Mystery at the Museum – A Collaborative Game for Museum Education

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Abstract. Through an iterative design process involving museum educators, learning scientists and technologists, and drawing upon our previous experiences in handheld game design and a growing body of knowledge on learning through gaming, we designed an interactive mystery game called Mystery at the Museum (the High Tech Whodunnit), which was designed for synchronous play of groups of parents and children over a two to three hour period. The primary design goals were to engage visitors more deeply in the museum, engage visitors more broadly across museum exhibits, and encourage collaboration between visitors. The feedback from the participants suggested that the combination of depth and breadth was engaging and effective in encouraging them to think about the museum's exhibits. The roles that were an integral part of the game turned out to be extremely effective in engaging pairs of participants with one another. Feedback from parents was quite positive in terms of how they felt it engaged them and their children. These results suggest that further explorations of technology-based museum experiences of this type are wholly appropriate.

Keywords: Handhelds, games, simulations, role play, PDA, museum, wireless

BACKGROUND – GUIDED TOURS AND HANDHELDS IN MUSEUMS

It is well known that museums have sought ways to engage visitors both more deeply and broadly in museum resources. Technology has enabled museums to explore new ways to provide visitors with richer experiences without necessarily producing additional physical exhibits. Many museums have employed audio tours, utilizing customized mobile devices with headphones for this purpose. These audio tours, which typically require visitors to manually enter codes displayed near specific locations and/or exhibits, offer visitors on-demand , information, commentary and even music. While these hardware devices have evolved from linear cassettes to non-linear digital CDs and MP3 players, making the user-experience more intuitive and more flexible, the concept has remained fundamentally the same – provide visitors with access to additional auditory content relevant to single items, or less commonly, exploring connections between multiple items.

More recently, some museums have started offering handheld devices which allow visitors to specify exhibits for which they would like to subsequently access additional media. Perhaps the best known example of this is the Experience Music Project (http://www.emplive.com/visit/about_emp/tech.asp) in Seattle, which not only provides supplementary audio content to exhibits, but also allows users to electronically "tag" items which they can then explore in more detail using a separate electronic workstation at a later time.

Other museums have also sought to offer electronic guides to visitors that not only provide supplementary information on the spot, but also allow them to retrieve related information later. The Exploratorium in San Francisco has conducted a study (Hsi 2003) of visitors' use of this strategy within their science center. In this study, location-aware Pocket computers provided visitors with web-based information about aspects of the museum including history, annotations and suggested explorations. Content, including audio, video and text, was delivered to the devices wirelessly. Two themes emerged in this study. First, visitors said that they technology isolated them. In order to hear audio, they wore headsets which tended to separate them from their surroundings. Additionally, visitors tended to focus on the device, taking away their focus from the rest of the museum. Second, visitors had trouble connecting the virtual content on their handhelds with the real content in

the museum. Despite these two shortcomings, however, the visitors did say the technology encouraged them to view exhibits in new ways and try things that they hadn't before.

As museums explore these new technologies it is important to consider the affordances of the specific technologies and how they can meet the goals of the museum's physical space while providing an additional layer of engagement. In exploring this notion, other museums have tried using roaming handhelds in different ways. In a departure from the guided tour metaphor, one design (http://woz.commtechlab.msu.edu/courses/theses/scavengerhunt/) was created at the Chicago Historical Society in the form of a scavenger hunt. The goal here was to create something more game-like that would attract the interest of younger visitors. The scavenger hunt would pose one of 10 questions such as, "Find this cup [picture shown] and see the logo and mascot carefully. Which famous brand's cup was it? [multiple-choice answers provided]". Players would earn points for correctly answering each of the questions. They found that students aged 9-13 liked the technology and actively sought the answers rather than simply guessing. However, from a museum education and design perspective, this scavenger hunt strategy may be viewed as counterproductive. It encourages students to see the museum as a bunch of disconnected, decontextualized artifacts. Many museums actively discourage the scavenger hunt motif because it does not encourage students to think deeply about what they are looking at or promote thoughtful inquiry. Yet, the concept of integrating a game into the museum space to engage students in this age range is intriguing, as many of them use and enjoy handheld games.

Museums have not employed these new technologies to encourage interaction with other museumgoers. For the most part, as noted in the Exploratorium study (Hsi 2003), the technologies do exactly the opposite, fostering a more private and isolated experience. Yet the field of computer supported collaborative learning certainly provides evidence that collaborative learning is effective in encouraging people to think critically about important ideas, and perhaps this notion should be more seriously considered in the informal learning space of museums.

MYSTERY AT THE MUSEUM

Building on of our experiences using location-aware handhelds for learning experiences at schools and nature centers (Klopfer and Squire 2003), a new game was designed for the Boston Museum of Science. The primary design goals were to:

- Engage visitors more deeply in museum exhibits – get visitors to explore and think about specific exhibits that they had not seen before
- Engage visitors more broadly across museum exhibits – get visitors to see connections across the exhibits of the museum, and explore parts of the museum that they had not visited in the past
- Encourage collaboration between visitors – get visitors to discuss ideas to promote engagement

In choosing a target audience for the game, we settled on the core museum going contingent of families – specifically late elementary through middle school aged students and their parents. An additional goal was then added to the project of increasing meaningful collaboration and interaction between parents and children around science and inquiry. These goals are consistent with the recently introduced AAAS supported Science Everywhere initiative (http://www.tryscience.org/parents/parent.html).

Through an iterative design process involving museum educators, learning scientists and technologists, and drawing upon our previous experiences in handheld game design (e.g. Klopfer and Squire 2003) and a growing body of knowledge on learning through gaming (Gee 2003), we designed an interactive mystery game called Mystery at the Museum (the High Tech Whodunnit), which was designed for synchronous play of groups of parents and children over a two to three hour period.

The fictitious premise of Mystery at the Museum (M@M) was that a band of thieves (The Pink Flamingo Thieves) had left their calling card (a pink flamingo) in an exhibit case indicating that they had stolen a priceless object from the museum and replaced it with a replica. The players (in M@M) have been brought in as a team of experts to try to solve the crime, apprehend the criminals, and identify and retrieve the stolen artifact. Each player took on one of three possible roles – a technologist, a biologist and a detective – each with special capabilities. The interdependencies among the roles encouraged different roles to collaborate throughout the game. Logistically, players were organized as six players (three pairs) per team with each pair (parent and child) using one one Pocket PC and a walkie-talkie. Players have many different ways in which they can collect clues - including interviewing virtual characters (unique to each room within the museum), collecting virtual clues found in exhibit halls, analyzing samples using virtual instruments, and understanding information from exhibits throughout the museum.

The Pocket PC used Wi-Fi positioning to determine what room in the museum it was in. It could then provide the players with information about dynamic virtual characters and objects in the room with which they could interact. These virtual objects and characters in turn referred to and complemented real, physical

components of museum exhibits which had been incorporated into the story. The fundamental interactions that were inherent to the game were as follows:

- In each room was a set of *virtual characters*, which could be "interviewed" by clicking on them. The characters would provide a monologue in the form of text, often accompanied by pictures. The characters could move rooms over time, and players in different roles might receive different information from the characters (i.e. a character might tell something quite different to a detective researching a case, than they would to a biologist). Many of the virtual characters referred to other exhibits or rooms.

- In many rooms there were *virtual objects*, which could be picked up and examined. Each had both a textual description and one or more images associated with it. Players could also "show" virtual objects to characters who would then react accordingly, often providing additional information. Some of the objects related to nearby exhibits.

- In several locations *virtual equipment* (e.g. a scanning electron microscope) could be used to obtain further information about the virtual objects. Where possible the virtual equipment was placed near real equipment of similar types (like the SEM). Equipment "use" was restricted to certain player roles as appropriate.

- Several items in the museum were tagged with *infrared tags*. These tags provided the players with virtual samples taken from those particular items (e.g. fingerprints from a glass case).

- Players could exchange objects and interviews with each other through *localized infrared beaming*. In many cases one role was the only one capable of retrieving a sample (e.g. the detective who could get a splinter from an unconscious guard), while another role was the one who could use equipment to analyze it (e.g. the technologist capable of using the virtual SEM).

The game was completed when players had accumulated enough evidence to obtain a virtual warrant for the arrest of the culprits. One of the organizers played the role of judge who considered the information presented orally by the players and, if sufficient evidence was presented, beamed the players an arrest warrant
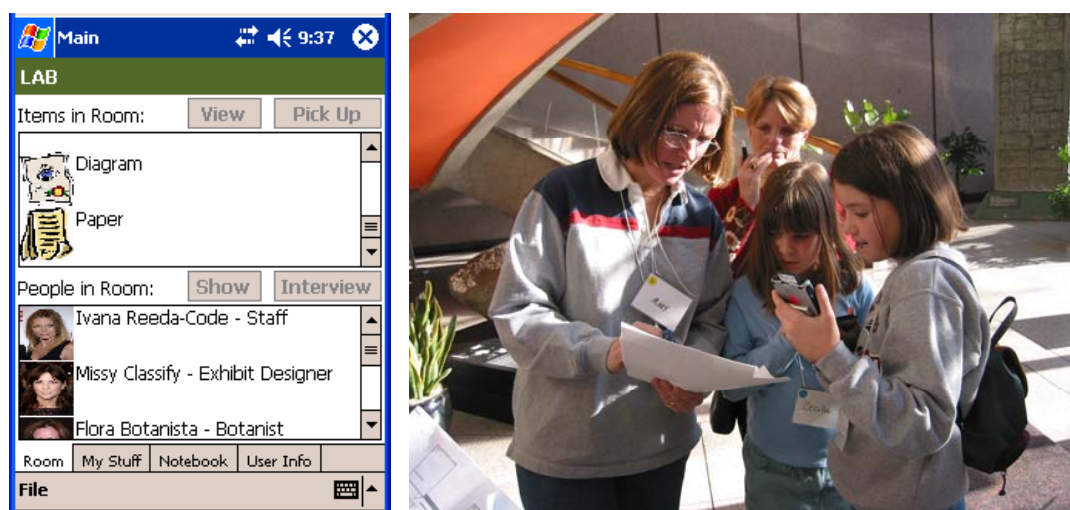

Figure 1. A screen shot showing virtual items and characters in the room (left) and a group of players collecting clues in the museum (right).

IMPLEMENTATION AND DATA

M@M was played at the Boston Museum of Science on two successive weekend afternoons with a group of approximately 20 parents and children each day. Parents were always paired with their own child. While several of the parents and children knew each other, the majority did not know any of the other participants before the game. The groups were subdivided into teams of six (as mentioned above). In cases with uneven numbers, a single redundant role was added to a team. After players were introduced to the "mystery" and given a brief tutorial of game mechanics, they were given one hour to play the first phase of the game. After this first hour of game play, players regrouped in the meeting room, checked in with the organizers for 5-10 minutes and then went back into the exhibit halls to play the second half of the game for an additional 30 minutes. At the end of the game the players met again to discuss the process, complete surveys. A sample of participants were then interviewed by the research team. In order to determine how well the game met our design goals several data

sources were triangulated to determine emergent themes. These sources included video tapes that tracked groups as they went through the entire process, pre and post game surveys of both parents and children on interests in the museum, technology and collaboration, and video tapes of the post game group debrief and individual interviews.

RESULTS

Deep and Broad Engagement

Players in the game were required to visit a wide variety of places in the museum, and to examine exhibits closely to find and understand some of the "clues". Several codes, for example, were woven into the storyline (the thieves used codes to communicate with each other). Interpreting these codes required players to find and connect information from several exhibits on mathematics, communication, and models. The feedback from the participants suggested that this combination of depth (examining some exhibits in detail) and breadth (thinking more broadly about multiple exhibits) was engaging and effective in encouraging them to think about the museum's exhibits. This can be seen in the interactions of one of the groups searching for information to help them decode one of the clues which the thieves left behind:

> *Mom 1*: We're looking for codes to help us decode this. If anyone finds stuff let us know [looking around]
>
> *Girl 2*: Over here! Over here!
>
> *Mom 1*: [Boy2] look in the 14th century [points to chronological history of mathematics]
>
> *Boy 2*: Look Look. Water and dice like on the code.
>
> *Dad 2*: [reads information about the code to himself and then applies that to the code "written" on the back of a virtual receipt] In an … hour.. [points to a part of the exhibit and speaks to the group]… it is telling him when to meet by the water. An hour after close.

This interaction shows how the teams worked together to discover and apply information from real exhibits in order to interpret the virtual information which in turn fed back into their game play strategies. During the group debrief discussion following the game, these feelings of connection with the museum were further conveyed. "…We did see parts of the museum we weren't aware of," said one of the parents addressing the variety of new exhibits they saw. A child commented that he, "hadn't ever seen the monkeys," which are one of the few live exhibits in the museum, and are tucked away in an area that is easy to miss. A parent noted on behalf of herself and her child, "We come a lot, and I still saw stuff in exhibits that I had never seen before." Another parent echoed, "I learned things that I had never seen before, like reading about the mummy or the banana tree. It made me read things that I wouldn't have otherwise."

Collaboration Across Roles

The roles in the game turned out to be extremely effective in engaging the pairs of participants with one another. Each individual role was forced to collect and share information to successfully solve the case. Here one group has met up after collecting information separately.

> *Boy 3*: Have you been to the mummy?
>
> *Mom 2*: Yes we went there.
>
> *Boy 3*: They have to go there since they're the biologist. It is upstairs…
>
> *Boy 1*: Let's give you [the Technologist] the splinters so you can look at them with the microscope.
>
> *Mom 1*: We got the hobo code but we can't fully decode it. What do you think this means? [beams to other groups so that they can all look at the picture]

Often the groups concluded that it was beneficial to move around the museum in groups which included multiple roles so that they could collaborate to solve the problems. As one parent said, "In the second part we all went together to every room or even though we might not have needed everyone in each room we did better as a group." One of the senior museum educators further commented, "…sometimes people have trouble with the logical reasoning… [but in this group] they saw that one person could get what the others couldn't and they got the power of roles. Then they started using the beaming and they got that roles idea and off they went." The interdependence of roles served as the starting place for collaboration which then promoted more general collaborative problem solving. It is interesting to note that in the post-game surveys many participants wrote that they felt that their role was the most important in the game for one reason or another. This was consistent across all of the roles, showing that the roles had fostered players' sense of a unique contribution in addition to promoting collaboration.

Parent Child Interactions

Feedback from parents was quite positive in terms of how they felt it engaged them and their children. Parents commented on the appeal of different levels of complexity within the game, with tasks that encouraged them as adults to take an equally active, but different, job from their children. For example, in many cases the children were the ones who collected evidence with the Pocket PC, while the parents frequently organized the investigation and helped them physically navigate the large museum space. One parent of a 14 year old boy noted, "this is the longest substantive interaction I've had with my son in years without fighting." While children similarly noted, "my mom actually had a reason to be here [to help me figure out part of the game]".

CONCLUSIONS AND NEXT DIRECTIONS

This implementation of Mystery at the Museum shows great promise for interactive games in a museum setting. Museum educators, parents and children were all pleased with the way that it engaged them with individual exhibits, the larger museum space and with each other. There were other positive outcomes which were not originally designed into the experience. One mother (a physician) noted that while her colleagues had all used PDAs (like the Pocket PC) in their practice, she had been too afraid in the past, and now was willing to give it a try. A 10-year old girl similarly noted that she was not "the techie in the family" and often felt left out by technology, but that during this experience, she "really got it." These results suggest that further explorations of technology-based museum experiences of this type are wholly appropriate. There are many design issues to be considered in the future including how the roles should be designed, how this model could be adapted to less synchronous implementations, and how portable the model is across institutions. Of particular interest is how this game can be adapted to museum environments in which synchronous runs of the game are not feasible or desired. There are several options for making these kinds of adaptations. One solution would be to allow players to start the game at any time, but limit their interactions to other players who started within an adjacent window of time. Alternatively, the narrative may be adapted such that it is dynamic and responsive to the actions of the current players. As we did in the original game, we can look to other gaming genres, which have conquered similar problems. The quests of many massively multi-player online roleplaying games, which are constantly unfolding, have much to offer in this regard. These ideas will be considered in future investigations.

ACKNOWLEDGMENTS

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