The Shannon Portal Installation: An Example of Interaction Design for Public Places

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Abstract
This paper documents the design and deployment of “The Shannon Portal”, an interactive artefact designed for public use and installed at Shannon International Airport, Ireland during July 2006. Our orientation is one that pays particular attention to the local context within which any technical artefact is installed, and takes a human-centred approach to the design of interactive tools and media, attempting to augment human activities through technology. We present an outline of the various stages in the design process that led to the development and implementation of the Portal, an interactive system that allowed people to load their own photographs on the system or select from an existing archive, annotate them, and then send them around the world to friends. The Portal also encouraged people to upload their annotated photos to a large interactive Image Wall that could be browsed by visitors through a movement-based sensing system. The paper describes the methodologies that were used during the design of the “Portal” as well as some of the features of the installation and their relation to the airport setting, and provides an overview of some of the findings from the public exhibition. The installation was successful in attracting the attention and engagement of a large number of airport passengers and staff, and a number of suggestions for improvement were noted.

Keywords
Interaction Design, public spaces, design process, augmented environments

ACM Classification Keywords
H5.2 Information interfaces and presentation (e.g., HCI): theory and methods; user-centered design; prototyping. H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

I. INTRODUCTION

The Interaction Design Centre is involved in a research project entitled Shared Worlds, funded by Science Foundation Ireland, that is investigating the design and deployment of interactive artefacts in public spaces. Our approach is one that views technology as a tool or mediator in human activities, thus requiring a careful observation and analysis of user activities as a prelude to concept design. In our work, we have been attempting to bring together aspects of the social and the engineering sciences to inform and structure the design process. Brainstorming and concept design activities are only undertaken after extensive fieldwork at the site has been performed, with a view to understanding the various actors involved in the use of the public spaces and their inter-relations – unfolding over time and space. Our design process is an iterative one, and attempts to be as participative as possible, in evaluating aspects of the prototypes we develop over the course of the project. For more background on the rationale for the project and our approach, see [3].

In this paper we describe the design, development, deployment and evaluation of an interactive installation for Shannon Airport, Ireland. The system allowed users to select and personalise by means of annotations and drawings photographs of their own choice, to email them, and to upload them to a public image wall gallery projected in the airport transit lounge. Users could either use
their own digital cameras, annotating and sending a photograph they have taken, or select an image from a corpus of public images on the system. Passers-by could magnify individual images from the collage of images on the image wall by physically moving their bodies in a certain fashion in front of the Image Wall. A computer vision algorithm detected their movement, magnifying the image in front of that person (see details in fig. 9). Feedback as to the locus of activity on the Image Wall was provided by the Image Wall Lens – which moved over the Image Wall at a rate determined by the movement of the visitors in front of the Wall. The system supported both Individual and Collective activities, averaging the movements to determine the Lens displacement.

We describe the main framing of our research, some major findings that emerged from a phase of field studies at Shannon Airport that have informed our design, an overview of the concept design development phase leading to the building of the system, and some highlights from its exhibition to the public. With this paper we aim to provide an example of activity-based design fully rolled out in an artefact deployed in a public space. Whereas the main focus of this paper is on the design process, we include some examples of people’s interactions with the installation in the setting of the airport to provide a sense of the kind of interactions and participants’ responses that occurred around the installation. We are presenting a case study documenting our efforts in designing for and exhibiting a public installation in an airport setting. This presents some general reflections on the importance of using a combination of methods at different stages of the design process, on the emphasis on understanding the place in its entirety, and on the need to consider the physical and material qualities of the designed system when designing for public environments.

II. AIRPORTS AS PUBLIC SETTINGS

The challenge of studying public settings, where a broad range of activities that go beyond the more traditional work-oriented scope of HCI and CSCW, is common to a number of ongoing research endeavours. For example, several current projects, such as “Fiasco” [5], “Familiar Strangers” [12] and Equator’s “CityWide” [13], are dealing with the augmentation of people’s activities within urban environments. Other public environments such as museums [4; 14] and exhibition spaces [17] have been the setting for explorations in ubiquitous computing technology enhancing people’s appreciation and interaction with them. Within this area of study, we have focused on a different and little explored type of public space: transitional spaces and, specifically, airports.

Airports are sites where extensive research has been done for improving the operational efficiency of the airport itself (see for example [16]).
However, little research has been carried out on how interactive technologies could support and enhance passengers’ experiences and activities in airports. Some technological explorations, such as “SmartKiosk” [6] and “WebWall” [8] have been developed considering airports as merely one of the potential settings of use, but they are not designed with the specific features of an airport and the activities taking place there in mind. Arguably, due to the increasing number of passengers travelling by air and spending more and more time in airports there is scope for envisaging ways in which interactive technologies could be of help. Our work on The Portal was aimed at exploring these issues and designing an on-site intervention explicitly for Shannon Airport and its users. In the following sections we will describe highlights from the different phases of the design process.

III. Phase 1 – Understanding Passengers’ Activities and Experiences of Shannon Airport

We conducted a series of field studies at Shannon Airport using a combination of qualitative methodologies of inquiry including naturalistic observations of people’s activities, video recording of specific areas of the space (such as check-in desks and customs hall), semi-structured interviews and conversations with passengers, visitors and staff. Quantitative methods included surveys of flow and of dwell-time through the different areas of the airport.

The ample waiting time that is a common feature of many passengers’ experiences through the airport is filled with activities such as talking to friends and relatives, working (mainly on laptops and mobile phones), looking after children, reading, sleeping, eating, etc., although structured and shaped by the overall rules of air travel (e.g. waiting for the check-in desk to open, waiting for boarding to commence, etc.). At the same time, people’s experiences are affected by issues of security control that pervade their activities at an airport, sometimes making them anxious to comply with the airport’s rules of behaviour.

In conducting the informal interviews, the conversations followed such themes as “what was your best or worst experience in an airport? And here at Shannon?”; “if you were to recommend this airport to a friend or a family member, how would you describe it?”.

We collected 21 interviews with passengers and visitors, and 8 interviews with staff members.

Recounting their personal stories, participants in our study provided us with an understanding of the main issues that characterise their experience as air travellers and as airport users, and of the main dimensions of the activities they perform in this context that the technology could support to some extent [10]. Major findings include:

- Overall, people tended to describe Shannon as a friendly environment, in contrast with some of their previous experiences of other airports, due to its small size and the friendliness of staff.
- People stated their need of having constantly up-to-date information regarding flights, as well as the need to relax through activities such as reading and conversing. Overall, they expressed an interest in the presence of novel forms of entertainment and engaging activities at the airport, as far as they would not be too intrusive, demanding or distracting.
- People commented on the lack of a strong link between the airport and its surrounding area (the West of Ireland). Non-Irish passengers waiting for connecting flights noted that they had only a vague idea of whereabouts in Ireland Shannon airport is located, and expressed an interest in knowing more about the region. Overall, people would appreciate if the airport had a more geographically rooted identity.

IV. Phase 2 - Concept Generation

Based on the analysis and reflection over observational and interview data, a number of design concepts were proposed and discussed at a series of planning and design meetings and during several informal conversations among members of the design team.

The first design brainstorming used keyword cards to trigger ideas and potential scenarios. The group subsequently discussed a smaller set of cards selected by the coordinator of the work at
Shannon. They included keywords such as:

- “flow” and “paths”: associated to the tracking and representation of people’s and planes’ movements in and around Shannon;
- “luggage”: associated to what people bring with them as they embark into an air journey;
- “postcards”: regarding the possibility of creating a record of stories and episodes from one’s journey to be shared with other passengers and travel companions.

The design team discussed the themes’ potential development in relation to the findings from field studies, and after formulating short scenarios in relation to each keyword, a “postcards” theme was selected and articulated into the initial idea for an installation which would allow passengers and visitors to produce a record of their journey for others.

![Image of keyword cards]

**figure 2.** Keyword cards documenting design concepts

The form of a fixed installation was decided in order to respect people’s desire not to be necessarily engaged by a pervasive or mobile installation. In this way, people would be free to decide whether to approach the installation or not. It was also decided that an ambient component (such as a visual or auditory display) should be associated with the standalone piece to provide some entertainment for onlookers.

In summary, the main requirements for the developing of the “postcards” scenario were:

- allowing people the freedom to engage with the piece at different levels, from active participation to onlooking
- providing some entertainment in a space that is considered to be quite boring, especially for children
- ensuring anonymity of the participants and respecting the airport security constraints
- potentially involving members of staff without interfering in their duties
- creating a link between the airport and its geographical area – in this case the West of Ireland.
figure 3. “Postcards” scenario card

These ideas were presented to and discussed with the airport management staff, who provided useful feedback and suggestions for the development of the scenario. After further discussions, it was decided that the proposed system would enable participants to create e-cards of their own photos, and to annotate them thus allowing for individual contributions to the installation. Our original discussions on the actual physical form the installation would take were around the idea of an old-fashioned post office desk/counter (the post office is traditionally a meeting and connection point in Irish society). We then discussed the possibility of a more timeless and less cluttered design (fig 6).

figure 5. Early post-office sketches for “Postcards”
Eventually a radical concept, with strong cultural, historical and geographical connections, emerged and was further explored: that of a modern-day, technologically enhanced portal dolmen. The people of the Neolithic stone age in Ireland built stone monuments, known as Portal Dolmen tombs, in the centre of each community or tribe, as a focal point and a memento of who they were. In the West of Ireland the highest density of Portal Tombs can be found. The idea of a portal as a link between present and past and as a community symbol rooted in the history of the area was further developed by the design team throughout the development phase.

V. PHASE 3 - DEVELOPMENT

The form of a dolmen fits very appropriately with a number of issues surrounding our design: it offers a linkage to local heritage and history, it can be built in local material, stands to represent the focal point of a community and its memento, plays on the idea of boundary (geographical and temporal) which is intriguing when connected to the identity of the airport as a “boundary space” in itself between here and there, earth and heaven, coming to the earth and departing from it. Moreover, it presented the opportunity for our design for Shannon Airport to be completely unique and strongly linked to the place and its traditions.

The final design of the installation was based on three spaces and levels of interaction:

- The interactive dolmen: its basic functionality is similar to the increasing numbers of “Make your own prints”-machines commonly available today. Different to those systems, users can annotate their photos, e.g. draw with an electronic stylus on the uploaded image (fig. 10). They can then submit their annotated images to The Portal’s Public Gallery: the images smoothly leave the dolmen’s screen interface, to re-appear on the image wall, sliding into place (fig. 8).

The activities supported by the dolmen are similar to those featuring in other installations, such as CommPose [2]: this project allows mobile camera-phone users to send their annotated pictures to a public screen. However, CommPose does not allow for handwritten annotations and email facility, important features of the communication allowed through “the Portal”, and can only be used by participants who are in possession of a camera phone.

- The Image Wall: the gallery, or rather parts thereof, is projected on a nearby “image wall”. The projection is a window into the gallery space. At any given time, a collage of uploaded images, with their annotations, is shown. Users in front of the projection can navigate the overall image wall by means of the Image Wall Lens, a “virtual magnifying glass”, controlled by their gestures in front of the display (fig. 9). To further improve the users' feeling of control of the virtual magnifying glass on the image wall, we added an auditory display dimension. As the airport is quite a noisy environment, we decided to use an in-harmonic Shepherd tone illusion [15] that provided left/right information through panning, and up/down information through the direction of the pitch change. The inharmonic series was chosen to fit into the general noise spectrum of the
site, but to be easy to segregate. The Image Wall allowed for ambient, implicit and subtle interaction, following the terminology of Vogel and Balakrishnan [18]: when not in use the display would show a selection of uploaded photographs and a short video showing how to interact with it; if a person approached the Image Wall, the display would “come to life” both visually and sonically giving the user feedback on its active state; finally, the participant could actively navigate the image archive by controlling the magnifying glass through body movements. A significant amount of research has been conducted on the use of large interactive displays for public use (see for example Churchill et al. [7]; Grasso et Al. [9] a), however these explorations usually take place in actual semi-public places, such as offices and labs, and are targeted to a particular group of users (mainly workers in a particular organisation), rather than on the general public. For example, the “Palimpsest” installation described by Agamanolis [1], which features a gesture-controlled display similar to the Portal Image Wall, was entirely deployed within the research lab itself, and even its physical design did not take into account any requirements (such as safety and robustness) for public exhibition.

- The Web Image Wall: a similar window to the gallery space is simultaneously made available on the World Wide Web at the URL www.shannonportal.ie/gallery/. The availability of free Internet access at Shannon Airport meant that this third component of the installation could be accessed both on and off site.

After reflections on the choice of appropriate material, scale and location, the components were sketched, technically drawn and specified, and finally built. Two Shuttle1 PCs were used in the system, one for the image wall, the other for the interactive dolmen. In the dolmen, the PC was connected to a Wacom2 Cintiq interactive pen display and a multiformat Flash card reader. The software for the dolmen was implemented in Macromedia Flash3 and PHP4, running on Unbuntu Linux5. Throughout our prototyping, we had experimented using both Microsoft Windows and Apple OS X, but due to handling issues with Flash cards from the users’ cameras and mobile phones, we needed full control over the mounting and unmounting processes, hence Linux was our best and preferred option. The image wall PC was connected to the dolmen PC via 100BASE-T Ethernet, a Logitech Web camera mounted above the user space in front of the image wall projection, and a Barco6 6iD R600 projector configured for back-projection on Glimm7 Blackfire screen. The image wall PC software was implemented in Microsoft C/C++ and Windows XP, using Intel's OpenCV8 computer vision library, to detect user movements in front of the projection screen, and OpenGL to generate the dynamic visualisation of the images uploaded by users. The interactive sonification generating the Shepherd tones was implemented in Pure Data9. When users uploaded images or annotated and emailed images, the data was copied to a web server running Redhat Linux 10 and Apache 211 (for an overview of the technical infrastructure of the “Portal” see figure 7). The dolmen screen interface and the image wall went through several usability evaluation phases involving test users in our lab.

VI. PHASE 4- LAB EVALUATION

The evaluation of initial versions of the dolmen interface involved experts from our research group, but external to the project, who conducted usability inspections on the interface pointing out its most significant usability flaws. We also involved students and postgraduate researchers in

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1 [www.shuttle.com](http://www.shuttle.com)
2 [www.wacom.com](http://www.wacom.com)
3 [www.adobe.com](http://www.adobe.com)
4 [www.php.net](http://www.php.net)
5 [www.ubuntu.com](http://www.ubuntu.com)
6 [www.barco.com](http://www.barco.com)
7 [www.glimm.nl](http://www.glimm.nl)
9 [puredata.info](http://puredata.info)
10 [www.redhat.com](http://www.redhat.com)
11 [www.apache.org](http://www.apache.org)
trials of the image wall, discussing and evaluating alternative designs of the photo display and of the ways of controlling the magnifying glass. Criteria such as visibility, feedback and learnability were applied. Suggestions and alternative ideas regarding the image wall were sketched on a shared SMARTboard system, in order to visualize them on a scale similar to that of the image wall itself.

Figure 7. Dolmen and Image Wall technical infrastructure
Once the suggested changes were implemented and the installation was further developed to allow more extensive trials, we undertook Cooperative Evaluation sessions, using the Thinking Aloud Technique [11] involving participants from the broader university community and from our personal social networks. 15 people agreed to participate in the Cooperative Evaluation of the Portal, which took place in our building’s lobby. The participants were Irish, Italian, Spanish and from the USA. The sessions were based on a task list exploring the dolmen, and on more informal trials of the image wall, where participants were asked to comment on the display’s feedback and visibility. The interface still presented some small technical glitches, which were taken into account in conducting the evaluation. All users were invited to bring their own digital camera along, and 4 people actually did. The users were briefed on the nature and goals of the project, although not on the functionality of the Portal. This was done intentionally, in order to assess how easily the participants could understand the function of the Portal, and to evaluate the effectiveness of a set of video instructions continuously showing on the dolmen screen when not in use. Following the introduction, all participants were asked to perform 2 series of tasks on the interface: the first dealing with sending an image from the image gallery, the second with sending another image from a digital camera/memory card.

In general, all participants found the installation intriguing and engaging, and potentially very successful within the Airport. They all stated that they would use it if they encountered it at the Airport, and some of the participants stated that they would encourage their children in using it. The dolmen shape was well liked. In the case of one participant, however, it gave her the impression that the installation would provide her with historical information on the local area. Following this comment, we decided to design and print leaflets, which would be distributed in the transit lounge, describing clearly the goals of the installation. Certain usability issues emerged from the Cooperative Evaluation sessions, and were followed by redesign of elements such as the dolmen’s initial screen layout, card reader feedback, and sketching interface.

Finally, the Portal was installed in the transit lounge at Shannon in July 2006, and remained available to the public for three weeks. Approximately fifteen hundred people interacted with it in some form: specifically, 432 photographs were uploaded to the image wall, and a total of 535 emails were actually sent. The images “donated” to the image wall can be viewed at www.shannonportal.ie/gallery/

VII. PHASE 5 – PUBLIC EXHIBITION OF THE PORTAL

During the Portal’s public exhibition, we conducted extensive evaluation in-situ. The bulk of observational data was collected in form of video and audio recordings through 2 cameras and 2 microphones located in the surroundings of the piece. Naturalistic observations and note taking integrated this process. Conversations and informal interviews with participants (both passengers and staff) were also conducted in order to obtain more explicit comments regarding the installation’s features. Although the main focus of this paper is on the design process, a brief overview of the main issues that have emerged from the public testing of the Portal is important to highlight the ways in which our design has led to interaction patterns in-situ.

The analysis of data has highlighted some important issues regarding people’s interactions with the Portal:

- The installation has supported multiple levels of engagement, facilitating a variety of behaviours: from onlooking, to active participation and interaction with the different components of the piece (see figure 8);
- It has engendered and facilitated episodes of collaboration and social interaction, including collaborative annotation and drawing, joint exploration of the image wall, and exploration of the piece by two or more users giving directions to each other (see fig. 9);
- The material and aesthetic qualities of the piece and its distinctiveness was appreciated by participants. The artificial grass area of the Portal was used for sitting, playing and posing for photographs. The dolmen was hugged and explored from every angle;
- Using auditory display in a public environment is always a challenge, but in this design and
environment, the auditory display element worked well both for grabbing initial attention and to contribute to the users' feeling of direct control of the system. No users found the sound annoying or intrusive.

- The participants appreciated the possibility of being able to contribute with their own content, whilst being able to choose whether to keep it private or to make it public. Privacy and anonymity are sensitive issues within the airport environment, and the design of the Portal allowed people to be in control of the content produced and the form of its display (by email only, on the image wall, or both).

**figure 8.** An annotated image being updated on the image wall

**figure 9.** Controlling the “magnifying glass” through motion (right)
VIII. DISCUSSION AND CONCLUSIONS

This paper documented the design and development of a full-scale, in-situ intervention centered on the features of a particular and challenging public space – Shannon Airport. Issues emerged concerning the relation between the positioning of elements of the installation – the Dolmen and the Image Wall – and the different activities being encouraged. In terms of the visitor interaction with the installation, a number of issues arose, and we are still analysing an extensive corpus of video data. We are also involved in writing-up a more extensive account of the prototype evolution, from paper sketches through to the deployed installation, as well as mining the video material for more micro-level analyses of visitor movements and interactions around and through the installation. In sum, besides producing a successful installation – as stated by the visitors, during the design process we learned valuable insights on the need for integrating different methodologies, and on how to incorporate them seamlessly into the design process. Facing the challenges of a public exhibition, the importance of focusing on situated activities emerged throughout the life of the project, as well as the crucial need of incorporating physical and aesthetic concerns into the design.

IX. ACKNOWLEDGEMENTS

We acknowledge the support of Science Foundation Ireland for the Shared Worlds project. Thanks to Joe Buckley, Claire McEnery, Dorothy Quinn and all at Shannon Airport for their support; Marcin Ziemnicki, the Sculpture Factory Cork and all at the IDC for making the installation possible. Thanks to John McCarthy for his contribution to the project and for his useful comments on previous versions of this paper.

X. REFERENCES


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