Collaborative storytelling as a tool for participatory design with children

Gregory Wilson
Computer Science Department
Virginia Tech
Blacksburg, VA 24060 USA
mrwilson@vt.edu

D. Scott McCrickard
Computer Science Department
Virginia Tech
Blacksburg, VA 24060 USA
mccricks@cs.vt.edu

ABSTRACT
As technology becomes more integrated into children’s lives, designers and researchers have been investigating how children can brainstorm about new uses for the technology. We hypothesize that children can be encouraged to think creatively about new technologies when given the appropriate framework and artifacts. We present an approach in which storyboards are used as a container for image artifacts to foster collaboration and communication through the activity and also to allow for idea reuse among designs. While storyboards could be viewed as a barrier to design, their role in a storytelling activity could prove beneficial in encouraging speculative and creative thoughts about design among children. This paper introduces an activity that uses image artifacts and drawings, similar to storytelling and comic books, for teaching design and introducing new technology to middle school students.

Categories and Subject Descriptors

General Terms
Design

Keywords
Storyboarding, storytelling, participatory design, children, comic books

INTRODUCTION
The biggest beneficiaries of the rise of technology in the information age are today’s children. Children not only use computers at school and home, they have access to other technological devices (e.g., iPods, cellphones, and cameras) for daily use. Teachers are beginning to integrate technology more in their lesson plans while museums as well as other places geared towards children are starting to use more technology to attract children. As designers continue to create technology for children, they have begun including children in the design process [5]. This participatory design allows children to have a say in technology that will be created for them, ensuring that the design meets their needs. Children are seen as partners towards the design solution and communicate with the adult team members throughout the entire process [5]. Using children as design partners not only benefits designers but the children learn collaboration skills, project/goal oriented attitudes, and the capability of reflection and critical thinking [5].

Storyboarding emerges as a promising tool for storytelling because it provides structure and allows the children to give purpose to each panel making for a stronger story. This technique can be a creative tool for introducing children to design. This position paper will discuss why designing with children is important, and how storytelling can be a beneficial tool for participatory design with children. We seek to use designing comic books as a way to overcome the cognitive load that children often encounter when storyboarding. Designing comic books provides the structure and boundaries that are needed in participatory design while also still allowing children to be creative.

DESIGNING WITH CHILDREN
Storytelling is an important communication tool that children acquire early and develop throughout childhood [4]. Storytelling helps developing skills such as innovation, creativity, problem solving, communication and collaboration which are key to prepare children for the future [6]. Exposure to technology and design is needed at an early age as well, in order to spark interest. Children participating in design activities benefit from learning how to collaborate with others as well as using creative ideas to solve a given problem. By tackling a design problem, children can be introduced to technological concepts that other subjects taught in school would not be able to provide. Collaborative storytelling inspires children to tell a creative story of how a design solution can be implemented. This type of tool can establish children not just as users of products but as able to “participate in shaping their future and become contributors to novel and creative applications” [5].

Storyboarding with children
Storyboarding is a type of collaborative storytelling tool that is a creative and fun activity that occurs early in design. Storyboarding can be beneficial to the designers trying to express their ideas and to other stakeholders who wish to understand how a system will function [6]. This fact makes it highly attractive to use when designing with
children. The low cost and maintenance of creating storyboards make it an ideal tool to use. Storyboards are created as a collaborative effort and should give anyone viewing them an increased knowledge of the design space for a proposed system and relevant ideas that can be implemented in a prototyping stage. Concepts that should be considered when constructing a storyboard include: level of detail, inclusion of text, inclusion of people and emotion, number of frames, and portrayal of time [6]. Using storyboarding can allow a child to think outside the box in a way that other physical artifacts would not allow. Misinterpreting pictures can lead to new creative ideas.

**Drawbacks to storyboarding**

The biggest drawback that children find when they are storyboarding is the intimidation caused by starting out with empty panels [8]. Children are often left confused and frustrated because of the open endedness that storyboarding creates. Children (and in some cases adults) have trouble deciding what to draw or are reluctant to draw because they are not skilled in drawing. There is also a cognitive barrier that children encounter while brainstorming [8]. Katterfeldt et. al. [7] used a concept called reserve storyboarding that involved creating a storyboard by capturing pictures of children acting out a design scenario. Although annotations or artifacts could be added to the pictures later, this eliminated the need for the children to create their own drawings.

**DESIGN INSPIRED COMIC BOOKS**

Comic books are similar to storyboards because they communicate ideas and/or stories by means of words and pictures that involve the movement of images (e.g. people, objects) through space [3]. Artifacts chosen in comic books are important because the success or failure of communicating ideas through comic books depends upon the ease with which the reader recognizes the meaning and impact of the image [3]. Moraveji et. al. [8] introduced the concept of comicboarding to address the drawbacks to storyboarding. Comic books were created in the 1930s and combine images and text in a creative outlet. The children are given an existing story and are expected to add to it rather than create a new story from scratch. Participants also have the option of having an available artist draw their ideas for them or they can draw characters themselves. Children are familiar with comic books and would be motivated and inspired by creating them. With comicboarding, the artist leads the activity of creating the comic panel, which allows the children to narrate their ideas while the artist draws them. This creates a more enjoyable experience with the children. The researchers also introduced a concept called magicboarding where the artist was placed in another room and a “Wizard of Oz” effect was implemented in which the children could command an object to be drawn and it would appear on the comic, creating a “magical” effect. Comicboarding addresses the drawbacks to storyboarding with children by taking away the burden of creating drawing themselves.

Creating comic books could be essential when designing with children as long as it is paired with the correct activity. Comics can be an effective design centric artifact because it communicates in a “language” that relies on a visual experience common to both the creators and their viewers [7]. This concept is important in using children as codesigners because there can often be a comprehension barrier between children and adults when the communication is done through verbal means. Hopefully, the idea of creating a comic book would excite the children and remove the burden of solving a design problem. This type of activity could be used as an effective low-tech prototyping tool that would allow children to overcome frustrations with creating initial ideas and iterate on their initial designs. Let’s examine an example of an activity that allows children to not have to start with empty storyboard panels, but also doesn’t have the image artifacts already set in place.

**OUR ACTIVITY**

We have designed an activity that uses pre-designed images in the creation of the comic books. The children will be given a design problem that they have to work together to solve. Because the design problems are based on situations that the children have likely encountered, they will already be familiar with the needs of the intended user. An example of a design problem is: “Design a notification system that would remind a student that he has homework due the next day.”

For our initial design, we used the software application “Comic Life” for creation of the comic book. Comic Life has an easy to use drag-and-drop interface that will be
Table 1: Structure of design comic books

<table>
<thead>
<tr>
<th>Number of Panels</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>Introduce setting, character(s), and design problem.</td>
</tr>
<tr>
<td>2-4</td>
<td>Design implementation, Introduce technology, Show interaction between characters and technology</td>
</tr>
<tr>
<td>1-3</td>
<td>Final result of using technology; Reaction of intended user</td>
</tr>
</tbody>
</table>

The children are expected to choose artifacts from folders labeled characters, settings, objects, and wearable interfaces that were already provided to construct the story. The children are people that benefit from the design solution and interact with the interfaces. The children may also add other characters that they think contribute to a more complete story. Adding characters allows the children to include persona artifacts in their comic book. Personas are stakeholders’ representations of people impacted by the interface under development. Personas have been known to inspire designers because it gateways for a particular user that they are designing for and they will care more about that particular person than an entire user group. We foresee the children modeling the users after themselves since the design problems are geared towards children. Personas will not hinder the design process because facts about the persona would be defined in the design problem. There will also be images of specific body parts (e.g., hand, nose, head) to be used when the children want to highlight certain wearable interfaces or interactions.

The settings will be places where the design solution is desired and where any interaction will take place. Settings only need to be established in the first panel which places the focus more on the user’s interaction with the system [8]. The objects will be other artifacts that may benefit from the design solution or that the characters may interact with (e.g., books, chalkboard). The children will get an idea of what type of characters, settings, and objects may be needed from reading the design problem, but they are free to use whichever images they see fit.

The children also have the option to create new drawings if they desire. Especially with the wearable interfaces, we do not want to limit the children to only the wearable interfaces that are in the image set. We expect the children to combine ideas for interfaces and essentially create new ones. These drawings will become new images that will be added to the image bank to allow the images to be reused in later activities. An example of a final product is shown in Figure 1. Prior knowledge of wearable interfaces through previously guided activities (that we are not able to elaborate on in paper) will help influence the children when creating new interactions.

**Structure**

Although we want the children to be creative and design a detailed comic book, we still want to place boundaries on the length of the comic to maintain focus while still allowing the opportunity for more in-depth designs. We also give specific purpose to each panel. Inspired by the basic structure of a comic book [2], we have designed a 5-10 panel structure that we envision being followed when designing the comic books as shown in Table 1. The children can place up to five panels on a single page. We also encourage the children to make panels with important interactions within the comic book a larger size than others. The bigger the size the more important the interaction is. Such important panels should stand out and catch a reader’s eye. This is taken from a comic book concept that states that the larger the panel, the longer a reader’s eye will linger on a specific part [9]. Bigger panels are also needed when there is a change in mood, theme, tone, or setting. The children will engage in conceptual design for the middle part of the comic book panels. The children have to think about how the user will learn about how the system is intended to be used. Conceptual design is constructed from the user’s point of view, which allows the children to take on the perspective of the created personas. The middle panels also involve the use of interaction design. The children have to focus on how the user will interact with the technology they decide to implement for the design solution. Implementing these types of design concepts will allow the children to learn the diverse types of design methods and use them when deciding on their design solution. This activity allows participants to communicate on the design issue and collaborate in creative and inspiring ways. At the end of the activity, the children will have a complete comic book implementing their design solution, making for an enjoyable experience. It would also get them interested in technology and promote more children developing the desire to pursue technological careers. Lastly, it can benefit real designers to use children as co-designers.

**FUTURE WORK**

We first want to create a final set of images that will be available to use and decide on a storyboarding application to conduct the activity. Images used in our initial design of the system were pictures extracted from free-use application as second language (ESL) flash cards. A decision remains to be made on whether the types of images used are appropriate for middle school students or whether the children would consider the images too “cartoon-like”. Because this is a design of a comic book, these types of images may be suitable to use. We also have to be careful regarding the type of interface images that we make available for the students. We don’t want to force the children to use the interfaces in the way that they are intended to be used because this may hinder the generation
of new creative ideas. For example, if they are given a watch that is built for the hand, they may not attempt to create ideas where the watch is on the ankle. Next, we will conduct a user study on a group of students to measure the effectiveness of the activity. This activity will be introduced to a group of middle school students who are part of a computing club that meets once a week. After conducting the study, we will interview the children to get their feedback on the activity and what improvements we can make.

Since this activity is meant to be collaboration amongst the students, using a regular desktop or laptop setup may prove cumbersome for them to use for the activity. In this setup only one person could control the application at a given time, or if each student is given a laptop, it may result in independent work being done. This may create a breakdown in communication, which may cause some children not to get their ideas heard. We would like to investigate conducting this type of interface on a tabletop display. Rather than using Comic Life, a new application would be created to augment the affordances of using a collaborative tool. A tabletop interface will allow the children to have more manipulation of the images. The children would be able to share, copy, and edit images. The children will also be able to work on different parts of the comic book at the same time. This type of interface can allow for work on the comic book to be distributed among the children (e.g. one student works on parts of the comic books, others draw extra characters or interfaces that are needed). Using a tabletop system for collaborative storytelling has been reported as a successful storytelling tool [1]. We are currently designing card manipulation games for a tabletop system to investigate what interactions we could incorporate when implementing our activity on this type of system.

The key to receiving effective feedback when using children as design partners is to create an engaging activity that motivates them to participate and use their creativity to develop new technology. The more motivated the children are the better the design solutions will be.

CONCLUSION
Creating comic books is a fun and creative activity that can assist children in learning design and becoming design partners. It is an essential artifact in which images are used as inputs into design and the completed comic book can be used with designers that are designing for children. As children began to use more technology in their everyday lives, it is only natural that they will want contribute ideas to the types of systems that are made to benefit them. This activity will be a great way for children to collaborate with each other and have their ideas heard. This inspiration will hopefully create positive feelings toward technology and design for the children, which in return may influence them in their career paths later.

ACKNOWLEDGMENTS
I would like to thank Shahtab Wahid, Kim Gausepohl, Dan Tilden, and Curtis Wilkes for their insight on storyboarding and artifact manipulation. I would also like to thank Keith Manville, Jacob George, Kristen Whetstone, and DeMarcus Townsend for their work on building a tabletop display and designing applications.

REFERENCES
1.) X. Cao, et al., "Telling the whole story: anticipation, inspiration and reputation in a field deployment of TellTable," In the Proceedings of the 2010 ACM conference on Computer supported cooperative work, 2010.
4.) S. Engel, The Stories Children Tell: Making Sense of the Narratives of Childhood, 1995
5.) F. Garzotto, "Broadening children's involvement as design partners: from technology to "experience", In the Proceedings of the 7th international conference on Interaction design and children, 2008.