Teachable Mo[bil]ment: Capitalizing on Teachable Moments with Mobile Technology in Zoos

Abstract
Researchers and practitioners have studied how technology can support visitors’ learning in science centers, but few have considered technology specifically designed for science center docents; the staff that explains and interprets exhibits to visitors. We present a qualitative, exploratory study at a zoo where we designed and evaluated technological supports for docents running an immersive, embodied-interaction. Our study focused on the affordances of portable tablets and large fixed displays, as well as on a comparison of two approaches to docent notification (an orchestration approach vs. a just-in-time approach). Making use of docent interviews, video observations, and feedback from zoo educators, we recommend the use of a hybrid approach. Our main contribution is the identification of advantages and disadvantages of display options and notification approaches leading to a list of design considerations for technology that assists docents in delivering information to visitor audiences.

Author Keywords
Museums; user-centered design; experimentation; understanding docents

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Introduction
Informal learning institutions (ILIs) such as zoos, museums, and science centers aim to explain scientific content to their visitors by designing their exhibits to be as informative and interactive as possible. On some occasions, the design of an interactive exhibit is enough to convey the message intended by the ILIs, but in others exhibits can benefit from the presence of a docent. A docent is a person who acts as a guide, to explain or demonstrate exhibit content, offer interpretations and perspectives to visitors, and generally serve as the human face of the ILIs’ educational mission.

The process of explanation and interpretation can be difficult for docents (especially novice docents). Few designers have explored the potential that technology could play for supporting docents, and instead have focused on improving the visitor experience. Because of this, when docents use technology, they are often reappropriating tools designed with visitors in mind, such as the tablet-controlled Science On a Sphere [4] or the mobile Electronic Guidebook [3]. This situation is less than ideal, and designers should focus on docents as a unique population who should not be forced to re-purpose technology that has been designed for visitors.

Zoo scenario
“A Mile in My Paws” – “Paws” (see Figure 1) is an exhibit designed to educate zoo visitors about the increasingly severe effects of climate change on polar bears and their arctic homes [7]. This exhibit was designed with docent interpretation as a critical component of the experience.

Figure 1: “Paws” is played by a visitor who interacts with the game with swimming and walking motions. Docents (in green shirts) provide explanation and context, facilitated by a tablet and secondary display. Spectators (not pictured) watch the player and attend to the docent explanations.

The goal of the game is to traverse an arctic environment in different eras, but observers may not necessarily pick up on the changes to the environment, especially if they were only watching someone else play. In particular, because the game responds dynamically to user actions, there may be different opportunities for “teachable moments” – instances where docents can deliver information that is relevant to the immediate game state. Thus, docents were tasked to control game parameters and to provide contextual information about climate change.
However, during our first pilot, we observed that docents did not always deliver the expected educational content. We provided docents with a list of topics to cover, including biological facts about polar bears and the mechanics and effects of climate change (which is often not the explicit focus of their interpretation). After a few trials, docents set aside this list. We observed that this was because they became comfortable with explaining certain topics, and omitting others. While this would not be a problem with a conventional exhibit, with a dynamic exhibit by selectively delivering the content, docents missed many critical teachable moments.

The type of exhibits our preliminary study is applicable to need to share certain characteristics. 1) The exhibit has a large display which is dynamically controlled by visitors’ input, 2) At the exhibit, some visitors will be providing input while some will be observing, 3) The exhibit has a second display that presents content the docent can draw on at key “teachable moments” to interpret the current status of the main display to non-participating but observing visitors, 4) The exhibit’s second display accepts input from both the docent as well as the activity present on the main display. We worked with the docents to develop and iteratively refine a dynamic technological tool. The purpose of this exploratory study was to examine the affordances of different interpretation support strategies (detailed in the Design Approach section).

**Prior Work**

Previous studies have investigated the use of technology for educational purposes in ILIs. This includes mobile electronic guidebooks that provide enhanced exhibit content [3], supporting tools that collect and annotate multimedia data for scientific arguments [6], or tools in collaborative games that improve group-learning experiences in museums [1]. While most of this research has focused on designing for visitors, docents may be a potential audience for these tools. Only few works such as [2] have explored designs using tablets that support docents (rangers) to monitor visitors’ activities during a field trip and to customize guided walks. Additionally, informal research has reported the use of iPad applications[^1][^2] for supporting tour guides, showing how these are well received as tools that support explanations and enhance visitor’s understanding of exhibits. They mainly have been used as a repository of additional information, where the docents have to performed searchers in order to present the required information.

In particular, teenaged youth docents, who volunteer both to educate themselves and ILI audiences [8, 9], may be a particularly receptive audience due to their age and presumed facility with modern technology (e.g., smartphones, tablets, motion-controlled games).

Any technology designed to support docents must be able to aid them in addressing large crowds of visitors, including visitors who are not directly interacting with an exhibit or docent. These spectators also attend to exhibit content, rather than just passively observing, especially when presented on large displays [5]. Thus,

Design Approach

Docents may have difficulty orchestrating interactive, narrative digital experiences (such as "Paws"), as they need to coordinate their interpretation with the action unfolding onscreen. We worked with docents to identify the difficulties they experienced. These included recalling all the information, and communicating it in a timely manner (based on what is occurring onscreen), engaging the spectators, and controlling the game. It is essentially a task management problem, and they could benefit from cues to help them with when and what to deliver to visitors. We identified two factors as needing further investigation: the timing for delivering cues to docents, and the means by which this delivery is managed. We hypothesized that these factors would affect docents’ ability to discuss scientific content, and to interact with both players and spectators.

Notification Timing

During the baseline pilot in the zoo, docents had a list of topics as a target to deliver to the zoo’s visitors. The list of topics was provided in two formats: printouts and web-based in a tablet. As a result of the first pilot observations, two models for the prompt system emerged: an “orchestration” notification approach (a pull query, where they summon media to be presented) and its alternative model, a “just-in-time” notification approach (where the system pushes the notifications). Both approaches display "pop-up" notifications on a tablet used to control gameplay parameters. These notifications include questions and images to create discussion around a topic (such as changing sea ice). In the orchestration approach, docents have more control, but this might compete with the attention they must give to the other elements in the context of use. On the other hand, just-in-time approach guarantees that the information will be situationally relevant by selecting pop-ups based on the current game state, but it takes control away from the docent.

Presentation Technology

Docents need to support both players and spectators, so we tested two different presentation modalities: tablets, which afford one-on-one discussions between docents and visitors, and large projection screens, which allow one docent to display information to everyone at the exhibit. We tested these technologies in three configurations: tablet alone (to take advantage of portability), large screen alone (to interact with larger groups), and a hybrid approach (using both a tablet and a large screen).

Zoo Study

The study was performed in 4 sessions: a baseline session (45 trials) followed by different configurations tested in three different subsequent sessions (38 trials, 12 trials, 3 trials respectively). Each session corresponded to a full day of using the “Paws” exhibit. After each session we revised our intervention design in response to our collected data.

Participants

The study involved 15 different docents, high school students (12) for the three first sessions and college students (3) for the last session. Most of the time they worked in pairs; there were less than 5 trials in which a docent worked alone.
Advantages and disadvantages of docent-center analysis, as compared to the previous configuration

1. No notifications + Monitor (print-outs and web-based)
   - Docents (D) had to remember the content; so they delivered only half (51%) of it
   - D mainly conveyed the information to the player, not the audience
   - D were constrained to a physical space since they had to be close to the secondary display
   + Automatic notifications helped D to deliver about 73% of the content, but they still skipped some of it
   + D liked to have the control of the exhibit in their hands
   + D could move around using the tablet
   + D conveyed the message to the audience
   - D addressed only small groups
   - Physical closeness to the audience makes quiet pauses noticeable

2. Orchestration + Tablet
   + Automatic just-in-time notifications support D’s interpretation
   + 100% of information was delivered by the technology
   - D felt interrupted by the technology a few occasions

3. Just-in-time + Tablet
   + Automatic just-in-time notifications support D’s interpretation
   + 100% of information was delivered by the technology
   - D felt interrupted by the technology a few occasions

4-5. Orchestration/Just-in-time + Large display
   + A larger audience was addressed
   - D lost mobility and in some extent the feeling of controlling the exhibit

6. Orchestration + Large display + Tablet
   + D could engage with a larger audience with the support by two presentation technologies
   + Mobility and control was recovered

Table 1. Tested configurations. + Advantages, - Disadvantages

Data sources
The information gathered includes: researcher field notes, individual docent interviews, group debrief meetings, meetings with the zoo’s staff, video recordings, and pictures of the activity.

Observations and results
After each trial we analyzed the outcome of the configuration. From our data sources, we identified advantages and disadvantage of the tested configurations, presented in Table 1.

The results of 27 short interviews and discussions during the pilot studies, and 4 meetings with zoo educators outside of the pilots and video recordings revealed important features to keep in mind while designing to support docents:

- Mirroring content. Replicating the exhibit content shown on tablets on additional displays helps to engage a large audience.
- Provide orchestration along with mobility. Use of tablets for controlling the exhibit provided a sense of independence to docents avoiding constraining them to a particular physical space.
- Support interpretation along with mobility. Mobile devices allowed docents to seamlessly shift between spectators and the main user.
- Adaptable delivery pace of notifications. Docents require a mechanism that adapts to their interpretation pace.
- Concise clear content and attractive pictures. The content notification should serve as both a mnemonic aid for the docent and be accessible to the public who may see it on a display.
Avoid showing videos. Videos are not good for dynamic settings where one needs to alternate between the video content and real time information about the activity in progress.

Conclusions and Future Work
We identified docents’ needs while they interpreted an interactive exhibit. The findings of this study suggest that designers should consider the implementation of a hybrid presentation approach—the use of tablets synchronized with a large display—to support the docents reaching both the users and the audience. Docents found different aspects of both notification systems helpful. The interviews and observations suggested that the docents preferred personal control (offered by orchestration approach) because it allowed them to finish their explanations without interruptions and to perform at their own pace, but just-in-time notifications were also useful to augment ongoing explanations. Combining these approaches would be beneficial. An on-screen control like a button is unsatisfactory as docents must shift their attention to the technology. One method might be to incorporate docent voice recognition to detect long pauses, keywords, or a falling voice pitch. Another method might be to incorporate touch-screen gestures where docents can switch between notification modes without looking at the screen.

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References