'Breaking the glass': preserving social history in virtual environments

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Abstract: New media technologies play an important role in the evolution of our society. Traditional museums and heritage sites have evolved from the 'cabinets of curiosity' that focused mainly on the authority of the voice organising content, to the places that offer interactivity as a means to experience historical and cultural events of the past. They attempt to break down the division between visitors and historical artefacts, employing modern technologies that allow the audience to perceive a range of perspectives of the historical event. In this paper, we discuss virtual reconstruction and interactive storytelling techniques as a research methodology and educational and presentation practices for cultural heritage sites. We present the Narrating the Past project as a case study, in order to illustrate recent changes in the preservation of social history and guided tourist trails that aim to make the visitor's experience more than just an architectural walk through.

Keywords: interactive storytelling; virtual reconstructions; heritage sites; social history; accessibility; digital preservation.

Biographical notes: Iryna Kuksa is a scholar interested in practice-based research. The focus of her academic work lies in the dialogue among design, education and new media technologies. She explores the role of multimedia within the field of theatre studies, art and cultural heritage research and investigates how novel methodologies, including 3D reconstruction of historical artefacts, can be applied to pedagogical practices. She is interested in designing and developing new visual research and learning strategies, in order to enhance learners' experiences through the medium of ICTs, and in researching user experiences in virtual learning environments, such as Second Life virtual community.

Deborah Tuck has a filmmaking background and worked on broadcast productions as a Director and Director of Photography. Currently, she is

developing audiovisual displays using 360° filming techniques for use in portable display domes. Her current research area involves interactive narrative environments, which explores the potential for virtual technologies as a storytelling medium. In her research, she investigates new possibilities for narrative and new ways of using this form for public display. Areas involved include audiovisual theory, game strategies, visualisation technologies and interface design.

1 Introduction

> We are witnessing the emergence of a new cultural meta-language, something that will be at least as significant as the printed word and cinema before it.
>
> (Manovich, 2001, p.93)

People are designing ways to socialise in new cities, communities and through new networks. They create novel modes to spread knowledge and information, resulting in a world-wide and rapid distribution of cultural and social messages (Stolterman and Schuler, 2000) and in encouraging novel ways to access and learn about our heritage. Nicholas Negroponte, in his 1995 book *Being Digital* defined new heavily computerised reality, as the post-information age, which, as one might argue, has already begun. He described future computers as machines with the ability to recognise human speech and even track eye movements, in order to respond to the users' needs and promote face-to-face interaction. Fifteen years later, this no longer seems impossible and contemporary users are able, at least partly, to communicate with a computer *beyond arm's length*. There is little doubt that technologies of computation changed the way we learn, behave and even think. They also play a crucial role in the process of production, storage and display of cultural values, naturally penetrating our everyday life. During the last decade, the use of virtual reality (VR) technologies for recreating heritage sites has reached such an advanced stage that accurate reconstruction in high fidelity has become commonplace. Viewers can now 'walk' or 'fly through' virtual models and have something of an experience of 'being there'. Various heritage sites have already adopted some of these technological innovations, in order to reinterpret their cultural background. The emergence of virtual heritage environments (VHEs) is often seen as the next step in developing thematic trails for existing and 'lost' cultural landmarks. These spaces, however, should not be perceived as a limited version of the real guided tours, but be regarded with the same objectivity to give a sense of 'what it was like' for people living at the time. But it should be done with care, attempting to answer a question about whether this type of environment is a thoroughly designed cultural space or a complicated computer game.

In this paper, we present the Narrating the Past project, which aims to enhance knowledge and understanding of Nottingham's rich cultural heritage from the early 1800s through designing a number of virtual heritage tours using interactive real-time virtual reconstructions of the town's key historical landmarks. The main idea of the project is to interconnect a number of heritage sites through a coherent narrative based around the events of the Reform Bill riots of 1831. This event had a significant impact upon the city of Nottingham and its history.

2   Applying new media technologies to cultural heritage tours

Virtual presence is now an important agenda for cultural heritage institutions. It poses a number of challenges not only to curators, but also to designers of VHEs. To date, a number of studies have explored the potential of interactive multimedia embedded in the delivery mode of cultural heritage exhibitions, as well as the compatibility and incompatibility between museums and computation technology (Parry, 2007). For example, Andrea Witcomb in *The Materiality of Virtual Technologies: A New Approach to Thinking about the Impact of Multimedia in Museums* (in Cameron and Kenderdine, 2007, pp.35–48) argues that the majority of existing discussions in the field tent to be based on a conflict between the notion of 'virtual' and 'material', as well as on an assumption that digital objects and environments cause 'a radical process of democratisation' of current exhibition spaces. Indeed 'digital technologies are implicated with historical transformations in language, society and culture, and with shifting definitions of the museum' (Cameron and Kenderdine, 2007, p.3). Current debates in the field of 'museology' suggest that there is a need to undertake 'reflexive reassessment of the disciplinary orientation as well as the apparatus and practices of museum studies', with a major goal of producing innovative ways to rethink and to reevaluate 'the complex relationships between culture and society' (Message, 2009, p.126; Whitehead, 2007). Nowadays, such 'museological' practices as collecting, assembling and exhibiting heritage are 'not necessarily confined to the museum', allowing the museum to 'shape ways of seeing beyond its walls' (Macdonald, 2006, p.6). One might argue further that new media have already achieved the status of 'materiality' (Witcomb, 2007). Nowadays, museums collect digital as well as material things, produce 'real' and 'virtual' displays, and, in the meantime, change the public's perception of the exhibition space (Parry, 2007).

Our study attempts to digitise and bring together a number of original artefacts (e.g. maps of buildings and landscapes, paintings and newspapers) that currently belong to different public and private collections. The goal here, however, is not only to reconstruct digitally several separate collections, but also to put the story of the Reform Bill riots in historical context, giving the user an opportunity to see related to this event artefacts in their natural environment – i.e. when they originally existed and were used. Naturally, some of the objects presented in our VHE no longer exist in real life and had to be recreated artistically, in order to generate the original atmosphere of that time. This helped us to draw upon a larger range of related knowledge and history than currently available in the participating heritage sites alone, ultimately 'breaking the glass' of conventional exhibition spaces.

Since the mid-1990s significant research has established the benefits of three-dimensional (3D) visualisation for cultural heritage; notably *Wordsworth's Dove Cottage* by King's Visualisation Lab, as well as the projects documented on the *Virtual Heritage.net* in 2008, the *Rome Reborn Project 2.0 (320 AD)*, which was embedded into Google Earth, making this real-time work widely accessible. Reconstructions have also been seen alongside exhibits in the Victoria and Albert Museum (*China Design Now, 2008*) and the British Museum (*Mummy: The Inside Story, 2005*).

In addition, there are various digital guidance tools that could be used for navigation between numerous historical venues in outdoor areas. A good example here would be the European Commission funded, Augmented Reality-based Cultural Heritage On-site Guide – the ARCHEOGUIDE project (2000) – (Figure 1), which pioneered a new

approach to accessing information at multistaged, open-air cultural sites in a user-friendly and compelling way. This was achieved through the development of a unique system based on advanced IT, including multimodal interaction techniques, augmented reality applications and 3D-visualisation technology.

Using head-mounted displays and earphones, together with mobile computing units, the ARCHEOGUIDE users were able to obtain various historical facts – textual and visual, which were relevant to the actual site information, and also to receive further instructions, explaining how to reach other locations and stages. One of the crucial outcomes of this project was that all actions required from participants inevitably led to their physical involvement; the opposite to a passive observation of another cultural heritage site.

Visiting an exhibition or a museum is a personal experience for every participant that requires personalisation of information and knowledge delivery. Wireless connectivity and contemporary global positioning systems (GPSs) have already become commonly accepted phenomena, enabling an absolutely new user-computer interaction. These technological innovations have enabled some museums and other cultural sites to revolutionise their methods of presenting secondary resources (e.g. background information on the exhibits) to their visitors, in relation to the displays. The TATE Modern multimedia tour, e.g. gives its users the possibility to arrange an exhibition visit according to their preferences through the use of a hand-held computer, which represents a fully fledged information tool. This type of mobile access technology provides detailed information about individual behaviour during the cultural site visit. It enables users to collect an array of data about visited areas and, in addition, traces the users' physical locations and offers flexibility and freedom of choice regarding the programme of a visit. All this data also serves for the evaluation of an exhibition and its services.

There are a number of research projects that take these technological advances even further and explore improvisational storytelling and cinematic techniques in a mobile tour guides (Lim and Aylett, 2007; Stock et al., 2007; Zancanaro et al., 2003), in order to create a meaningful tour experience. For example, the creators of a multimedia guide for Torre Aquila (a tower at the Buonconsiglio Castle in Trento) attempted to synchronise visual and verbal parts of the presentation by employing such cinematic techniques as shot segmentation, camera movements and transition effects (Zancanaro et al., 2003). Furthermore, the Mobile Tour Guide project team (Lim and Aylett, 2007, p.3) created guides 'with different personalities and beliefs, presenting users with different versions of stories about the same events or places', in order to achieve the element of improvisation in digital storytelling practices.

Finally, motion capture technology (Figure 2) has great potential for further development as a part of cultural and theatrical events (e.g. boosting cyberperformance, dance and character animation practices). It emerges as a 3D representation of recorded movements by a performer achieved through special sensors which are fitted to a human body (or suit) in a way that allows their signals to be tracked in space and time by an array of cameras. All digital information is transmitted and consolidated into data files in a central workstation and then transferred to a computer, where they can be merged, connected, resequenced and mapped onto other anatomies in animation software, such as, e.g. *Character Studio* (Birringer, 1999).

Figure 1   The ARCHEOGUIDE project (see online version for colours)

Source: Available at: http://www.cultivateint.org/issue1/archeo/index.html.
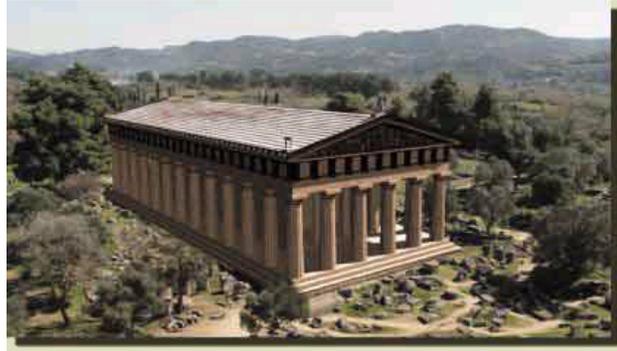
Figure 2   Using motion capture technology (see online version for colours)
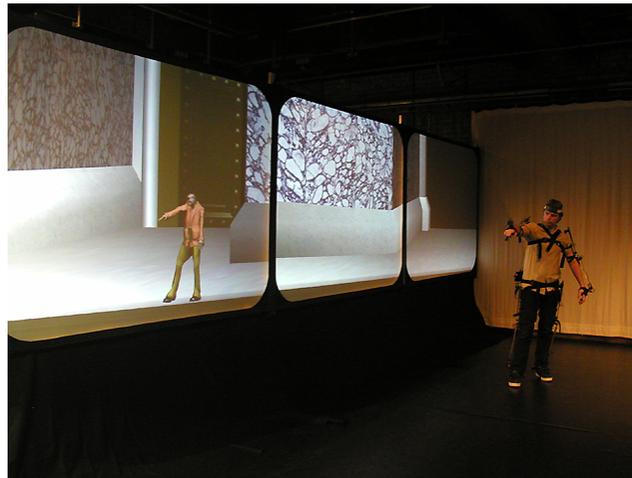
Source: Available at: http://www.kvl.cch.kcl.ac.uk/mocap01.html. © King's Visualisation
           Lab, King's College London.

In our study, we currently use technologies for individual presentations in the VHE. Despite the fact that GPS and augmented reality are not part of our research at this stage, in the future we are planning to adopt a 'multidevice' approach to the implementation of our project. This could entail, e.g. a personal presentation experience with the large screen display to enable group interaction, as well as the use of motion capture to record actors' movements for the purpose of supporting a sense of 'real life' in the VR environment. At present, our system is not adaptive. It was decided to use proximity triggers to activate narratives within the VHE keeping the interface at this stage of our research as simple as possible, in order to be accessible to a wider range of audiences. The design of the environment was conceived in the form of small story worlds (Ryan, 2003), where the user can select the sequence, in which the stories are heard by choosing various 'walking' routes. These proximity triggers are also used to fade and halt the stories (should the user wander away) and they remain paused until the user returns back

to encounter the remainder of the narrative. This design allows visitors to explore the environment according to their interests and at their own path. At the moment, the system is used by one character at a time. In the future, however, we are planning to use multiple users and to integrate input devices to enable participants to add their own content (e.g. images, texts and sounds), which will reflect their experiences within the virtual tourist trail.

3   The narrating the past project

Considering the fact that there are 'real' tours available at various historical and heritage locations, one might ask why it is necessary to reconstruct these historical places virtually. In 2007, our interactive design research group based in the School of Art and Design, Nottingham Trent University was approached by the representatives of three key heritage sites in Nottinghamshire – Green's Mill, Nottingham Castle and the National Centre for Citizenship and the Law Galleries of Justice. The group was asked to assist in investigating how digital technologies might be used to make these cultural landmarks more accessible to wider audiences and to visitors with limited mobility. The initial meetings with the sites' managers and curators revealed that some of the key areas within the sites were inaccessible and could not be modified or adapted for public access due to construction restrictions. On a purely pragmatic level virtual models of the sites would fulfil an immediate need of the accessibility of some parts of the historical buildings. A strong interest was indicated in our suggestion to link all three heritage sites in a virtual trail, stating that this would enable the telling of a more substantial history and will also support the development of new audiences to museums, attracted and engaged by exciting new media.

3.1   Overview

All three participating heritage sites are historically important attractions of Nottingham that are currently open to visitors.

The Greens Mill was built in 1807 and was one of the most powerful and advanced mills in the area at the time. It is situated in the Sneinton district of the city, which in 1831 was described as a small village just outside of Nottingham. By the 1880s with the growth in new industrial machinery and steam power the mill became non-profitable and was left in disrepair until 1985 when it was restored as a memorial to George Green, a famous mathematician and son of the original owner. The Mill has had a chequered history and there are many viewpoints from which the historical narrative can be told.

Nottingham Castle is one of the major tourist attractions in the city. During the 1830s riots, it was set alight leaving extensive damage to the building's structure. The owner of the castle – the Duke of Newcastle – never returned to reside there and thus the castle was never rebuilt to its original form.

The Galleries of Justice is a Museum of Crime and Punishment and popular tourist attraction in the Lace Market area of Nottingham, England. In 1831, two young local men, Hearson and Beck, were arrested and questioned at the Galleries of Justice for their part in the riot. The local community was outraged at the level of accusations made at these young men and a petition was signed in protest against the trial. Despite their

efforts the men were found guilty and sentenced to death at Weekday Cross near the Galleries.

At present each site offers visitors guided tours and reenactments:

1   Green Mills is a fully functioning flour mill and the tour invites visitors to investigate the windmill and its cogs; to weigh and measure grain and flour; to make bread while listening to a guide and meeting the mill's characters.

2   Nottingham Castle has a number of man-made caves and tunnels for visitors to explore, some of which date back to medieval times. Visitors can also take a guided tour to see Mortimer's Hole, King David's dungeon and the old wine cellar hearing on the way gruesome tales of Roger Mortimer and King David of Scotland.

3   The 'Crime and Punishment Tour' around the Galleries of Justice, reenacts a trial in the original Victorian Courtroom where visitors can be put in the dock before being 'sentenced' and 'sent down' to the prison cells, laundry, medieval caves and prison exercise yard. Prisoners and gaolers guide visitors through this site.

Although all three participating heritage sites are firmly embedded in the City's Tourist Trail, physically they lie in different corners of Nottingham which affects their accessibility. This could be overcome in the interactive virtual environment. To increase the accessibility of the VHE even further we intend to make it available on a big screen of the Broadway Media Centre located at the heart of the city. This is a fully digital and accessible building that can now provide new models of entertainment that support new and versatile technologies. Our project resonates with their ambitions to explore the innovative use of the contemporary cinema, equipped with high definition, 3D projection and networked screens. Larger audiences, with a range of abilities and ages will be able to experience this tour at Broadway due to the confines of the heritage sites buildings.

3.2   Objectives

Narrative is a powerful and well established way to communicate, educate and share our cultural heritage. If combined with virtual settings, it could create new interactive art forms that engage and enrich public's experience of historical places. The Narrating the Past project explores the dynamic insertion of digitally enabled stories into real-time VHEs as a means of re-presenting the social history of particular events and associated artefacts. Much of the history is intangible; in particular it pre-dates modern recording methods. Finding material and information about some historical figures and events are difficult; in some cases there are only snippets of information, such as maps, paintings, newspaper clippings, prisoner logs and books written by local historians. The employment of the VR reconstruction techniques allows us to bring these artefacts together and place them in context. The interactive 'story world' format we propose enables the visitor to feel immersed and to participate actively in what they discover and learn about history and cultural sites. The VR techniques we employ also enable the user to gain a variety of historical perspectives as they are given a number of historical viewpoints to consider. The location of each heritage sites is in the process of being digitised as 3D computer models and the model of the Green's Mill has already been accomplished. All reconstructions are based on existing ground plans, historical land survey and images from the sites' photographic archives.

3.3   Research strategy

Our research is deeply rooted in three following areas: narrative environments, computer games and historical virtual reconstructions.

3.3.1   Narrative *e*nvironments

Film and theatrical techniques are often used to transport visitors back in time with evocative sound effects and captivating narrative (Levy, 2001). Indeed, a good storyteller can conjure up and animate the spirit of history. These stories are significant in enriching the visitors' experience of historical memories and culture. They have been demonstrated to be engaging and entertaining as well as educational, whether they are live reenactments or self-guided audio tours (Cameron and Gateword, 2000).

3.3.2   Computer games

The popularity of role-playing computer games, such as *Oblivion* and *World of Warcraft* emphasises social interaction and collaboration, and demonstrate players' desire to go beyond game play by the addition of layers of narrative. At the same time, adventure games developers' use cut scenes to create drama and build a storyline. Games often offer the user a profile which allows them to take the viewpoint of a particular character. In the VHE, such ability to change the perspective can enable new demographic associations to emerge around the historical facts. This diminishes the influence of the 'institutional authority' and allows the user to understand how historical events were perceived by different people at the time (Witcomb, 2007).

3.3.3   Historical virtual reconstructions

The majority of heritage tours are designed to engage the visitor and to help them to understand the social history surrounding the site and the artefacts within it. Despite aforementioned advances in technology, however, 3D reconstructions still lack a sense of presence and are often sterile, clean spaces, where the viewer's experience is limited to the architecture of the site. These virtual models satisfy the desire for structural design of a VR environment; however, while exhibited in museums and heritage spaces, they require the same attention given to contextualising real artefacts. Thus incorporating aspects of social and cultural history by embedding audiovisual narrative into a 3D model can assist in generating a deeper understanding of the historical site and, hence, making it more accessible.

3.4   Structure

Our project redeploys some of the film, theatre and game techniques within VR environments and investigates the narrative methods and devices needed to immerse the audience and hence to promote a greater sense of social engagement with a historical narrative. The Narrating the Past system was designed using the Quest3D real-time development engine. Based on Microsoft's DirectX, Quest3D is a hierarchical node-based visual programming system. It allows developers with limited programming experience to connect pre-coded function blocks together, in order to create interactive

virtual environments rapidly (Tuck et al., 2009). A 3D computer model of the Green's Mill heritage site was constructed and embedded with audiovisual stories (Figure 3).

As it was mentioned above, we define narratives as small 'story worlds' that do not follow a linear story or are related to a macro plot. Yet storyline coherence still exists as all the stories have Reform Bill riots as their common thread. The narrative architecture of the VHE can be compared to promenade theatre (Tuck and Patel, 2008), where the audience inhabits the space, rather than just watching the narrative to unfold. Participants move around the environment to view the action, encounter scenographic spaces and virtual actors performing simultaneously through the building.

A site-specific promenade performance of *Faust* by Punch Drunk in collaboration with the National Theatre that was performed at a non-theatre venue in Wapping in October–November 2007, influenced our decision to employ the 'action space, epic wandering and story world' model developed by Ryan (2003). According to this model of structuring the narrative, the user is free to choose which route they follow within the virtual environment, but once they have arrived at their destination the system takes control of the narrative and 'sends them on a self-contained adventure' (Ryan, 2003, p.255).

Figure 4 illustrates the structure of the storyline that was employed for the 3D reconstruction of the Green's Mill.

Figure 3   The 3D reconstruction of the Green's Mill (see online version for colours)

Figure 4   Narrative structure (A) demonstrates the paths of participants wandering and 'story worlds' they encounter and (B) illustrates the non-linear narrative journeys the participant can take
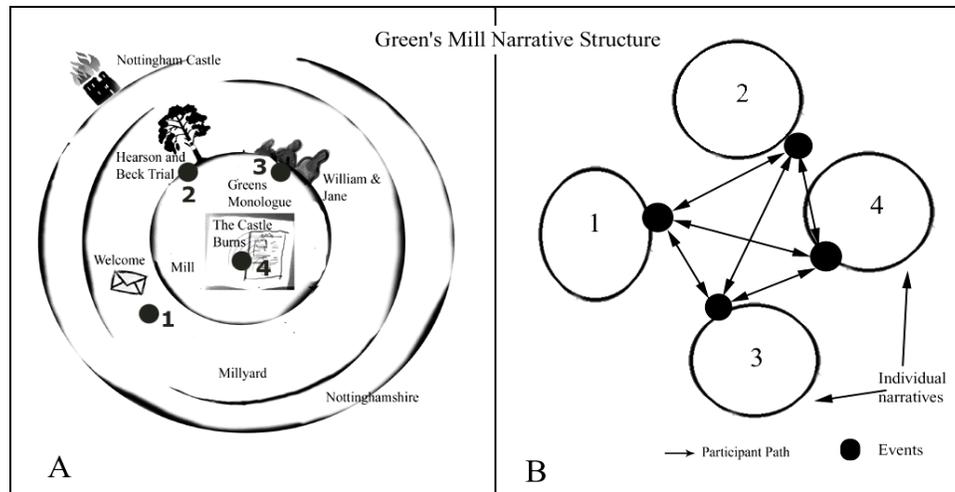
3.4.1   Video

To provide a more natural source of movement and support the sense of 'life' within the VHE, it was decided to use video narratives. There are a number of examples of virtual worlds in games, which are inhabited with animated characters (avatars). Although these characters are interactive and fairly realistic, they do lack the detailed natural movement found in 'real life'. Two of the narratives in the VR environment of the Green's Mill are experienced through embedded video, much like video projections are used to augment the theatrical stage. As the participant approaches the window opposite a desk on the top floor of the mill they trigger an audiovisual story delivered by George Green. The video is semi-transparent and makes the image appear as if it is a reflection in the window; as the participant moves so does the reflection in response. This effect was used to enable the user to have a view of the environment outside the mill so that they can see the changes, which correlate to dramatic events within the Green's narrative. Another embedded video draws participants to a conversation outside the mill, where the characters are represented as shadows on the cobbled mill yard, giving the impression that somewhere below there are people just out of sight. This (similar to Denis Severs House in Spitalfields in London) creates a sense of life behind curtains and doors within the VHE.

3.4.2   Audio

Sound in virtual environments can be very evocative in the way as in real-time environments. The use of soundscapes can create a greater sense of spatial immersion and an additional source of information which can help to enhance the VR experience for the participant (Turner et al., 2003). The Green's Mill environment contains the sounds of the birds, trees and local animal life, which change according to the narrative played. For example, when the video of the narrator George Green is triggered, he tells a tale of riots.

As he does, the sound of the animals in the yard change from peaceful to panic stricken, the riots can be heard in the distance coming from the edge of the mill yard (which is where the rioters travelled in 1831).

3.4.3   Mise en scène

One of the principle ideas of the Narrating the Past project is to offer more than one point of view (POV) to participants, enabling them to learn about the riots history via POVs of different historical figures. A film director, e.g. can enable the audience to see the action through the protagonist's eyes and to identify with this POV as in real life (Silverman, 1989). In the VHE, the user is given a choice of several character profiles (i.e. tailor; George Green's wife, Jane; delivery boy). Each profile focuses on different aspects of the historical site and its artefacts, as well as providing differing relevance and contexts of the effect of Reform Bill riots on the community.

Due to the interactive nature of VR environments, there is a certain limitation of control over the participant's POV, meaning that the VE designer needs to rely greatly upon the mise en scène (Clarke and Mitchell, 2001). Thus we employed some of the techniques found in computer games (e.g. the Elder Scrolls IV: Oblivion) to design and structure the virtual story space, using mise en scène as 'the use of space within the frame' (Kolker, 1998). For example, in one instance the environment changes from Green's Mill to the cells of the Galleries of Justice (Figure 5).

If participants were to wander off from this story then they would find it very difficult to understand the dramatic changes in the VHE. For this reason, we decided to 'fix' the user in a one way collision perimeter, in which participants are restricted to head movement and minimal distance travel while the story unfolds and are released after the narrative is complete. The focal point of the story here is a poster advertising the hanging event of those accused of rioting. We restricted the distance users can move away from the poster, maintaining their attention while the mise en scène around them changes. This method is commonly used in film as a smooth transition device that minimises the visual disruption of the change from one shot to another, by holding the focus of the eye still.

In *The Castle Burns* narrative for the Green's Mill, we have attempted to recreate a fast dramatic scene around the participant, aiming to focus their attention on the story. The narrative is set around a copy of the Nottingham Herald newspaper placed upon a table in the top room of the mill. The front page and text are a digital copy of an original article published in October 1831, which also includes the lithograph of the Nottingham Castle on fire. A sound of a crackling fire is placed around the area of the newspaper. When the participant approaches, the narrative 'set' on the front page of the newspaper is triggered (Figure 6). The lithograph's image is animated and slowly takes the form of a 3D model of the castle in flames. At the same time, the user hears a sound bite of the Town Crier telling the story of the riot and the sound of Nottingham City Market fills the room.

Figure 5   'Ghosts' guide the participant to a tree, where she/he is transported from one VE to
          another

Figure 6   *The Castle Burns* – the participant hears a sound and approaches the table, trigging a
          video narrative
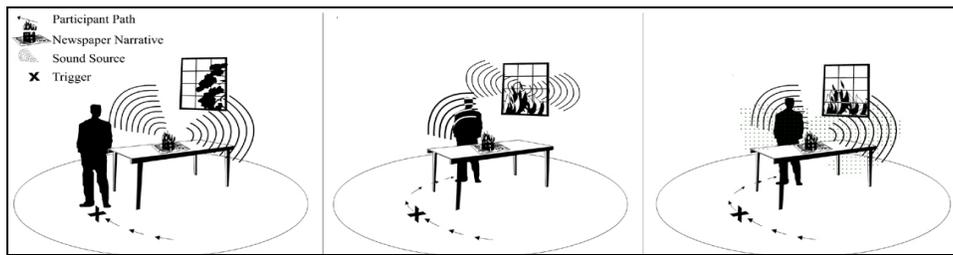
As the story progresses the VE environment around the participant turns dark, the
lanterns in the top room provide dim light and the room is swathed in flickering fire
effects (as if a fire burns outside the mill). The animated image in the newspaper emits
smoke as if it appears to come from the castle scene; this fills the top room of the mill
creating a dim smoky environment. Once the narrative is completed the VE is
transformed back to the daytime and the animation and audio ends. This scene is similar
to a 'flash back' in film. The devising process and timing of the effects were cued as it is
done in theatre.

3.5   Project contribution

A number of virtual reconstructions of cultural sites fail to 'recapture' the past in regards
to the people and life that existed at that time. In our study, we strive to bring the sense of
'real' space closer to the participant by embedding audiovisual narratives into 3D models
of historical buildings. We aim to create the 'representation of the past', by generating a
dramatic environment rather than a simple 3D 'walk-trough'. We integrate seamless film,
theatre and scenography conventions in the VHE to 'steer' the user to the narrative
without pre-programming their paths. This can assist in generating a deeper
understanding of the heritage site and, hence, making it more accessible to a wider range
of audiences (e.g. younger audiences that respond well to interactive media). Our
approach to design of the virtual story space is similar to one used in the INSCAPE
project (Dade-Robertson, 2007). We also include lifelike elements in the narrative and

'realistic' behaviours and emotions. The main difference is, however, that we do not use simulated environments and serious games applications, but original reconstructions and historical representations. We also use the first person perspective in the VR environment which allows the viewer to be part of the action and to feel greater engagement and empathy with the characters and their stories.

The audiovisual content places the participant back in time giving them a sense of the 'real' environment (including the spoken local accent of Nottinghamshire and the sound of the countryside and mill yard) and helping them to understand how different it was then compared to the rumbling cityscape of today. Indeed, the vista of Nottingham has changed dramatically over the centuries. Nowadays, the countryside landscape of the 1830s can only be seen in 2D paintings, as this era pre-dates photography and sound recording. The scene of the castle burning, e.g. is based on the original oil painting by Henry Dawson *Nottingham Castle on Fire, 10 October 1831*, bringing it 'to life' in 3D. Our project not only recreates the views, historical buildings and the atmosphere of the time, but also gathers and contextualises a number of artefacts that previously have been lost or distributed amongst various public and private collections in Nottingham (i.e. not easily accessible by the public). For example, the newspapers presented in the VHE are detailed copies of the original documents that can be found only on microfiche at the local studies library. Furthermore, the original of the poster is located in a vault within the Galleries of Justice archive and viewable by special appointments only. In our project, we address this issue of accessibility by giving the user an opportunity to examine these artefacts more closely and interactively than normally permitted by more conventional exhibition spaces. Furthermore, the narratives used in the VHE were collected from local heritage site archives (using primary and secondary sources) and Nottingham history and archaeology experts, and then discussed with the participating sites' curators and managers. We attempted to accommodate a multinarrative format within the interactive VR environment, basing pre-recorded stories on historical facts and figures. Our study attempted to address the immediate accessibility problem expressed by the participating sites, in order to enable local communities to learn about their social and cultural history in a more user-friendly way. This VHE is an important project output, which will lead to installing a permanent real-time exhibition at the participating sites.

4   Pilot evaluation

In April and June 2009, we conducted two rounds of user evaluation. During the first round, participants were navigating the VHE themselves; while during the later evaluation they were shown the project on a big screen. The reason for this was our collaboration with such media centres as the Broadway Cinema and Media Centre, situated in the heart of Nottingham. There is a strong interest in experimenting with new ways of utilising their smaller screens and finding new commercial models for entertainment, learning and display. Therefore, our research is also concerned with investigating how the medium of cinema could be linked to the museum sites.

The respondents totalled 23 (11 – 2nd year Multimedia students; 12 – 1st year Multimedia students). Our preliminary results suggest that the majority of students (82%) participating in the first round of user evaluation indicated that they felt immersed in the story space, while only 50% of the participants from the second round felt the same. This could be due to their passivity during the interaction with the VHE (i.e. they were

observers – not active participants). Furthermore, 10 out of 12 respondents from the later part of the evaluation indicated that they would have preferred to navigate within the VHE themselves. Although these results are quite preliminary, they give us some scope to conduct further research on the big screen displays with a particular focus on the potential audiences. Another interesting result of the second part of the evaluation was that 70% of the respondents pointed out that they would like to have an opportunity to interact with avatars in the VR environment. This result, however, was not surprising because the majority of students (83%) defined themselves as gamers, or indicated that they play computer games very often. In both rounds, the criticism was expressed regarding the overall length of the stories (i.e. too long) told by the video characters, which we will address in the near future. Otherwise all the respondents indicated that it was a different and quite educational and engaging way to learn about the history of Nottingham.

In the future, we are planning to evaluate further whether the incorporation of social and cultural history through audiovisual narratives helped users in generating a deeper understanding of participating historical sites, in comparison to more conventional tour guides.

5 Conclusion

There is little doubt that the possibilities of implementing various computation technologies to enhance existing heritage sites and spaces are vast. The attempts were made by the scholars and practitioners to invest in what could potentially be a new form of experiencing and learning about cultural heritage. When designing any virtual heritage tour it is crucial to navigate the 'narrative', investigating new ways to use the environment as a storytelling space rather than a game with goals. The virtual heritage tour model described in this paper provides a versatile alternative to 'real' tours, benefiting those who are unable to occupy the space physically. The technology we propose to use allows for exploration and discovery of spaces and artefacts that might not be readily available in reality. The interactive narrative format permits the user to see different perspectives of social history that could help towards disintegrating the 'voice of the authority' of the museum display. The versatile nature of the format means that 3D reconstructions can be used for one to one and group-based viewings, as well as in a variety of ways and with varying interaction suitable for different types of audiences and display spaces (e.g. more interactive film-based displays in the cinema and virtual walkthrough displays within the heritage site). In our project, we attempted to bridge social history, narrative and virtual environments together, with a major goal of achieving the balance between technology, creativity and culture and ultimately 'breaking the glass' of the traditional museum display.

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