for co-participation and

engagement in technological exhibits can be restricted. Here visitors face opportunities to engage in different ways and at the same time. However, when large groups enter together, they can often block opportunities for others to participate. Thus, whilst the assembly and the distribution of the assembly through the exhibition space provides opportunities for multiple engagement, it also raises issues regarding how to manage those multiple forms of participation. SHAPE will have to consider how to design *for* multiple simultaneous forms of participation.

Action Points and View Points

Given the various activities and positions possible for engaging with the exhibit, numerous issues arise with regard to the relationship between *action points* and *view points.* For example, there are numerous instances at the ship's portholes where people notice the face of another appear on a monitor. They then may encourage that other to move their head in a particular way in order to produce a particular effect. However, that other cannot witness the effect being produced. Thus, it is rather an inflexible experience for both co-participants. Companions take turns at placing their head near a camera and then stepping back to watch another's face appear in the monitor. However, neither can see an image of themselves, play with that image or see what others are trying to get them to do. Thus, they have relatively constrained opportunities to 'shape' the experience for the other and indeed their own experience.

There are also instances where individuals notice another appear in a monitor and want to show them how their image has been transported across the assembly. Nevertheless a problem can then arise, as the following fragment reveals. Jean is exploring *Ghost Ship* with her daughter Edith. At the particular moment we are interested in she is showing Edith how different cameras and monitor images relate (see Figure 5.7). Edith is standing in front of the left hand camera and her image appears in the right hand porthole. However, when Jean attracts her attention to it by saying "Look over here, who's this?" Edith steps towards it and therefore out of the view of the camera. Jean says "Oh, you've just moved off the camera" and then proceeds to more rigidly manipulate Edith between the different camera positions by physically moving her between different images.
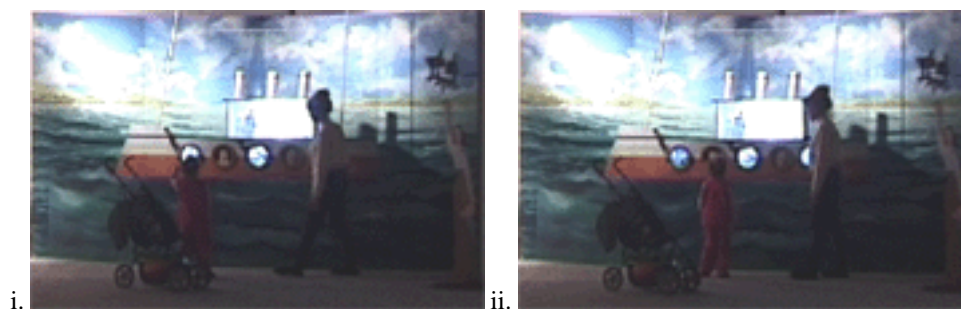

Figure 5.7: i. Edith is in the right hand monitor; ii. When Jean tries to show her, Edith steps off camera

Thus, those wishing to show others how their actions can influence the display of images in the scene are restricted in their opportunities to do this smoothly. Difficulties arise because the action point is not also a view point for the action undertaken - i.e. it is hard for an individual to witness the visual effect of their own actions.

Although participants are able to see the responses of colleagues, they are unable to see the details of the exhibit which restricts opportunities for playful and inventive interaction.

Indeed, the physical distance between camera and associated monitor, seemed to disrupt opportunities to share views of images. Of course, one benefit of the distance was that it set a puzzle for visitors, namely what's the provenance of the image displayed on this monitor, but at the same time raised problems for more flexible forms of co-participation. Interestingly the cameras were attached with bendable, flexible mountings, but participants rarely (only once) noticed or grasped the cameras to shift their position.

Related issues emerge with regard to the large public display that 'broadcasts' images of action on deck. For example, in another example (see Figure 5.8) a young boy, Julian, has been exploring different aspects of *Ghost Ship* for some time with some of his companions. When his mother approaches, he starts to describe its different features and functionality. After discussing the portholes with her, he reveals how he can make himself appear on the large display. To do this, he steps away from the right porthole and says "Mom, check this out". She is in a discussion with someone and doesn't respond, so as he steps past her he touches her and says again "Mom, check this out". At this moment she turns to look at him and he runs across to the deck area.

Figure 5.8: Through talk and gesture Julian attempts to get his mother to look at him on the large display

While he is on deck she is looking at him and therefore cannot see the phenomenon he is interested in showing her, i.e. his image on the public display. So, he explicitly tells her to "Look over there" and he points towards the ship. The placement of action point in one part of the room with the display of that action directly opposite works to Julian's advantage on this occasion. He is able to run on to the deck before his mother notices him on screen. Therefore he is able to prepare himself and more easily time his actions such that his mother confronts the image at the moment he dictates.

There are numerous examples where people time or design their appearance on the screen for a companion entering the space elsewhere. They design their actions such that they suddenly appear on the public display. For example, they might wander behind the deck area, hunch down below the window line and then pop up onto the screen. In some cases they can even be seen watching their companions around the edge of the deck area. Then at just the point they can see them looking at the screen, they shoot their head upwards so that their image confronts their companion.

On other occasions the spatial design of the relationship between deck and ship display can prove more problematic for interaction. Visitors are beamed onto the public display when they stand on the deck, in front of the deck or peep through the 'windows' behind the deck. When they discover this, they almost always wave towards the camera so that the display presents an image of them waving farewell as the ship leaves the harbour (of course the ship

is static). Often companions are standing off-camera looking at the display. This develops an intriguing tension between the action point (of the person waving) and the view points of the companions.

Whilst someone waves from, on, or around the deck area, their companions often wave back. However, whilst they are able to view their co-participant waving on screen, they do not appear on the screen themselves. They are, of course, off camera. They are usually in a position in front of the other so that their waving actions can be seen from behind. This produces an asymmetry of visibility in that one person is able to see themselves appear on screen waving and the back of their companion waving. However, the other, the 'spectator' if you like, is only able to view their companion on screen – they can see neither their own actions nor the physical waving body of the other. Some attend to this by turning around to wave, but this entails turning away from the display, the very object of interest or novelty in many ways (see Figure 5.9).

Figure 5.9: i. Waving at the screen ii. Waving back to the deck

So, throughout these examples the relationship between action points and view points have different sorts of implications for the ways in which participants can interact with each other and the exhibit. To support flexible, inventive and playful forms of (co-)participation it would seem critical to consider the impact of different configurations of action points and view points.

Producing Assemblies

It is not always immediately apparent to visitors that the large video projection on the ship broadcasts images from the deck area. Indeed on numerous occasions the discovery of this characteristic of the assembly is almost by accident.

In one example, Bob and Rose have been briefly looking at the portholes and playfully pushing one another into the line of the cameras. When they turn to leave Rose asks Bob to pick up a copy of Jason's brochure lying at the feet of the wooden captain. While he does this she starts to wander off, but rather than follow her he steps towards the deck area to inspect it. Unbeknownst to him, his image is thereby beamed onto the public display. When Rose turns around to see where he is, she is confronted by his larger than life image on screen. She steps towards him and points it out. Once he has seen himself he then has fun with the image by pretending to be a seagull flying around on the edge of the deck. (see Figure 5.10).
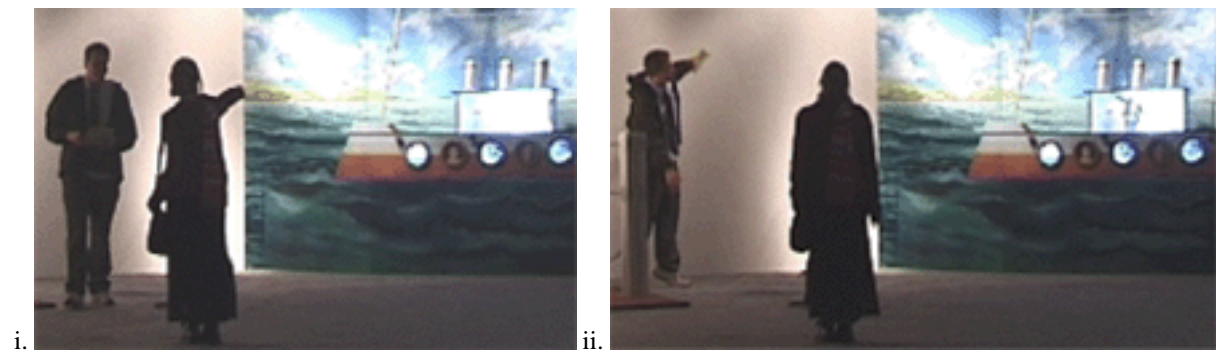
Figure 5.10: i. Rose points out Bob's image on-screen; ii. Bob pretends to be a seagull

In another instance (see Figure 5.11), Marjorie, who is inspecting the exhibit alone, discovers the relationship between the screen and the deck by virtue of the presence of others. She is looking at the screen just at the point that Stephanie and Sophie approach the exhibit from behind her. Sophie's trajectory of approach would lead her up to the portholes and to somewhere alongside Marjorie. However her companion, Stephanie, breaks away from this trajectory and moves towards the deck area. As she does this, she beckons Sophie to join her. As all of this unfolds, Marjorie continues to inspect the ship ahead of her. However, the moment Stephanie steps onto the deck, her image appears on the screen in front of Marjorie. Marjorie immediately turns to see where Stephanie is and moves towards her to join her on the deck and on screen. Her gaze may be drawn in part by the sound of Stephanie's voice. However, she is certainly able to relate the change in the image (i.e. the appearance Stephanie on screen) to the local assembly of objects.

Figure 5.11: i. Stephanie steps on deck and on screen; ii. Marjorie turns to see her

The provenance of the video projection on the ship is often discovered by one person looking at the screen whilst another explores the space around them. These different forms of participation in different parts of the assembly can provide individuals (and then groups) opportunities to discover previously unrecognised connections between video images and spaces. Unfortunately, however, individuals exploring *Ghost Ship* alone, and devoid of the presence of strangers, rarely recognised the various connections. The problem emerged for individuals even in front of the portholes. For example, they would often be able to see themselves when they looked in the central camera, because they would appear in the monitor beside it. However, they would very rarely discover the display of their image when they looked at either of the extreme portholes. Indeed, this was not just a problem for individuals. Some couples would stand close by one another, which meant that they were rarely in a position to be able to see an image appear at the far end when they looked in the nearest

porthole.

Interestingly, as the examples related to Figures 4.10 and 4.11 show, changes or movements in images often enhanced participants' abilities to connect and interrelate different parts of the assembly. In such a way they would discover previously unrecognised functionality. To clarify this connection in other assemblies therefore it may be worth considering the use of automata in the physical space that sporadically move and those movements can be witnessed on screen. Although we placed wooden 'statues' in the space, which sometimes appeared on screen, they did not seem to help visitors to draw a connection between screen and space.

Publicising Interaction

Instances in which seeming strangers strike up discussions or debates whilst exploring *Ghost Ship* are rare. However the following is clear instance which reveals a brief conversation initiated between people who are not companions on their museum visit.

Arthur, a man on his own at the exhibit, has taken some interest in it. He has spent several minutes wandering around and inspecting different parts of the assembly. As the fragment begins he is standing in front of the ship itself and staring at it. Just at this point, two women (Tina and Andrea) approach. They are together, but do not know Arthur. Nevertheless Tina steps alongside him, whilst on the other side of him Andrea inspects area in front of the deck.

Figure 5.12: L to R - Andrea, the wooden captain, Arthur and Tina. At this moment, Tina is telling Andrea that she is on screen.

Simply by exploring the area in front of the deck Andrea's image is beamed onto the large screen mounted on the ship. In some ways, her 'presence' could be said to be augmented by the video display. Her appearance is twofold – physically in the space, and visually or digitally on the ship's public display. She is unaware that her image is publicly available and presented in the exhibit that she is inspecting. Meanwhile Arthur and Tina *are* able to see her image appear on the screen. Indeed, almost as soon as she appears, Tina turns towards her companion and says "Andrea, look there".

However, Arthur is standing between the two companions. As Tina has turned her gaze in

his direction he treats the utterance as designed for him. Indeed, he may mishear, because he says "You think that's me do you?" This misunderstanding is quickly resolved when Tina says "No there she is see" and Arthur replies "Oh, oh, her. Heh heh heh". Nevertheless, it provides an opportunity for further interaction and discussion between the two women and Arthur. Indeed they go on for some moments to discuss how it works and the character of the porthole monitors. So the mishearing provides an occasion for interaction.

The large space that the exhibit occupies often leads to different members of a group of companions investigating different parts of the assembly. Also, given that numerous groups and individuals occupy the same space at the same time it means that there are often groups bisected by other groups or individuals. This case is a prime example. To talk to Andrea, Tina must talk over, around or through Arthur, or else step closer in towards to her companion. In this case she talks across him and confusion (and verbal interaction) emerges. Interestingly, reference to the common screen before them may provide Bob with further evidence that the utterance is for him. The utterance relates to an image before them and it is physically projected towards him.

On a tangential point, before this moment Andrea did not know that she was appearing on screen. She was simply inspecting and exploring the assembly whilst unbeknownst to her, her image was broadcast publicly a matter of feet away. We are of course potentially in view when we wander through a museum. Others can see us and maybe even surveillance cameras are tracking us, but there is something quite different about being incorporated into an exhibit – to be put on show. Even though the image is only a few feet from the actual person, this shift seems to transform the nature of our behaviour. If Tina were not to tell her friend, then her (non-)action might, in some way, be accountable. One might even claim that there is some moral obligation to tell her because Andrea is not being seen as she routinely imagines she is being seen. In such a way, *Ghost Ship* plays with the public nature of relationships.

Interestingly, then, *Ghost Ship* seemingly engendered only one case of verbal interaction between those who happen to be in the same space. Moreover, the two people who do spark up conversation are standing right alongside one another and facing the same display. This co-orientation is therefore similar to *Deus Oculi*. Our attempts at encouraging interaction across and between parts of an assembly have failed, but we may have learnt something more about why.

5.6 Discussion

The description of the low tech assemblies that we discuss in this chapter are clearly at an early stage. We are very keen to explore the preliminary analytic themes and issues raised with regard to the *Ghost Ship* data in much more detail. Also of course, we look forward to imminent data collection and analysis of *Keepsake*. In particular, when we combine analytic materials from the two pieces, we will begin to make significant headway on issues concerning 'mediated communication' in public places. For example, in what ways do video projections facilitate interactions?; what types of interaction do people use this for?; and how do they interleave the use of images with face-to-face or verbal interaction?

Nevertheless, there is a range of issues that we can move forward from this deliverable. For example, the study of room-sized exhibits presents significant data collection problems. Where to place cameras, microphones and the like is critical to the character and the quality

of the materials collected. On this first run of collecting data from *Ghost Ship* the sound in many parts of the assembly are lost. Also close-up images of faces, glances, glances and the like are unavailable. We may be able to exhibit *Ghost Ship* in Britain and if so we will explore different types of recording possibilities.

In terms of implications for design, the foregoing discussion suggests that SHAPE:

- Consider and design for the full range of forms of participation possible within room-sized exhibition spaces - central/peripheral, active/passive, overhearer/overseer, etc. This demands careful attention to the positioning of artefacts around a space, the functionality and interaction they entail, and the visibility of the participants' conduct.

- Recognise and explore the implications of arrangements of action points and view points. Discussion at the portholes such as "Am I looking at the camera?", "Can you see me?" restrict opportunities to animate transform or enliven the exhibit for others. They are unable to tailor their actions to the image that can be seen and they are unable to experience how they are seen. Although this asymmetry may at times provide a useful experiential tension for visitors, it should be recognised.

- The success of table interfaces may be in part due to the interesting combination of people around a table providing easy access to glance between, with and alongside others, whilst able to see a central image or effect. This could be useful explored further with iterations of ToneTable (see Deliverable 1.1) and similar technologies.

- Ensure that both visitors who are alone, and those who are with others can enjoy and experience the exhibition in some way. It may be highly inappropriate to design an exhibit such that a single participant cannot recognise its functionality and possibilities.

- Examine how individuals recognise and work with 'assemblies'. Designs could consider how people may interconnect parts of an assembly.

- Take into consideration the practical and organisational constraints that museums and galleries are working with. In particular, we may consider the relative advantages and disadvantages of attempting permanent exhibits as opposed to temporary or performance oriented exhibits. The demands of robustness and the like may be beyond our more unconventional and exploratory approaches.

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6. Discussion

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6.1 Introduction

Although officially only engaged in Task 2.1, we have already made significant headway on various aspects of Task 2.2. In particular our studies have begun to uncover issues of relevance to understanding action and interaction in room-sized assemblies. In this chapter we summarise and highlight some of the key design sensitivities that we will be taking forward into future SHAPE project activities.

6.2 Design Sensitivities for Hybrid Assemblies

It should be recognised that this is very much an 'organic' project document. We have discussed many, if not all, of the issues raised here internally with the whole SHAPE consortium. Indeed, even in the first SHAPE workshop we contributed to the design of the ToneTable (reported in Deliverable 1.1 and 4.1) with preliminary findings and issues raised from our early analytic effort. Since then many of these issues have at least peripherally informed the design discussions around 'Unearthing Virtual History', 'Glasstrons' and the 'Invention Observatory' (all reported in Deliverable 1.1). Not only have these issues been used to inform the design of prototypes in Tasks 1.1, but just as importantly observations of those technologies-in-use have contributed to the development of these sensitivities in various ways.

We expect that the list we have below will evolve, emerge and be worked up throughout the project life cycle. In the short term however they will be used as a resource in design and deployment discussions for the first SHAPE Living Exhibition to be held in Stockholm in 2002.

The sensitivities are structured as follows: Forms of Participation; Interaction and Co-participation; Assemblies and Assembling; Hybridity; Organisational, Educational and Museum Issues.

Forms of Participation

SHAPE should:
- Consider and design for the full range of forms of participation possible within room-sized exhibition spaces - central/peripheral, active/passive, overhearer/overseer, etc. This demands careful attention to the positioning of artefacts around a space, the functionality and interaction they entail, and the visibility of the participants' conduct.
- Recognise and explore the implications of arrangements of action points and view points. Discussion at the portholes such as "Am I looking at the camera?", "Can you see me?" restrict opportunities to animate transform or enliven the exhibit for others. They are unable to tailor their actions to the image that can be seen and they are unable to experience how they are seen. Although this asymmetry may at times provide a useful experiential tension for visitors, it should be recognised.
- The success of table interfaces may be in part due to the interesting combination of people around a table providing easy access to glance between, with and alongside others, whilst able to see a central image or effect. This could be useful explored further with iterations of ToneTable (see Deliverable 1.1) and similar technologies.
- Ensure that both visitors who are alone, and those who are with others can enjoy and experience the exhibition in some way. It may be highly inappropriate to design an exhibit such that a single participant cannot recognise its functionality and possibilities.
- Recognise and design with regard to possible ecologies of participation.

Interaction and Co-participation

SHAPE should:
- Recognise that interactivity need not, indeed should not, simply refer to interaction between individual and exhibit. Indeed there are multiple forms and types of interaction in museum spaces and SHAPE exhibits should recognise and design for them. These include different degrees and combinations of verbal, non-verbal and non-vocal conduct amongst individuals, groups, museum companions and strangers.
- Consider how to encourage people to interact with, and around, the exhibition. For example, this may involve a consideration of how to provide enhanced or variable functionality when participants interact with each other in and through the exhibit.
- Recognise and design for the fact that individuals often wish to show, introduce or shape exhibition phenomena for their museum companions and others. This may involve a consideration of different ways to allow participants themselves to time and design the 'effects' of an exhibit with regard to the actions and orientations of a companion.
- Consider how to, and the implications of, facilitating co-participation not only amongst museum companions, but also those who happen to be within the same space at the same time. In doing so, we should recognise that providing 'tickets to talk' or 'occasions for interaction' is different from simply enforcing strangers to talk to one another.
- Be wary of 'individualising' the experiences of visitors as audio guides and touch screens tend to do. Rather SHAPE might like to consider how to make experiences and activities publicly visible and sharable.
- To encourage continued interest and engagement, we might consider how 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.

- These issues suggest that facilitating interaction and co-participation would need to be a critical consideration from the outset in designing the exhibition and not treated as an 'add on'.

Assemblies and Assembling

SHAPE should:
- Examine how individuals recognise and work with 'assemblies'. Designs could consider how people may interconnect parts of an assembly.
- Recognise and design for the shape of the space in which our exhibits will be deployed. As we have seen in a number of examples in this deliverable, even the entrance to the space can impact on the way it is used and experienced.
- Consider how to make visitors question, explore and interconnect functionality which arises at different locations and points within the ecology (while at certain points allow discreet individual experience to occur). Thus, rather than providing a single focus object or display, we should provide various 'interfaces', displays and materials located in different parts of a room.
- Not only entail differential sequences of action at different points which can be interrelated, but consider how to provide participants with highly variable and contingent access to each other's conduct. In this way participants might be able to progressively discover the conduct of others in, with and around the exhibition and the various means in and through which they can co-ordinate conduct and activities. Therefore, participants may encounter emerging functionality.

Hybridity

We might like to take as a topic the notion of 'hybridity'. Although Deliverable 1.1 provides our technical definitions for 'hybrid artefacts', the broader notion of hybridity would seem a ripe concept to begin to unpack and explore from a social science perspective. In this regard SHAPE might:
- Recognise that participants do need to see and experience the exhibition in the same way at the same time; however we might wish to examine ways of providing opportunities for them to interweave their experiences of different aspects of the exhibition. Therefore we may wish to consider how we could provide opportunities for participants to configure and enhance each other's experiences *at a distance*.
- Recognise and design for public places as social spaces, which people use with more or less familiarity, with more or less confidence and the like.
- Consider the implications of interweaving different sensational experiences (visual, tactile, aural) into coherent educational or artistic activities.
- Encourage different and contingent forms of interaction and participation with and around the assembly.
- Examine how more traditional museum materials (including signs, labels, historical artefacts, etc.) might be connected with and interrelated to the more advanced core SHAPE computational artefacts.

Organisational, Educational and Museum Issues

Schauble and Bartlett (1997) describe various reasons why collaborations between science education researchers and a museum remain rare. In particular they argue that the cost of more exploratory research erects a powerful barrier to research projects. Additionally, Schauble and Bartlett point to importance of developing trust and personal relationships, as well acquiring common understandings of key goals and practical constraints, with museum staff in order to be able to pursue more adventurous studies, designs and evaluations. Such inter-personal work takes time and effort, as Chapter 4 of this deliverable also highlights. Therefore, SHAPE should recognise these distinctive issues and:

- Recognise that new technologies in museums and galleries are often designed to augment and support a 'collection' or they can be deployed to enhance opportunities for visitor learning. The danger, as we have seen with the electronic guides in the Roman Baths and with the touch screens in some science centres, is that they become the topic of interest rather than encouraging the visitor to focus on the collection or to some didactic message. With the advanced technologies in SHAPE, attempting to make the technology 'transparent' will be a key challenge.
- For our Living Exhibitions, recognise the contemporary educational role of museums and consider how to develop distinctive materials or activities to aid teachers in preparing and organising effective school visits.
- Take into consideration the practical and organisational constraints that museums and galleries are working with. In particular, we may consider the relative advantages and disadvantages of attempting permanent exhibits as opposed to temporary or performance oriented exhibits. The demands of robustness and the like may be beyond our more unconventional and exploratory approaches.
- Ensure that early analysis of social interaction and human experience of prototypes and exhibits is incorporated as a valuable and informative component of the design process.
- Tailor the design of technologies to the *character* of the museum space in which it is situated.

6.3 Next Steps

In conclusion, we raise a series of future concerns and issues that we plan to pursue in the short to medium term:

Methodological Issues.
- In this document, we have discussed some of the problems associated with collecting and analysing video-based data in public places. Although this is difficult enough for examining interaction with and around single artefacts, the problems develop further when analysing movement and interaction in and through room-sized assemblies. Within the DC programme as a whole, various researchers are using video materials to study human conduct in public places and in the course of 'mobile' activities. Therefore, we have sought (and gained) funding for a *Video Analysis Working Group* to combine DC expertise in addressing common methodological difficulties around video data collection and analysis in these challenging research domains.

Low Tech Prototypes
- Work at the Interaction Design Centre in the coming months will involve further exploration of a variety of technical devices and platforms that may assist us in achieving some of our objectives for the prototypes, such as RFID tags, use of accelerometers and potentiometers for sensors, projection surfaces, webcam tracking etc. It is hoped that there will be an initial low-tech prototype available for study by Easter 2002.
- Work between KCL and Jason Cleverly will continue. Access to study *Keepsake* is secured as soon as it 'goes live'. There is also a possibility that *Ghost Ship* can be exhibited in Britain with associated opportunities to collect better quality audio-visual data. Two further low tech prototypes are under consideration, one that will definitely be exhibited at Chelsea Crafts Fair in September 2002. One of these new exhibits is likely to take considerations of 'assembly' as its principal topic and concern.

Field Studies
- Field studies of visitor behaviour in museums and galleries will continue in all key sites.
- Additionally both UL and KCL have a keen interest in examining the work of exhibit and exhibition designers. They are engaged in organising and deploying 'hybrid assemblies' and as such their expertise and reasoning is of prime interest to SHAPE considerations.

1ˢᵗ Living Exhibition
- A key role of this document and the participants of Task 2.1 is to inform the design of the 1ˢᵗ Living Exhibition.

More generally, project effort in Workpackage 2 will devote an ever keener eye to the relationship between the use of museum exhibits and the use of technologies in public places more generally. Some of this effort will involve studies in a variety of other public places, and some will involve reflection and comparison.

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