Exploring historical, social and natural heritage: challenges for tangible interaction design at Sheffied General Cemetery

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Exploring historical, social and natural heritage:
Challenges for tangible interaction design at Sheffield General Cemetery

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Abstract: This paper presents current research on the design, deployment and evaluation of tangible interaction concepts for an outdoor heritage space, the Sheffield General Cemetery. The Cemetery is an area of historical and natural importance managed and maintained by a community group. Following a co-design approach, we have conducted a series of activities at the Cemetery with the goal of developing novel physical/digital installations to support visitor experiences at the site. In this paper, we describe our work so far, particularly focusing on the "Companion Novel" – a fully operational prototype installation we have evaluated on and off site. We reflect on the challenges posed by such a complex site when developing novel tangible interactions for heritage interpretation.

Keywords: tangible interaction; outdoor heritage; physical/digital artifacts; co-design

Introduction

We present ongoing research on the project meSch (Material EncounterS with digital Cultural Heritage), exploring the potential for tangible interaction technologies to enhance activities at Sheffield General Cemetery (SGC), a conservation area of rich historical, social and natural heritage located in Sheffield, England. As well as a historical park displaying significant works of art and architecture, the Cemetery is also a local nature reserve. It is managed by a community group that organizes volunteer work for conservation, guided tours and other initiatives. In our project, we are exploring the challenges of visitor access, interpretation and appreciation at such a complex open-air heritage site, and how novel technological installations could support the activities of visitors and volunteers. Our focus is particularly on tangible interaction, and on how integrating digital capabilities into material objects and spaces can provide immersive and engaging experiences (Petrelli et al. 2013). This is our response to an increasing awareness (Dudley 2009) that information and digital technology in particular can move the attention away from the heritage toward screens and devices (vom Lehn and Heath 2003) thus diminish the affective engagement with the heritage itself. By designing hybrid physical-digital experiences of the kind discussed in this paper we aim at bridging the gap between heritage and digital information and expand the range of interactions that cultural heritage professionals can use.

The research we are conducting follows a co-design approach, whereby our multidisciplinary team of designers, developers and social researchers is collaborating closely with SGC volunteers both in documenting and reflecting on the complexities of the site, and in exploring design ideas and rapid prototypes of tangible interaction concepts to be discussed and evaluated.

In this paper, we present results of empirical work highlighting the challenges for access and interpretation at SGC: its outdoor and open nature, the significant seasonal changes, and the

interweaving of historical, artistic and natural heritage occurring there. We also outline design themes that have emerged from the series of field studies conducted at SGC that are shaping the current phase of design exploration and rapid prototyping of concepts merging digital and physical interaction. In particular, we will detail how the challenges have been tackled during the realization of the “Companion Novel”, a prototype personalized visiting companion that was designed for the Cemetery.

meSch at the Sheffield General Cemetery

The Sheffield General Cemetery (http://www.gencem.org/) is a historic parkland cemetery, which opened in 1836 and closed for burials in 1978. It is now a free and open-access historical, architectural and natural conservation area owned by Sheffield City Council but managed by a community group, the Sheffield General Cemetery Trust, dedicated to maintaining and promoting the site. The meSch team has established a partnership with the Trust that includes a close collaboration with the volunteers who take care of and present this historic space to the public. The Cemetery was landscaped to be the peaceful resting place for people from all walks of life: the site is dotted with funerary monuments, memorials, chapels and a row of semi-interred catacombs. It is also a haven for wildlife and plants (Fig. 1). The volunteers offer regular guided tours on several themes, from history to wildlife, as well as providing assistance to people interested in locating a particular grave or memorial. The tour guides offer their services on a completely voluntary basis and based on their own knowledge and interests.

Figure 1: A view of the Sheffield General Cemetery in Winter

Field studies at Sheffield General Cemetery

In an initial phase of work, the team paid repeated visits to the Cemetery and conducted observations of the site in order to understand its structure, the layout of monuments and of other places of interest, and to gain insights on the number and type of visitors that access the site. Members of the team also took part in a historical guided tour, taking note of the strategies that the guide employs to show the participants around the site, the themes that characterize the narration and the reactions and commentary by the participants.

In a second phase of work, the team interviewed eight of the SGC volunteers while taking a walk around the Cemetery. The participants were asked to describe their involvement with the Cemetery, their opinions on how the local community and visitors benefit from the site and to show the researchers their favourite places around the Cemetery. Through the interviews, the meSch researchers wanted to understand how the Cemetery is maintained and presented to the public, as well as to learn more about its history and heritage value by the people who know the site best. The meSch team learned many important characteristics of the Cemetery: particularly, that there are many different motivations for visiting, and that the historical and architectural importance of the site is only one of them. The many regular visitors go to SGC for its peacefulness, to exercise in beautiful surroundings, for relaxation and for informal exploration of the space while walking their dog or breaking the working day with a stroll. As the site is open-access, there are also many passers-by that

use the main path crossing the Cemetery as a shortcut between two busy roads and might not notice many of the interesting features of the site.

Thematic tours are organized on a regular basis to present themes as diverse as architecture and landscape, local and social history, bird watching and fungi discovery (Fig. 2). All the events are free and always well attended. Activities are targeted to specific audiences such as short lunchtime tours for nearby workers, Halloween family crafts activities, bat and bird watching, etc.

Figure 2: A guided tour at Sheffield General Cemetery

Seasonal changes are an important aspect in shaping the visitor experience of SGC. The landscape changes significantly throughout the year, with a very strong contrast between the starker landscape during the Winter and the lush vegetation and foliage in the Summer. Moreover, thick vegetation in the Summer makes it more difficult for people to see gravestones and other monuments at a distance, and the lack of artificial lights in the Cemetery means that visiting hours are more limited during the winter months.

There is also a distinct atmospheric difference between the part of the Cemetery that was cleared of gravestones during the 1970s and the part that retains all the original structures; people entering SGC from the former might not realise that the site is indeed a cemetery and that there are historic monuments a short distance away. This duality of purposes is intentionally maintained: while paths cross the whole site, not every corner can be reached as many parts in the historical section are fenced off for safety reasons. These off-limit zones guarantee a natural sanctuary for animals and create an evocative atmosphere with overgrown vegetation partially covering Victorian monuments and tombs.

These characteristics of the site shape the visitor experience of the Cemetery, and are cared for and worked around by the volunteers, who help in the conservation of the buildings, the wildlife and, in general, of the atmosphere of the Cemetery. The design exploration activities that our team conducted, envisioning novel interaction possibilities for SGC, taking the features and challenges of the site into careful account.

Exploring design ideas

The meSch team initiated creative design activities in parallel to field studies by running team brainstorming and by producing a number of design concepts for possible installations at the Cemetery. The volunteers participating in the interviews were shown sketches of the designs created by the team at the end of each interview, to inspire them joining in co-design activities and propose novel interaction concepts of their own.

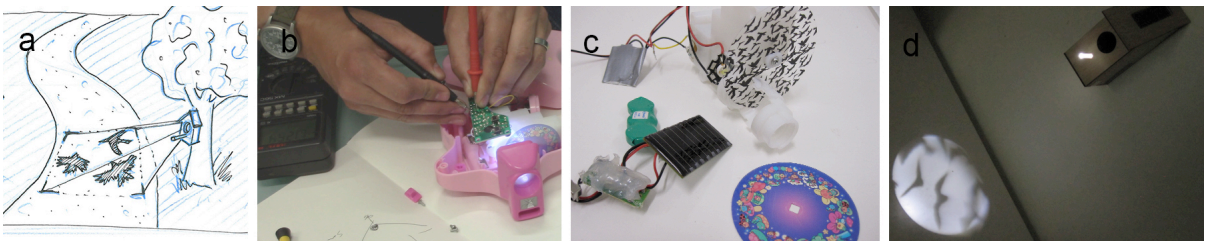
The range of ideas covered by the concepts include portable artifacts that visitors can take with them during their walk around the Cemetery, as well as standalone installations for particular areas of the site. Core to all concepts was the attempt to focus on the heritage, to grab the attention of passers by and to provide information in place to anyone interested. We aimed to be open and inclusive of people with different interest or even no-interest, just walking through the Cemetery. Respect to other solutions, such as an app for a smart phone, this approach does not require to know an app exists or how to install it; it exploits the here and now, the serendipity of being there, in a cultural heritage place with no previous planning but the willingness to engage and enjoy.

The concepts were further discussed and developed during a creative workshop that was attended by a group of volunteers. They were invited to discuss the team's ideas and to propose their own ideas for tangible interactive artifacts, or modifications and add-ons to the concepts the team had shown them. The volunteers were then asked to explain whether, and how, they thought such designed artifacts could enhance the experience of the Cemetery. Other design constraints were discussed at length: for example, how to design technology that would work at equal effect in different environmental conditions, how to overcome power issues, bad weather, wear and tear and possible antisocial behaviour.

Prototyping tangible interactions

A preliminary set of prototypes has been developed as an initial attempt to transform design ideas into working installations. The concepts revolve around three degrees of engagement with SGC: grabbing attention, inviting closer exploration and in-depth engagement.

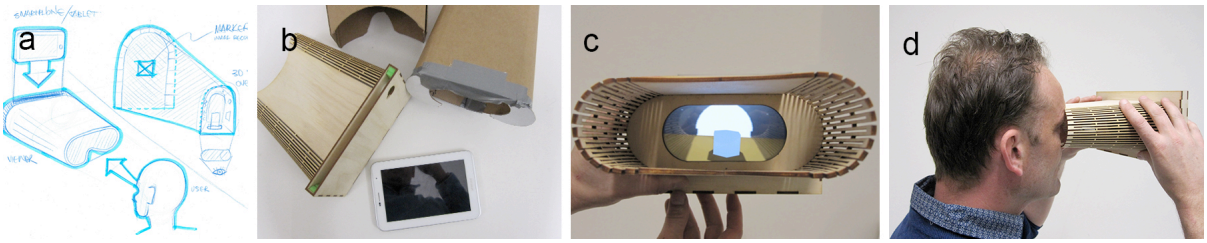
Figure 3: The development of the Bird Box



The first prototype idea, the "Bird Box", is meant to grab the attention of the visitor, and without demanding too much full interaction, it simply hints that there is more in the Cemetery to be discovered. The Bird Box is a standalone, solar powered box that projects an animation of birds in flight to attract the visitor's attention towards certain paths in the Cemetery (Fig. 3). The animation can be regularly updated to reflect the seasons and the birds currently present at the Cemetery.

The second idea invites closer exploration, yet provides relatively simple occasions for interaction. We realized this with the "Binoculars", a rugged set of binoculars (which can either be hand-held or fixed on the ground) that provide an orientation-based augmented reality visual overlay to particular areas of the Cemetery to aid interpretation (Fig. 4).

Figure 4: The development of the Binoculars

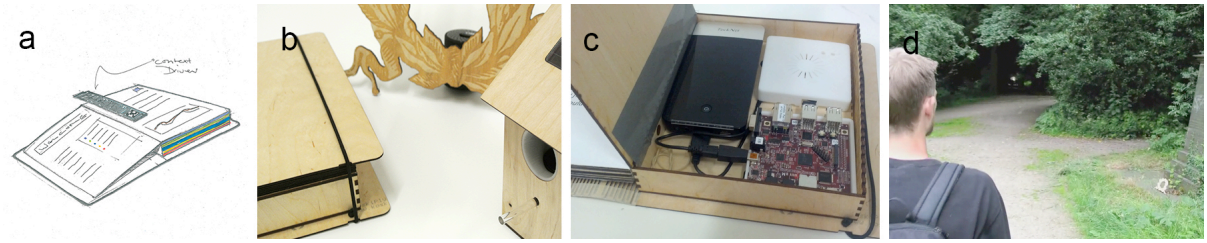


The third idea is focused on those visitors who wish to engage more deeply with the site and are willing to explore more information and to undertake more prolonged interaction during their visit. This

is realized by the “Companion Novel” (Fig. 5), that the team has developed into a fully working prototype for testing at the General Cemetery and which will be described in full detail in the following section.

As a set, the prototypes provide multimedia, multisensory and complementary experiences that can engage visitors with the heritage surroundings. They are intended to provide different degrees of interactional complexity to different categories of visitors, thus offering something for people who do not wish to engage with detailed information as well as for those who desire a simple and relatively short interaction with additional content, and, finally, visitors who are interested in delving deeper. In the following section, we discuss the “Companion Novel” in more detail, as the prototype that is at the furthest stage of development and testing.

Figure 5: The development of the Companion Novel



The Companion Novel

The Companion Novel (Fig. 6) is an interactive book-like device that visitors carry with them during the visit, complemented by a set of Bluetooth speakers located close to points of interest (hotspots). By placing a magnetic bookmark on a page of the book, the visitor selects a different narrative theme: the appropriate auditory information on that theme is played by the speakers when the visitors reach a hotspot. The Companion Novel tracks the visitors in the Cemetery and their position with respect to the hotspots. When the visitor is approaching the hotspot a loud sound is played to attract the visitor toward the precise location; when the visitor is close enough to the hotspot, a story on a particular theme is played. Which content is played depend on which theme is currently selected via the bookmark. By virtue of the distributed audio, the locations themselves invite the visitors to approach, thus adding a new sensory layer to the site, and avoiding the problem of social isolation that has been found with certain audio guides (Grinter et al. 2002). At any point in time the visitor can change the theme by simply moving the bookmark to another page, thus supporting the exploration of either a single theme or multiple themes.

The form factor of the book is meant to support intuitive handling and to fit in with the environment in an unobtrusive way. The themes that the prototype proposes to the visitor are inspired by the lived qualities of the place, specifically: “Nature in the City” gives insights on the natural richness of the Cemetery; “This is My Story” tells the personal stories of some of the people buried there; “Weird and Wonderful” recounts surprising and amusing anecdotes in the history of the Cemetery; and “Favourite Spots” showcases some of the favourite places in the Cemetery as chosen by the volunteers and past visitors. Overall, the Companion Novel is a flexible means for visitors to immerse themselves in different characteristics of SGC.[1]

Figure 6: The complete prototype of the Companion Novel

[1] A video detailing interaction with the Companion Novel can be found at: http://www.youtube.com/watch?v=GP0wAPO84Qo.

This concept satisfies a set of constraints:

- It focuses attention onto the heritage: sound is the key medium utilized, and the strategic placement of the loudspeakers focuses the attention to a given place
- It engages visitors at multiple levels, including physically by walking and bookmarking
- It supports group dynamics: the content delivery based on audio is inclusive of whoever is around; bookmarking a page can also be a group-mediated decision of what to listen to
- It is novel, but offers straightforward interaction: no explanation is needed on how to use a bookmark on a book, and the stories will surprise or amuse
- It shows alternatives and allows users to choose at any time: the Companion Novel holds different themes, one for each page; selection is simple via the bookmark and can be done at any time
- It personalizes the content on the basis of clear conditions such as the theme selection made with the bookmark, and the moving towards a point of interest

The stories proposed to the visitors by the Companion Novel are a critical element of the experience. The themes, the length, the type, even the tone of voice of the narrator have an impact. Discussions with the volunteers pointed out that the SGC Trust discourages attempts to use the Cemetery in ways that could be macabre, frightening or unsettling. This is not to say that all information provided in tours or publications is sanitized, quite the contrary. Ghoulish details are part of the narrative, but they are contextualized to provide a proper and historically sound setting for interpretation; Victorian society was very different in taste and manners than the society of today.

Time was spent by members of the team talking to the volunteers, searching the local library studies, reading original historical documents, considering the technical constraints (e.g. points of interest must be at least 30m apart; speakers have to be placed in a high position), visiting the Cemetery, and overall trying to understand which physical layout would offer a good ground for a variety of stories. Seven points of interest were selected for the prototype: one in the park side, four in the historical side and two on the border between the two. In the creation of content we favoured variety and used sources as different as acts of parliament, historical newspapers, leaflets and publications. We also went through a process of re-writing and dramatizing certain stories, particularly the self-accounts - for this a professional creative communication strategist was involved.

Different people, each playing their own character, recorded the narratives to be used in the Novel. Each file was associated with the conditions that would play it. While some conditions relate to the physical context such as the proximity to a point of interest, or current setting such as the theme selected by the bookmark, other conditions aim at maintaining a coherent narrative. For example, in two points of interest visitors can see how old headstones have been reused as building materials: it is then possible to introduce into the narrative an explicit reference to the spot previously visited. Of the seven points, five had multiple stories, while two had a single narrative that suggested personal

exploration. Invariant points where everyone, irrespective of the theme chosen, would receive the same content were introduced following the co-design workshop with curators. They commented on the need, sometimes, to force a piece of information or to push a certain reflection, therefore overriding any choice made by the visitor.

Overall 32 pieces of content have been created, ranging in length from about 20 seconds up to just over two minutes, for a total of about 45 minutes of recorded sound. This is a limited set, however we are supported in this choice by empirical findings that only part of the content provided is accessed and only a little time is devoted to interacting with technology (Serrel and Raphling 1992; Hornecker 2008).

The final step in the creation of the content was the selection of the "attraction sounds", played when the visitors are about 10m away, to attract them closer to the speaker, to a position that enables them to hear the story. To trigger curiosity we selected unusual and contrasting sounds: a traffic jam for "Nature in the City"; a piece of opera singing for "This is My Story"; a high neigh for "Weird & Wonderful"; and a rap phrase for "Favourite Spots".

Challenges for the Companion Novel on site

The current Companion Novel prototype is the result of an interative process that alternated design and evaluation. We conducted expert evaluation where the different steps in the interaction were considered and possible problematic or open interaction issues were noted. Items that emerged were related to the lack of feedback when setting a theme via the bookmark, and to how to find the points of interest in the 14 acres of the Cemetery. The design of the prototype was modified to address these: the book now plays the attraction sound for that theme and a map of SGC showing the points of interest is now etched on the back of the book.

The feedback from the Cemetery volunteers complemented the expert evaluation. They gave us advice regarding the need for a minimal set of instructions on what to do with the book to give to visitors, and regarding the volume of the sounds. Some volunteers noted how the sound was too quiet to be heard over the bird song. They also observed that the vegetation during Summer is dense and it may further dampen the volume. These comments directed our thoughts on design modifications. The first page of the book now explains what the bookmark does and invites visitors to take their preferred path. We also focused on choosing loud and unexpected attraction sounds to effectively grab attention.

Field tests were carried out in the Cemetery to prove if the technology was working in-the-wild as it was in the lab, as the transition between a controlled environment and the complex site of SGC was one of the biggest challenges. Indeed, we quickly found out that Bluetooth (which the wireless speakers rely on) is prone to interferences and certain positions work better than others: a speaker placed at ground level works well only if there is no vegetation around it, the best position for a speaker in terms of Bluetooth connectivity is high in a nearby tree. The range of the signal also changes substantially from indoor to outdoor: in the lab the speakers picked up the Bluetooth signal within a 30 meter range; in the Cemetery, however, this distance was reduced to about 10 meters. It also happened that the attraction sound was sometimes skipped by the system and the story was played directly. We believe both issues to be due to the Bluetooth receiver within the speakers as they both disappeared when the Bluetooth receiver was on a Raspberry PI controlling the speaker.

Considerations of cost and maintenance informed the design of the hardware and software architecture. The intelligence of the system as well as all the content files is all contained within the Novel, a speaker just plays whatever sound is streamed to it. As such any change or amendment must be done on the Novel alone and the cost of the speakers left in place can be relatively cheap as they are passive devices. Moreover the content of a Novel can be changed completely by laying new pages on the book and recording new sounds thus allowing to reuse the same system in different outdoor heritage sites or to offer more and different interpretations. Both ways offer a sustainable solution to heritage sites that can share the costs or extend the use of the same technology for a longer period of time.

Most importantly for our research, the sound-in-place proved to be very evocative and effective in attracting attention to the surroundings. The bookmark was also very effective in providing a simple mechanism for switching the theme while at a point of interest. There was no delay in playing the story

when switching to a different theme, therefore allowing visitors to explore multiple stories in a straightforward manner.

Conclusions

In this paper we have discussed current design work at the Sheffield General Cemetery. We have described some of the challenges presented by the site when envisioning novel tangible interactions to attract and engage visitors: the complexity of themes pertaining to the site, the environmental constraints and the ethos and mission of the SGC Trust. We have also described a set of design ideas generated with the collaboration and input of the Cemetery volunteers. These concepts address different types of visitors and play on some of the different qualities of the site, from the winding paths and vegetation that make memorials and monuments hard to discover, to the multiple themes of interest around the Cemetery. We have described in greater detail the design concept that is currently realized into a working prototype, The Companion Novel. Its architecture (the book-like device and the set of wireless speakers) responds to particular challenges surrounding heritage technologies for content delivery: the risk focusing the visitor attention on the technology, rather than on the heritage holdings; considering the social dimension of the visit; and creating unambiguous and intuitive ways for visitors to personalize the content and manner of their visit (Ardissono et al. 2012). As well as these, we have faced other challenges that are more specific to outdoor sites: in particular, the changeability and openness of the environment and the limited possibilities for maintenance at such a large site ran by a volunteer group.

The prototype was progressively refined through a set of evaluation activities. Specifically, moving trials from the lab to the actual site unearthed a variety of technical challenges that we had not addressed before, from the positioning of the speakers, to issues with power and reception and issues regarding the design of the auditory content. The design of the Companion Novel addresses considerations of easy and economical maintenance by embedding most of the technology into the book device, while cheaper components are placed across the site. Embedding the content in the book device makes the update of the information to be delivered to visitors more manageable for the volunteers.

Through our work with SGC, we are aiming at exploring a set of design challenges and issues that are common to outdoor heritage sites in general. By creating a set of physical/digital prototypes responding to such challenges, we hope to provide the heritage community with open platforms for the provision of digital content through tangible interaction that could be then extended and customised by specific institutions and heritage professionals.

Acknowledgements

meSch is funded by EC FP7 ‘ICT for access to cultural resources’ (ICT Call 9: FP7-ICT-2011-9) under the Grant Agreement 600851.

References

Ardissono, L., Kufti, T., Petrelli, D. (2012). Personalization in Cultural Heritage: The road travelled and the one Ahead. *User Modelling and User-Adapted Interaction*, 22 (1-2), London: Springer, pp.73-99.

Dudley, S. (2009) Museum Materialities – Objects, engagements, Interpretations. *Routledge*.

Grinter, R., Aoki, P., Hurst, A., Szymanski, M., Thornton, J., Woodruff, A. (2002). Revisiting the Visit: Understanding How Technology Can Shape the Museum Visit. In *Proceedings of CSCW 2002*, New York: ACM, pp.146-155.

Hornecker, E. (2008). “I don’t understand it either but it’s cool” – Visitor Interactions with a Multi-touch Table in a Museum. *Proceedings of IEEE Tabletop 2008*.

Petrelli, D., Ciolfi, L., van Dijk, D., Hornecker, E., Not, E. and Schmidt, A. (2013). Integrating Material and Digital: A New Way for Cultural Heritage. *Interactions*, July + August 2013, New York: ACM, pp.58-63 .

Serrell, B., Raphling, B. (1992). Computers on the Exhibit Floor. *Curator – The Museum Journal*, 35 (3).

Vom Lehn, D., Heath C. (2003) *Displacing the object: Mobile technologies and interpretive resources*. ICHIM International Cultural Heritage Informatics Meeting.