

Interactive Storytelling and Gaming Environments for Museums: The Interactive Storytelling Exhibition Project

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Abstract. Interactive storytelling and gaming technologies have great edutainment potential for engaging visitors with museum exhibitions. This paper presents the development and testing of the *Interactive Storytelling Exhibition Project* devised originally within the Factual and Learning Interactive Television Department of the British Broadcasting Corporation (BBC) and continued development at the University of Brighton. The project combines both interactive television storytelling and gaming technologies to immerse museum visitors with artefacts on exhibition, engaging the user into physical space using virtual stories.

Keywords: Digital Heritage, Interactive, Television, Museum Exhibition, Storytelling and Game Narrative

1 Introduction

Nowadays, the focus in museums is shifting towards the use of artefacts for providing an interactive experience to visitors, in contrast to the traditional museum approach, where the focus was on the collection, display and storage of objects. Hence, more people are increasingly visiting museums with the expectation to learn something, while having an entertaining experience. Digital technologies, in particular interactive storytelling and gaming, have a great potential for assisting both the education and entertainment of visitors in museums. This is because they can communicate the heritage of societies in an interactive way; overcoming some of the problems presented by more traditional means, such as text. Moreover, technologies can provide personalisation and contextualisation of the information delivered to the visitor providing advantages, such as visitors learning at their own pace. This is important as visitors to museums have particular requirements, hence their behaviour and attention is different in the museum environment. While educational or specialist visitors require more detailed information and the museum's expertise on the collection. General visitors desire

instead broad understanding and informal learning [2] so they gaze in observation mode focusing on pictures and sounds first and text last. A study on public perception of museums [7] conducted among young people, between 16 and 25 years old, indicated poor opinions of museums. The *Interactive Storytelling Exhibition Project (INSTEP)* presented in this paper, combines both storytelling and gaming technologies to immerse museum visitors in an Egyptian exhibition using a story surrounding the opening of King Tutankhamun's tomb. The project started as a creative and technical commission undertaken within the Factual and Learning Interactive Television Department of the British Broadcasting Corporation (BBC). It was born out of a brief with the objective to make BBC content more accessible in local areas as a free public service by collaborating with museum curators and local institutions. The following sections of the paper present related work on using these technologies for creating museum experiences; as well as the background, development and testing of the project. In addition, the results of the testing are discussed in order to examine the potential of these technologies for visitors to become more engaged with the heritage material as well as the lessons learned from the project. Finally, further work and conclusions are presented.

2 Related Work: Interactive Technologies in Museums

For many years museums have made use of computer-based interactive applications. These efforts have difficulty in creating a meaningful interaction or engagement with specific exhibits and are often stand alone systems, with the notable exception of handheld or kiosk-based on-demand guides. Interactivity in most cases is limited to requiring the visitor to press a button to trigger a response on a screen or an audio system. Hence, there is a need to improve the interactivity as well as to strengthen the connection between the use of these technologies and the artefacts in the exhibit so technologies can enhance the experience, rather than becoming the experience themselves. Interactive storytelling and gaming can exploit digital technologies to provide a new level of engagement within collections, exhibits and even locations. Interaction between the visitor and technology can enhance the interaction between the visitor and his/her surroundings.

2.1 Interactive Storytelling

Storytelling is deeply embedded in human learning, as it provides an organisation structure for new experiences and knowledge [9]. [4] recognises that across cultures and over time, people can mentally organise information better when it is recounted in the form of a story. The most common conception of story is a linear sequence of scenes, for example a book or a movie. This type of storytelling is already popular in museums, allowing stories to be presented not only of artefacts, but also of people who lived through more recent episodes in history. Thus, storytelling in museums is mostly linear and only partially interactive, as

previously mentioned. Digital technologies allow more sophisticated nonlinear stories; allowing visitors to interact with the story at different points in time. For example the ART-E-FACT project which introduced Mixed Reality interactive storytelling with virtual characters, positioned next to real art pieces in an exhibition, discussing art, while prompting visitors for their opinions and questions [12]. The Dark [3] gallery also delivers audio content to visitors according to their position in a physical darkened space. While, the NICE project developed an application for museums to enable youngsters to have multimodal conversations with 3D animated fairytale author Hans Christian Andersen (HCA) and his fairytale characters [1].

2.2 Interactive Gaming

Museum visitors provide different challenges when visiting an exhibit:

- They want to explore the space and see the artefacts
- They want to have an entertaining experience
- They want to learn something from the artefacts and the visit

Games genres, such as role playing games and treasure hunts might be suitable to address these challenges. These types of games usually involve exploration and puzzle-solving, and they focus on a narrative by interacting with game characters. In this way, storytelling and gaming can be combined to create highly interactive experiences, where visitors engage in new worlds enabling them to learn more about the artefacts in an exhibition or environs. For such interaction to happen, the visitor could take a fictional role making the experience more appealing for particular types of visitors. This type of interactivity requires identification of a user to the interactive system (i.e. smart RFid tags, bar code technologies, etc). These technologies allow the system to keep track of individual visitor's paths across the exhibition. Hence personalisation and contextualisation of the information delivered to the visitor is possible. Although, the combination of these technologies is not popular in museums yet; there are some examples available, such as the Dino Jaws [11] in the Natural History Museum in London, UK. This exhibition combines educational intent and a focus toward children with a collection of life-size dinosaur models. Another example is the Science Museum NEMO [10] in Amsterdam, NL; where interactive gaming is used for encouraging children to learn about science and technology.

3 Interactive Storytelling Exhibition Project: Background

The primary objective of the project was to make BBC content more accessible in local areas as a free public service by collaborating with museum curators and local institutions. The secondary objectives included immersing visitors in a public space exhibition using departmental core skills (technical and creative) as well as understanding how existing skill sets map onto creating immersive interactive exhibitions of museum artefacts in an innovative way. Any interactive

technology devised for a museum environment must respect and understand the aims and objectives of its host. At an educational level museums aim to fulfill a series of General Learning Outcomes [7]:

- Knowledge and Understanding
- Skills (including intellectual, information management, social, communication and physical skills)
- Attitudes and Values (including feelings, perceptions and opinions)
- Enjoyment, inspiration, creativity
- Activity, behaviour, progression (in the way that people manage their lives)

Following these directives, a method to engage an audience with artefacts on exhibition exploiting interactive television was devised and software architecture specified from an external contractor [8].

4 Project Implementation: The Interactive Environment

The pilot Interactive Environment was based on a temporary exhibition with Egyptian artefacts kindly loaned from Birmingham Museums and Art Galleries and Birmingham University Department for Archaeology and Antiquities. Both exhibition and pilot Interactive Environment went live to the public on the 31st October 2005 in the BBC Birmingham Public Space in Birmingham, UK. Museum curators and interactive exhibition specialists across the UK were invited to ensure feedback from a suitable cross section of public and professional alike.

4.1 System Architecture

The system consists of a network of interoperable computers, running a bespoke software platform and interactive environment. Built using open source Internet technologies Linux, Apache, MySQL and PHP; the network comprises of a number of personal computers known as 'stations', one central 'server' and out reach 'client' computers (running Microsoft Windows). One of these client machines is identified as the 'registration' machine. The visitors make the journey starting at 'registration'. The interactive journey continues from any client machine excluding the registration machine which also serves to de-register users. Each visitor registers by entering a unique user name which is associated with a unique RF identity tag in the system database. Users are encouraged to explore the exhibition in 'familiar groups' of up to seven individuals. Each station delivers content dependant on the identity and needs of the visitor within a linear story narrative. The server retains user's name data and journey data from registration to completion of the interactive journey. As shown in Figure 1, when a user introduces the unique identifier the system plays the appropriate episode for that user (or group). The user is 'kicked off' and 'locked out' for a timed period (adjustable at each client machine). There are seven episodes of content from BBC Egypt comprising graphic, audio, and video files and any game format capable of running in a web browser environment (see Figure 2).

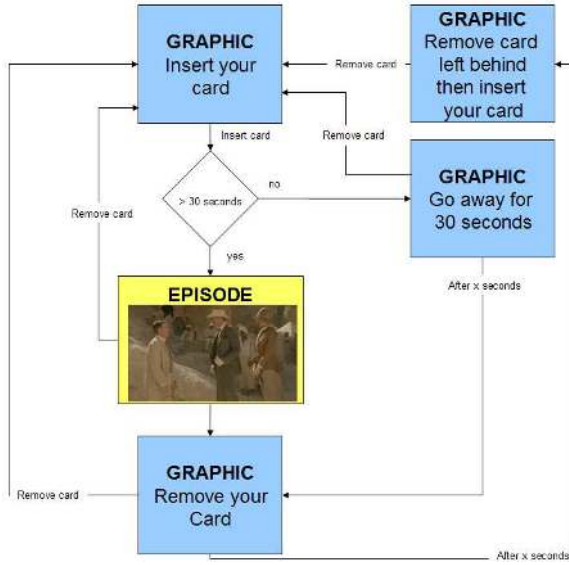


Fig. 1. Instep system logic functionality and graphic display

4.2 Storytelling Narrative

The system engages the visitor into stories working on different levels: A story to provide a context (Carter and Carnarvon), a story to support the role of the user (a newspaper Editor needing a new angle on a tomb discovery, see Figure 3); and the story provided by the exhibition (Ancient Egypt). Each of these stories are brought together by placing the visitor at the centre of all three stories in the role of a newspaper journalist.

The story is set in the early 1920's at the height of 'Egyptomania'. In the exhibition context visitors are immersed in the period using mixed media, 'set', 'props' and 'dressing' from the BBC1 show, a video presentation and posters provide a local context. Strong reference is made to local newspaper coverage and superstitious beliefs surrounding ancient Egyptian artefacts. Key information is the fact that Carnarvon sold exclusive copyright of the story surrounding the opening of King Tutankhamun's tomb. As the story becomes hot news the story hungry tabloids are looking for new angles. The television narrative is based on accounts from the period and real life characters. Visitors are offered the chance to become a tabloid reporter and follow up an exciting 'breaking news' story about a curse connected with the tomb opening. Following the registration process and the issuing of an 'International Press Identity Card' the visitors proceed to an interactive screen (see Figure 4). This card identifies the visitor to the system using RFID technology enabling the system to deliver appropriate content on demand from any interactive terminal.

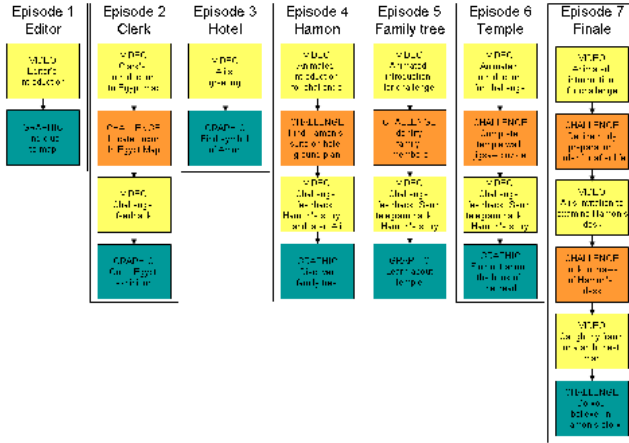


Fig. 2. Seven episodes of content from BBC Egypt

On screen visitors meet the 'Editor' (see Figure 3) a character who sends them on a mission to get a scoop for the paper by interrogating the mysterious character Count Louis Hamon, AKA 'Chiero' who claims there is a curse threatening the team about to open the tomb. The visitor is given a lead and they start the mission. Each part of the story from here on has a challenge and knowledge based game linked to it. Complete the challenge, do the game to prove you have done the challenge, get rewarded with further narrative content. Games drive narrative, narrative informs games. What is unique is the fact that the user completes the challenge away from the television screen in the context of the exhibition space only returning to a screen to prove the challenge is complete and continue the story. Each challenge has learning value and is linked to ancient Egyptian history, with a thread and story of its own. After five games the visitor is in a



Fig. 3. The editor



Fig. 4. User RFid Press Card

position to decide whether they feel there is any truth in the curse story. For the climax, the visitor must choose a headline for the paper to get the scoop they set out to find for the tabloid editor. Before they leave the exhibition they must return the card and collect a personalised newspaper front page (see Figure 5). This 'take away' includes the information gathered about the stories they have researched, and the correspondents name (or group identity) at the top.



Fig. 5. Samples of the three print out 'take away's' without correspondents name

4.3 Interactive Gaming

Games are seen as primary interactions and the narrative as a link between game activities. The paradigm of kick off a lock out can be seen as a third level of engagement where the focus shifts from screen interaction to engagement and interaction with the physical world. Each game theme is dictated by two key requirements: 1) To fit with the needs of the story, and 2) to fit with generic interpretation themes and learning objectives. The games are:

1. Key locations in Egypt - This is a hot spot map where the visitor is required to locate Egypt in Africa and the town nearest to Valley of the Kings amongst one of four key sites in Egypt: Giza, Amarna, Luxor, Abu Simbel.
2. Gods of Ancient Egypt - This hot spot game challenges the visitor to identify the god Amun on doors of hotel suites to find where 'The Count' is staying. Museums can display any artefacts with reference to any Ancient Egyptian gods. In this case, the exhibition contained a cabinet with a variety of artefacts, figures and depictions of gods.
3. Family Tree - in this drag and drop game the user needs to be able to recognise key members of Tutankhamun's family to make the Tutankhamun family tree. Especially the fact he married his half sister. Museums generally carry a dynastic timeline. Any artefacts relating to Pharaohs family can be exhibited here as they link with the dynastic chart.
4. Desecration of the Temples - This drag and drop game illustrates the story of the power struggle between Tutankhamun's family and the most powerful priesthood of Amun. This is to prove the workings of ancient cursive behaviour. Artefacts, especially relating to Amarna and Akhenaten and Amun, show evidence of curses or superstitious belief (except afterlife). This is evidence that Tutankhamun's family were despised by some people who wished to curse them and deny their memory. The ancient story of this desecration is a classic tale for the enjoyment of the more mature and academically engaged visitor still being researched into by archaeologists today.
5. Book of the Dead and the Afterlife - This is a 'drag and drop' game requires the user to understand the concept laid out in the Book of the Dead describing the journey to paradise after death. The user has to check the order of events and requirements for entry to the afterlife. Any artefacts relating to death and the journey to the afterlife are useful here: Mummies, shabti figures, canopic jars, Osiris, Anubis, etc.
6. Curse Story True or False? - This game brings the user back into the role of undercover reporter searching through a virtual desk, each drawer contains information to help the user form an opinion on 'The Count'; are his stories true? is he to be trusted? The exhibition context for this can be of 'Egyptomania' including Chiero's publications. The user must decide could the death be related to a curse on the evidence from 'The Count'?

Games mainly use two different styles: 'hot spot' multiple choice or 'drag and drop'. Feedback is given on incorrect actions, bringing up a 'factoid' about the wrong answer as another learning point. Hot spots and drag and drop are chosen as they are simple template HTML based games. Any game software capable of running Microsoft Internet Explorer will work in the system i.e. Adobe Flash.

5 Usability and Acceptability Visitor Evaluation: Lessons learned

The pilot Interactive Environment was evaluated to find out the acceptability of visitors to the overall experience as well as the usability of the system. The

evidence was collected from visitors using a combination of methodologies, including:

1. Observation, visitors were shadowed and hidden cameras were used to observe behaviour and comment.
2. One-to-one interviews, questions were based on interview guides designed and tested by the project inspiring learning for all project, the General Learning Outcomes [7] and on a guide for museum evaluators [5]. Three types of structured interviews were carried out with a range of visitors: Teachers, family groups, friends, individuals.
 - Pre visit one to one interview focused on why they had come and on expectations for the exhibition.
 - Post visit one to one interview targeted different visitors and focused on their experience, learning and ideas for future exhibitions.
 - Anonymous questionnaires - given to all visitors.
3. There was also a student survey which pupils completed after their visit - this was a simple tick box again based on MLA research and a more freeform drawing of their experience. There were 2 questionnaires one for under 10s and one for over 10s.

From the total number of registrations of 468, the feedback sample was approximately 164 persons, plus pupils who also gave their feedback. N.B. each registration may have included as many as 7 individuals. Ages recorded range from 8 years upwards. The number of visitors observed was much more. In total approximately 30% of the visitors who provided some type of meaningful feedback. This testing demonstrated that the narrative worked well enough. People, especially children, were almost unanimous in saying that they enjoyed the exhibition, that it was an exciting place and the visit made them want to find out more. People liked the interactivity of the experience most; the interesting content as well as being a fun activity (see Figure 6). This suggests that visitors enjoy themselves more having an interactive experience rather than just passively looking at artefacts.

Interactivity meant that visitors were encouraged to actively look for information and look at the artefacts to continue their experience. This type of interactivity strengthens the connection between the technologies and the artefacts. The use of challenges to complete in order to advance the story proved more adequate for some users. The templates 'drag and drop' and 'touch the screen to identify or make a choice' games were considered by a few too simple for a sophisticated audience but suit the younger users very well. The more sophisticated user responded well to the game presented in Adobe Flash, which provided a more complex environment to explore. It is not surprising that interactivity scores highly in the evaluation, as this issue has been already highlighted by others studying the incorporation of technology in museums [6]. However, the fact that content scored highly in visitor's favourites suggests that people get more engaged with the experience if what they are being told and how they are being told is interesting for them. In this case, telling the story of the curse and the opening of King Tutankhamun's tomb proved to be a successful way

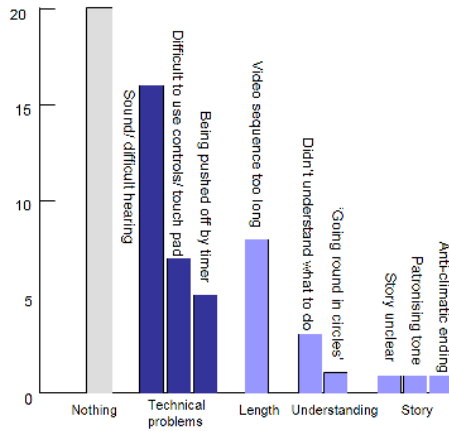


Fig. 6. Visitor Study: What people liked most

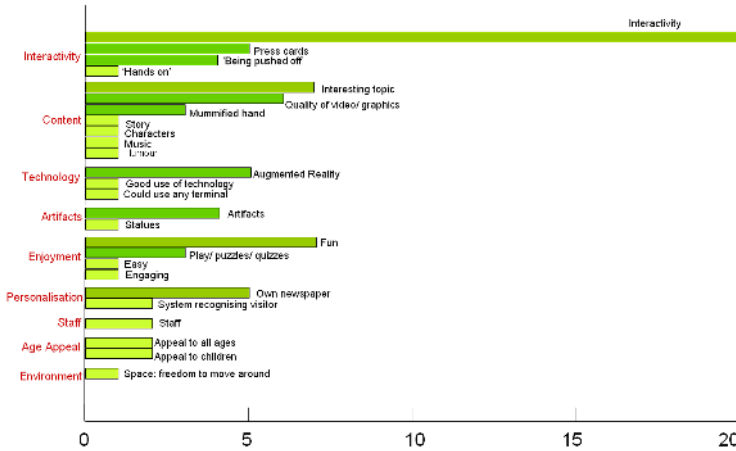


Fig. 7. Visitor Study: What people liked least

of engaging people with the museum exhibition. Despite this, some visitors, especially younger children, found the story a bit complicated suggesting that different storylines might be more adequate for different types of visitors. Being truly engaged with the experience resulted in people enjoying themselves and having fun while learning about Egypt. One respondent reflected this by stating "Interactivity makes the whole learning experience lots of fun"; while another stated "The interaction between the objects, story, character and quality of screen video was fantastic". Furthermore, when people were asked what they liked least; the greatest number of visitors said there was nothing they did not like (see Figure 7). However, technical problems, such as sound problems and difficulty to use controls, scored also highly in the list. A low cost solution

will involve containing sound through housing normal speakers in plastic hemispheres. In addition, a few commented on the length of video episodes (between 40 seconds and nearly three minutes) without a break for a game or interaction. It was considered that no longer than 1 min 30 seconds is a maximum for a standing audience at a screen. Any longer than this turns a video into a proper television experience. Another issue is that people get uncomfortable when they do not know how long something will last, museum designers will often explicitly state that a video sequence will be 3 minutes or 5 minutes so that people are prepared and their thoughts do not drift into wondering how long they will have to give their attention.

6 Further Directions and Conclusions

Following the pilot Egypt exhibition a Beta release 'quantised' ROM Disc version has been created a copy of this disk may be available on request (January 2007). A new updated version of Egypt is installed in Torquay Museum. The INSTEP authorware is being used to edit content. New graphics making reference to 'Birmingham' are replaced with content with reference to 'Torquay' retaining the local feel of the experience, thus the Birmingham Gazette becomes the Torquay Gazette. The Torquay exhibition space is designed to reflect local stories within the context of the interactive narrative. Brighton University also used the INSTEP/INOTE template editor software to enable three students to create an interactive narrative for Brighton Fishing Museum (UK). The differences found in the creative production of the Fishing Museum interactive are indicative of learning from the pilot project. The story is more constrained and focussed without the same level of integration and complexity. The back story is not of a factual nature to allow for convenience in development and to appeal to a specific age group 8-13 year olds. (The Story - A nine year old wanders into the museum only to find herself in a time trap. The user registers to help Lucy return to her time by finding time keys in the museum space to make the journey through time with 'Lucy'). Games rely on visitor objectives to find visual references, locations, names and dates. The video production is restricted to just two scenes making the video more manageable, affordable and achievable to a junior production team. Following from this project, further applications include multiple galleries, specialist user tracking, visitor management and flow control. Development towards users includes alternative audio language/commentary or video content versions according to preferences expressed at registration. Personalised feedback could provide a 'help feature' during the lock out period. Accessibility issues also require further research. With the increasing demands of more engaging exhibitions; alternative hardware interfaces are also of great interest. The system might be configured to respond to user actions other than screen based encouraging more dynamic physical interaction. In addition, the paradigm will be extended to larger scale networks, beyond the museum towards interpretation of a site or grounds, even a city or town. If the paradigm of 'engagement with the real and virtual world through engagement with

stories with continuous assessment of learning' can work, the next question to be raised is: Can it be applied to the Internet?. The nature of the system naturally extends itself in this direction. Towards learning of any kind computer based training activities and applications.

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