Interactive Storytelling: Interacting with People, Environment, and Technology

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ABSTRACT
Stories are an important part of children’s social and cognitive development and are an integral part of their lives. In this paper, we share a short synopsis of Mobile Stories, one of the narrative systems we have developed with and for children. We also share lessons we have learned while designing, developing, and evaluating Mobile Stories. In designing and developing narrative systems for children, we advocate iterative co-design (specifically Cooperative Inquiry). It is also important to encourage and enable creativity, interactivity with the environment via movement and mobility, and interactivity between users. When evaluating interactive storytelling systems one should consider the different story tasks of reading, creating, and sharing.

Categories and Subject Descriptors
H.5.3 [Group and Organization Interfaces]: Collaborative computing; H.5.2 [User Interfaces]: Interaction styles, prototyping, user-centered design.

General Terms
Design, Experimentation, Human Factors

Keywords
Children, mobile devices, collaboration, collaborative configurations, constructionism, narrative systems, stories, user interfaces

INTRODUCTION
Narrative systems have the potential to impact children because of the important role stories play in children’s lives and how stories can facilitate learning [9]. In designing our most recent interactive narrative systems, we have focused on interactions not only between technology and a child, but also the interactions between children and their environment, as well as children and other people (e.g. friends or parents). We focus on mobility for two reasons: (1) children are highly mobile, and (2) to encourage technology usage that promotes activity (instead of many technologies that encourage sedentary activities). In the remainder of this paper we give a high-level overview of Mobile Stories, a narrative system which allows children to read, create, and share stories on mobile devices. We then share some lessons learned in the design, development, and evaluation of the system; and conclude with some comments on next steps.

MOBILE STORIES
Mobile Stories is an application designed for mobile devices that children (ages 6-10) can use to create a shared narrative. By “shared narrative”, we mean there is one story that all participants are working on together. Children can influence the narrative by adding or modifying pages which can each include multimedia content: words, pictures, and sound. Story data is synchronized across all devices so all participating children have the same version of the story. Mobile Stories is designed to encourage children to interact with others and their environment (Figure 1). Narratives can be fictional, or represent a shared understanding of a location the children are exploring (Figure 1).

Figure 1. Children using mobile stories: left, indoors in a lab setting; right, outdoors in a U.S. National Park.

From the outset, Mobile Stories was designed to support collaboration. The theoretical foundations for this approach are found in Papert’s constructionism and his predecessors, Piaget and Vygotsky [10]. Our primary concern was to promote collaboration through an elaboration process centered on a public, shared artifact.
From early explorations in our design, we learned we needed to better support collocated collaborations – to support children as they came together to work together. We addressed this issue with our intergenerational design team and the ideas of content splitting and space sharing emerged (see Figure 2). In content splitting media is split onto different devices such as the picture on one device and the words on another (see Figure 2, middle). In space sharing, items are shared across both devices such as the picture being enlarged and shown across both devices see Figure 2, right).

![Collaborative configurations](image)

**Figure 2. Collaborative configurations:** *left, a single page from a book with a picture and words on one device; middle: content splitting, two devices showing the same page (one device has the picture, the other, the words); right: space sharing, two devices showing the same picture on a page spread across both devices.*

Our decision to focus on supporting collaboration illustrates our belief that interactive storytelling is not only a solitary activity, but is also about interacting with other individuals.

**LESSONS LEARNED**

Below we detail some of the lessons learned pertaining to the design, development, and evaluation of the narrative systems we have developed including Mobile Stories. We briefly describe each and offer some support via a short example of each item.

**Design and Development**

**Give Children a Voice**

While many designers seek to address the needs of their users, we employ the Cooperative Inquiry method [4], which we believe gives children a voice in the design throughout the design process. Children are full, collaborative design partners with adults on the team. Each respects each other’s ideas, together they elaborate on one another’s ideas creating new concepts and technologies that are innovative and truly collaborative. We feel that by continually incorporating the voice of children in the design process, the final design is improved.

**Iterative Design**

In taking a co-design approach we also follow an iterative approach. Design processes are generally iterative in nature. However, unique to Cooperative Inquiry is that we work with the same child design partners throughout the iterative design process so that the children become true members of the team and have a sustained voice throughout the design process.

In designing and developing Mobile Stories, we iterated several times with the full design team (children and adults) using low-tech prototypes that included cardboard and paper cutouts. We also involved the team as the design progressed from low- to mid/high-tech development. One notable development was that initial investigations provided little support for collocated interactions. However, after iterating and using the mid-tech prototypes it became more and more apparent we needed to better address this need, which we addressed via Cooperative Inquiry techniques leading to the design and development of the collaborative configurations mentioned briefly in the previous section.

**Encourage Creativity**

In our own experience, we have witnessed how children are engaged and energized by the prospect of creating something. In one of our recent studies where children read, created, and shared stories (see more discussion of this below in the evaluation section, or in [5]), all participants noted that the creation portion was most engaging. In fact, none of the participants wanted to stop after the allotted fifteen minutes for creating stories, and some of the participants even offered to trade their Nintendo DS systems if they could take home Mobile Stories to finish their stories and create more stories at home [5, 6]. We attribute this positive reaction in large part to the power of encouraging and enabling creativity.

**Encourage Interactivity with the Environment via Movement and Mobility**

Some devices targeted for children are advertised as being portable or mobile. We feel it is necessary to infuse mobility into the purpose of the system, so that the system mobility is not just an ancillary feature, but rather that children are encouraged to move when using the system. While some narrative systems encourage interacting with physical objects [1, 2, 7], we feel it is important to allow and encourage children to move about on a larger scale so they can interact with stories when and where they are.

**Encourage Person-to-Person Interactivity and Collaboration**

Previous work demonstrated how technology can promote collaboration [3]. Mobile Stories allows users to work together and elaborate on one another’s ideas. The collocated collaborative configurations (illustrated in Figure 2) explicitly facilitate working with collaborators. This collaborative process not only is socially and cognitively appropriate for children [11], but it also helps children connect with one another or with whomever they are sharing the story [8]. In Mobile Stories, the children involved as participants in the evaluation were generally already friends, and we did not specifically look at how their use of Mobile Stories affected their personal relationship, however, it was noticeable that most children enjoyed the activity with one another – especially the story creation portion.

**Evaluation**

In terms of evaluation we have learned that it is imperative to analyze narrative systems using from the perspective of each task and have found a mixed-method approach to be
effective. To illustrate this, below we share some data from a recent study of 26 children who were paired to collaboratively read, create, and share stories. Details of this study can be found in the dissertation [5].

**Analyze by Task: Reading, Creating, and Sharing**

While this idea follows the general usability principle of evaluating the effectiveness of a system by user task, in narrative systems there can be a blending of these tasks as children elaborate on one another’s stories. In the past we have broken up these tasks explicitly and have found interesting user interface differences for each. For example in [6] we observed that children moved more when they created more content. We also noted that children effectively used the collaborative configurations (described briefly above) for reading and sharing stories, but did not while creating stories even though they verbally coordinated collaborative strategies that were explicitly supported by the collaborative configurations (e.g. “You take the pictures, I’ll write the words.”; “You work on the next page while I work on this one”).

**Use Mixed Methods Analysis**

While we advocate a mixed methods approach, it is important to note that this kind of evaluation requires more resources than a controlled, quantitative study. The primary additional requisite resource is time. Despite this added cost, we identify two reasons for using mixed methods analysis. First is that metrics for evaluating collaboration and narrative construction are not as easily quantifiable as measuring temperature or barometric pressure. Second is that multiple perspectives such as users’ impressions and qualitatively analyzing their actions and interactions allows researchers to triangulate and corroborate findings, thereby strengthening them. For example, when evaluating the collaborative configurations illustrated in Figure 1, using our mixed methods analysis we were able to identify an overall preference for the content splitting configuration using multiple qualitative metrics. Our rich qualitative data enabled unveiling user preferences as to when they would use each configuration [5].

**CONCLUSION & NEXT STEPS**

In the previous section we presented lessons we have learned, and stances that we have taken which we have attempted to briefly justify. As noted in the call, we need larger scale studies to demonstrate these benefits and the practicality of these systems in full-scale, real-world settings. Currently, the first author is pursuing a larger-scale study where many children will share multimedia ideas, concepts, and stories pertaining to geographical locations within a national park.

Interacting with technology can be not only engaging, but we believe that the proper use of technology can encourage mobility, exploration, and collaboration. Thus the interactivity in storytelling is not just between a single child and an electronic device, but more importantly encourages interactions between people and their environments.

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**REFERENCES**


