An Evaluation of MyArtSpace: a Mobile Learning Service for School Museum Trips

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ABSTRACT
We report the main findings of the final evaluation study of the MyArtSpace project. MyArtSpace is a combined mobile phone and web-based service to support learning between schools and museums. On arriving for a museum visit the children are loaned mobile phones running the MyArtSpace software. They can view multimedia presentations of museum exhibits, take photos, make voice recordings, write notes and see who else has viewed the exhibit. After each action, the content is automatically transmitted over the phone connection to a website which stores a personal record of their visit. Back in the classroom they can review their visit and the media they have collected, share material with other children and create presentations. MyArtSpace has been deployed in three museums for a year-long trial during which over 3000 school students used the service, on organised visits from local schools. The final user study took place in one museum during November 2006, with a group of twenty-three students aged 11-14 and their teachers. It covered usability, educational and organisational issues, through focus groups, observational studies, questionnaire surveys, and face to face, telephone and email interviews. The study showed that MyArtSpace had a positive impact on school museum visits, and identified areas for improvement in the technical and educational aspects of the service.

Author Keywords
Museum learning, evaluation, multimedia phones, school visits.

INTRODUCTION
MyArtSpace is a service to support learning on school visits. It addresses the problem that a school visit to a museum, gallery, or heritage centre is often isolated from classroom work. The learning objectives are not set out in advance, the teachers have little control over what their students will do during the visit, the students rush through the museum filling in worksheets, and there is little or no follow-up work back in the classroom. Guisasola, Morentin and Zuza (2005) suggest that, to be effective, museum visits should be guided by three principles: (a) Integrating school learning into museum learning; (b) Guiding students towards development and contrasting of their own ideas; (c) Facilitating strategies that are appropriate to the museum's context (op. cit., p. 545). A difficulty in following these principles is that museums are also places for learning by exploration, so guiding students in a pack defeats the aim of allowing them to engage with authentic artefacts and discover their own responses to the exhibits.

The MyArtSpace service aims to connect and guide learning between the classroom and museum, while allowing students to create their own interpretations of the visit through active enquiry. The service was developed by a multimedia company, TheSEA, through discussion and iterative design involving teachers, education advisors, museum

curators and software designers. It builds on previous work in the design of mobile technology to support museum visits, including the Bletchley Park/CIPHER Project developed by the Open University, UK (Mulholland et al., 2005), ArtScape at the Peabody Essex Museum MA, USA (Johnson, 2004), Electronic Guides at the Exploratorium, San Francisco, USA (Fleck et al., 2002) and DiGiT at the Dulwich Picture Gallery, UK (Dulwich Picture Gallery, 2004).

MyArtSpace was deployed in three sites: the D-Day Museum (a museum in Portsmouth that interprets the Allied landings during World War 2), Urbis (a museum of urban life in Manchester) and the Study Gallery (an arts centre in Poole). Throughout a year-long trial between February 2006 and January 2007 over 3000 school students used the service, on organised visits from local schools. The authors of this paper were recruited to carry out a lifecycle evaluation of the service, which involved both intervention in the design process, to critique early designs and propose improvements, and also assessments of the usability and educational effectiveness of the service in use.

A previous paper by the authors (Vavoula et al., 2006) has outlined the lifecycle evaluation approach and described a case study evaluation of MyArtSpace in use at the D-Day Museum. In this paper we report the final evaluation of the project, at the conclusion of the year-long trial.

Brief Description of MyArtSpace

MyArtSpace connects a web-based client that can be accessed on a desktop computer in classrooms or homes with software running on mobile phones in the museums and gallery. A typical museum or gallery visit would run as follows.

In the classroom, the teacher discusses the forthcoming museum visit, making use of a printed Teacher's Pack provided by the museum. Typically, the teacher will set one or more questions or goals to guide the visit (such as "Were the D-Day landings a success or failure?", or "What was the role of women in the Allied landings").

On arriving at the museum the students are divided into pairs or groups of three and each person is handed a Nokia 6680 multimedia mobile phone, pre-programmed with the MyArtSpace software (a Java application running on the mobile phone). The phone powers up to a MyArtSpace screen (Figure 1), so they do not have access to the normal phone functions. Each pair uses the phone keypad to type in a unique identifier that identifies them to the service.

Figure 1a Initial screen

Figure 1b Menu of functions

As they tour the museum, each pair of students can 'collect' an object by typing in a two-letter code shown on a printed card beside the exhibit. The phone screen shows an image of the object for confirmation (Figure 2a). This starts a multimedia presentation on the phone, using audio and images to describe the museum exhibit. After collection, they are shown a "did you know" screen that offers some extra background information (Figure 2b). They are then prompted to type in their reasons for choosing that object and are shown a list of who else has collected it.

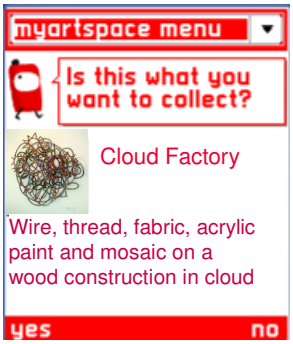

Figure 2a. Confirmation screen

Figure 2b. 'Did you know?' screen

As well as accessing pre-prepared information in context, they can create their own interpretation of the museum, in relation to their goals. They can take photos with the phone's camera, record audio commentaries, and take notes. At any point they can see a summary list of what they have collected and created. After each action, the content is automatically transmitted over the GSM phone connection to the MyArtSpace website, which builds a personal record of their visit.

Back in the classroom, or at home, the children can log into the MyArtSpace website using their unique identifier. There, they see a 'store' of the objects they have collected or created (Figure 3), and can add new ones by creating them (for example by recording a commentary) or copying them from online stores provided by their peers, their teacher, or the gallery.

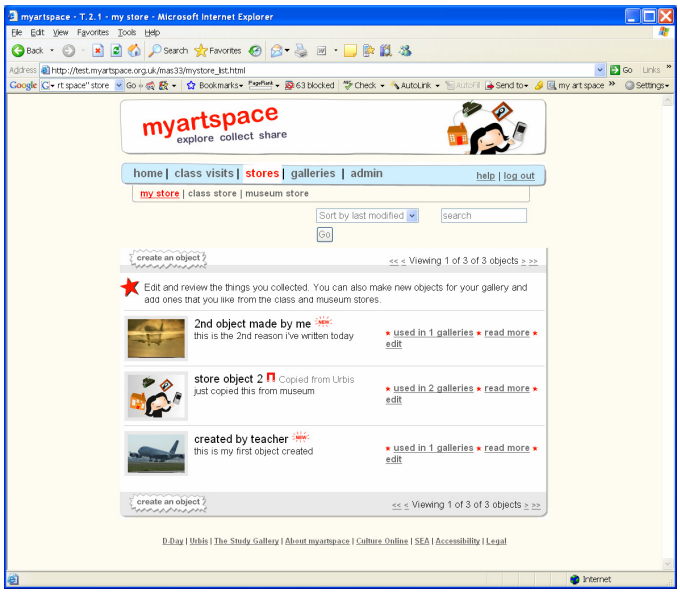

Figure 3. 'Store' of objects collected or created by the students.

Then, they organise the stores into online 'galleries' which are similar to presentations, using a tool like a simplified PowerPoint presentation manager. Figure 4 shows one frame from the online gallery, with a photo taken by a student along with a written caption. The teacher acts as moderator of the content and can opt to publish student's 'gallery' presentation on the web so that it can be seen by other schools, parents, and the general public.

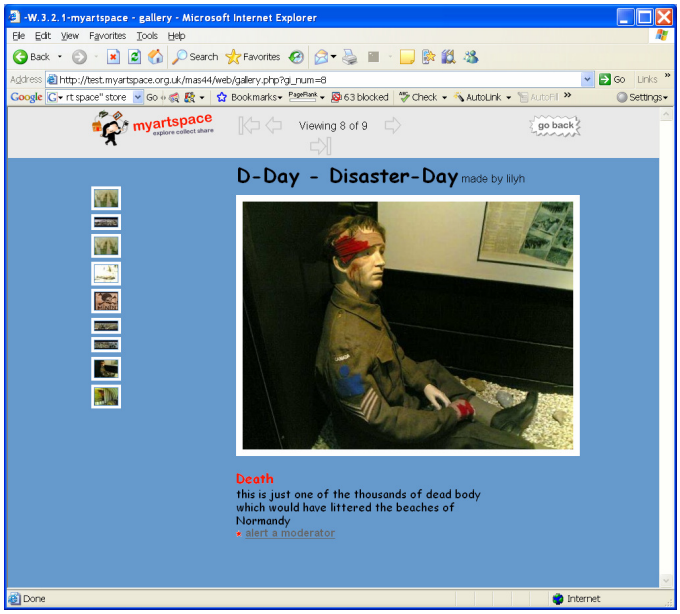

Figure 4. Frame from the online 'gallery'.

FINAL EVALUATION OF MYARTSPACE

Method

The final user study took place in November 2006 in relation to the D-Day museum, with a group of twenty-three KeyStage 3 (age 11-14) students and their teachers. The main evaluation aims for this study were to:

– assess the educational value of MyArtSpace;

– ascertain whether the service meets the ISO 9241 standards of usability;

– assess whether issues highlighted in earlier evaluations had been addressed.

The evaluation illuminated the use of the service by teachers, students and museum staff at three levels of granularity: Micro (usability issues), Meso (educational issues), and Macro (organisational issues), see Table 1. At each level, a three-step analysis was carried out:

Step 1. What was supposed to happen. Pre-interviews with stakeholders (teachers, students, museum educators), documents provided to teachers to support the visits.

Step 2. What actually happened. Observer logs, post-focus groups, analysis of video diary.

Step 3. Differences between 1 & 2. Reflective interviews with stakeholders, critical incident analysis.

Micro level: **Usability issues**	**Meso level:** **Educational Issues**	**Macro level:** **Organisational Issues**
Technology usability Individual and group activities	Learning experience as a whole Classroom-museum-home continuity Critical incidents: learning breakthroughs and breakdowns	Effect on the educational practice for school museum visits Emergence of new practices take-up and sustainability

Table 1. Framework for the evaluation

The data collection methods were as follows:

One-to-one interviews. These were conducted with the teacher prior to the study, following the initial lesson, following the museum visit and following the post visit lesson.

Focus groups. The teacher selected two groups of students (a group of three girls and a group of three boys) to be interviewed following the pre-visit lesson, museum visit and post visit lesson.

Observations. The students and teacher were observed during the pre-visit lesson, museum visit and post visit lesson. During the museum visit DVD recordings were made of two groups as they worked their way around the museum. Critical incidents in the DVD of their visit were shown to students during post-visit focus groups to enable them to reflect on their use of MyArtSpace.

Questionnaires. These were distributed to students following the pre-visit lesson, museum visit and post visit lesson.

Telephone / Email interviews. These were conducted with representatives from TheSEA, the project sponsors, and the participating museums.

The data collected by these methods were analysed by the project team to identify critical incidents that indicate either breakthroughs (evidence of successful learning activities and outcomes) and breakdowns (evidence of failures in the interaction between the students and the technology, or failures to take advantage of the learning opportunities within or between the sites. Where a critical incident was identified, it was explored in the interviews and focus groups to see if it was indicative of a more general success or problem.

Overview of the study

The MyArtSpace experience for the school students who participated in the study involved three lessons. A previsit lesson took place at school on the Friday before the museum visit. During the lesson the teacher introduced the topic of D-Day to students. The teacher had prepared worksheets that students would work on in the museum. Each worksheet dealt with a D-Day issue (e.g. ‘life at the home front’) and contained a number of associated questions.

The museum visit took place on the following Monday. Students arrived at the museum with their worksheets and login details. The museum Education Officer gave them an introduction to MyArtSpace, explaining how the phones worked and what they could do with them. Students were told to explore the museum in groups and collect items relevant to the questions on the topic in their worksheet.

The post-visit lesson took place on the next day. Students worked individually for the post-visit lesson to create their galleries. The teacher and the classroom assistant walked round the room helping students.

Evaluation activities took place before, during and after each lesson. The teacher suggested two student groups, one group of three girls and one group of three boys, who would be the 'focus' groups. These two groups were interviewed after each lesson, and were followed closely in the museum. The footage from the girls' museum tour was edited before the post-visit lesson to create a video-diary of interesting incidents from the group's tour in the museum. The girls' group was then shown that diary in the interview following the post-visit lesson and were asked to clarify the incidents. In addition, questionnaires were distributed to the whole class after each lesson. The teacher was interviewed before and after all three lessons.

Summary of results

MyArtSpace had a positive impact on school museum visits from the perspective of the teacher and students, compared to previous museum visits that had not used the service. Feedback from museum representatives regarding the day-to-day running of the service suggested similar benefits. The study also identified a number of areas in the design of the MyArtSpace experience at the technological and educational levels that need further refinement to enhance the benefits. The advantages of MyArtSpace and the areas that can be improved are summarised below together with related recommendations.

Advantages of MyArtSpace

The form factor of the devices was appropriate. One of the students in this study remarked that they liked the fact that the device was actually a mobile phone and not a typical handheld museum guide. Mobile phones are commonly owned by students in this age group.

Collecting and creating items was an easy and natural process. The students generally found no problems in operating the phone and, providing it was within range of a signal, the content was sent seamlessly to the website.

The service met students' and teachers' expectations. All teachers and students in the trials reported positive impressions of MyArtSpace. In summary, teachers reported that their students engaged more with the exhibits than in previous visits and had the chance to do meaningful follow-up work. Students reported that they enjoyed their visit and that they found it more interesting and fun than traditional visits.

The activity supports curriculum topics in literacy and media studies. In addition to supporting curriculum topics related to the museum displays, MyArtSpace encourages children to make informed decisions about the content and viewpoint of their collections, to combine text and visual media, and to create reflective multimedia presentations.

It encourages meaningful and enjoyable pre- and post-visit lessons. Pre- and post-visit lessons are not standard practice for many teachers/schools. The teachers in the trials commented on the way MyArtSpace offers an easy route to the planning of pre and post-visit lessons which are enjoyable for the students.

Students spent longer exploring the museum. According to the Museum Education Officer, the average length of time a student spent exploring the museum increased from 20 minutes for a conventional school visit, to 90 minutes with MyArtSpace. Although some of this time included operating the equipment, it was clear from our observations that this mostly involved activity related to the educational task, such as framing a photograph, rather than the technology.

Students engaged with the museum. Observations of MyArtSpace in use showed students working with exhibits and asking questions such as 'why do we want to collect this?', deconstructing objects, and reflecting on their relevance to the learning task.

It supports students of differing abilities. A teacher at the Urbis site noted that the lower ability students used the camera to capture their experiences as they walked round, whereas higher ability students engaged with a map of the site to plan where to collect and create material. These appear to match the cognitive processes proposed by Scardamalia and Bereiter of *knowledge telling*, where a simple linear sequence of actions invokes further, related, actions and *knowledge transforming*, where a learner explicitly explores goals, content and structure to solve a problem (Scardamalia & Bereiter, 1987).

Museum appeal is enhanced. Many students and teachers commented that they would visit the museum again and said they would recommend it to others.

It bridges the gap between museums and classrooms. MyArtSpace was successful at bridging the museum-classroom gap by facilitating the teacher's design of pre and post-visit lessons, enabling students to create artefacts in the museum

and have them readily available for further work in the classroom, and extending the museum context into the classroom through the online museum stores.

Student motivation was enhanced. Students in the trials appreciated the use of modern, 'cutting edge' technology and teachers have remarked on how enjoyable the experience was for students.

Limitations of MyArtSpace and areas for improvement

There were usability problems. Usability problems included confusion between standard uses of buttons on the mobile phone, and the uses for the MyArtSpace application. Thus, the use of the Nokia 'Clear' button was used as a 'Cancel' button in text entry fields, which led to frustration and confusion over whether an item had been collected, resulting in duplicate items.

The phone connection sometimes failed. Inside the museum the phone connection was unreliable, which sometimes resulted in the system failing and the phones needing to be reset.

The phones rapidly became outmoded. During early evaluations, in November 2005, some students described the phones as 'cool'. During the final evaluation, in November 2006, students were less impressed with the devices and asked for features that are now standard on consumer phones, such as a video recording facility.

There was a lack of teacher orientation. Most teachers did not attend the museum for an introduction to the service prior to using it with their classes and the information in the Teacher's Pack did not include a section on how MyArtSpace works. Many teachers first used the MyArtSpace web site without any background knowledge on what it was about or how it worked.

Student orientation was poor. Most classes did not use the MyArtSpace website during the pre-visit lesson. At best the teacher would demonstrate an example gallery; at worse the students would know nothing about the desktop web software until after their museum tour. Students thus went to the museum knowing in theory what MyArtSpace would enable them to do, but not the specifics.

A quick reference guide was needed. Teachers, students and museum representatives have expressed a need for a quick reference guide, in the form of a 'how to' set of instructions.

The post-visit activity can be time consuming. For the class we observed, one post-visit lesson was not sufficient for students to finish their galleries, so another lesson was scheduled. In part, this was because the students were using unfamiliar software, but also because they were engaged in the productive activities of sifting evidence and creating a coherent presentation.

Students had problems in organising images and sounds out of context. Some students found difficulty in identifying pictures and sounds they had recorded. This indicates a more general problem of re-creating the context of the museum visit back in the classroom. The time-ordered list of objects list of objects they had collected provided some cues, but there needs to be a facility to link objects, photos and sounds at the museum to create a richer, more contextual object.

The more items are collected, the harder it was to organise them. The more that students engaged with the museum visit, collecting items and creating content, the more difficult it was to organise the material back in the classroom. There is a difficult trade-off between constraining the museum visit to make it easier to manage the material (for example by limiting the number of items that can be collected) and stifling creativity and engagement.

The tools for group awareness were not effective. The facility to find who else has collected an item (and thus compare experiences with them) was seldom used. However, this is not necessarily a problem. The students generally worked well in groups of two or three, planning how to take a photo or discussing a note, and there may be little to gain from further collaboration inside the museum. However, tools could be added to support collaborative project work back in the classroom.

The service is costly. Museum representatives have expressed concerns about the running costs of the service, including staff time and resources. Many museums already provide audio guides for museum visitors, and MyArtSpace is yet another service for the museum to manage.

CONCLUSIONS

MyArtSpace is different from other multimedia museum guides. It connects the museum visit to the classroom and to the student's homes, so that the visit becomes part of a sequence of planning, engagement, and reflection. The pre- and post-museum visit lessons extended the museum visit into the classroom and enabled the students to reflect reflected on their experience. The alternative educational service for student visits to the museum is paper-based worksheets, which a teacher has described as "passive". In contrast, a student described the experience with MyArtSpace at the museum as "less boring, more modern".

The opportunity to carry out an evaluation throughout the project lifecycle has provided insights into the design and deployment of a mobile learning service. The way a system like MyArtSpace is used cannot be determined until it is actually used by real people in real settings. The continuous evaluation and fine-tuning of the new technology in concert

with the learning practice (including lesson planning, IT support, and activity planning) resulted in a system that met the initial design aims and provided a generally reliable service to museums. The study also identified issues that will need to be addressed in future services for museum or field trips, including the need to orient teachers and students to the experience, how to re-create the context of the visit back in the classroom, and finding a suitable business model for museums and schools to support a continued service.

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