

Telling the Whole Story: Anticipation, Inspiration and Reputation in a Field Deployment of TellTable

Xiang Cao, Siân E. Lindley, John Helmes, Abigail Sellen

Microsoft Research Cambridge

7 J J Thomson Avenue, Cambridge CB3 0FB, United Kingdom

{xiangc, sianl, jhelmes, asellen}@microsoft.com

ABSTRACT

We present a field study of TellTable, a new storytelling system designed to support creativity and collaboration amongst children. The application was deployed on a multi-touch interactive table in the library of a primary school, where children could use it to create characters and scenery based on elements of the physical world (captured through photography) as well as through drawing. These could then be used to record a story which could be played back. TellTable allowed children to collaborate in devising stories that mixed the physical and the digital in creative ways and that could include themselves as characters. Additionally, the field deployment illustrated how children took inspiration from one another's stories, how they planned elements of their own tales before using the technology, and how the fact that stories could be accessed in the library led some to become well-known and popular within the school community. The real story here, we argue, needs to take into account all that happens within the wider context of use of this system.

Author Keywords

Storytelling, interactive tabletop, children, creativity, sharing, community, collaboration, play, field studies.

ACM Classification Keywords

H5.3. Group and Organization Interfaces: Computer-supported cooperative work.

General Terms

Design, Human Factors

INTRODUCTION

Storytelling is an important communication and learning activity in life, and a skill that is developed throughout childhood [9]. Furthermore, the fantasy play that underpins it is often collaborative, with friends developing ideas for plots together and suggesting possible characters to one another. The characters that populate these stories are inspired by personalities from many different sources, ranging from books to films to the internet, and from toys to objects in the home. Indeed, children often base stories

around their own toys, acting out voices or narrating their actions. However, it has been argued that where technology is concerned, computer-mediated toys offer insufficient support for the co-creation of stories. Technology for children tends to entertain, rather than serve as a source of inspiration for child-initiated creativity [e.g. 6].

We present a system called TellTable (Figure 1), which allows children to develop their own stories using elements created through photography of real-world objects and drawing. The system was designed to run on a multi-touch interactive table, in this case Microsoft Surface™, and as such has the potential to support collaboration in both the development of characters and in the telling of stories. It was our hope that TellTable would support creativity and self-expression amongst children, by allowing them to combine elements of the physical world with the digital, and by supporting them in sharing ideas.



Figure 1. TellTable being used in a school library.

However more importantly, through our deployment of TellTable in a school library we realised that the experience of using the technology to create stories was not limited to interaction around the table itself. As a shared object within the school community, TellTable became an archive for the stories and characters that were made during the field deployment. Some of these stories became well-known, and one even spawned a sequel and spin-off. Further, other people's stories became sources of inspiration, in terms of plot twists, characters and themes. Finally, such was the draw of TellTable, the development of ideas for potential stories sometimes began days before groups actually used the technology, with a subset of children developing characters, props and even, in one case, a script.

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

CSCW 2010, February 6–10, 2010, Savannah, Georgia, USA.

Copyright 2010 ACM 978-1-60558-795-0/10/02...\$10.00.

In this paper, we report how children collaborated in using TellTable to develop stories that mixed the physical and digital in creative ways, sometimes incorporating themselves as characters. But further, we hope to give a sense of the wider story surrounding the deployment of this technology, focusing in particular on how children prepared for their TellTable sessions, were inspired by stories created by others, and how some of these stories forged reputations. This study thus serves as a good example of how collaborative technologies find their place in a real community and how use and interaction is much more than that which happens locally with the device. As important are the activities that surround it, that lead up to it and follow it, and how a community of practice develops.

RELATED WORK

We have already alluded to an argument put forward by Cassell and Ryokai [6], that technology designed for children normally serves to entertain rather than to support child-driven creativity. However, within the field of HCI there has been a fair amount of work based around the notion of storytelling, from the appropriation of mobile applications [e.g. 17, 21] to computer programming [15]. Furthermore, a number of researchers have created bespoke systems designed to support storytelling as a creative activity. A good example of the latter is Cassell and Ryokai's own proposed system, StoryMat [6], which was developed to foster storytelling and collaborative play. StoryMat is a quilt-like play-mat that records voice and toy movements as a story is being told. Once finished, the mat selects a similar story to be re-told from an archive, with the aim of providing inspiration and an opportunity for mediated collaboration. Indeed, in testing StoryMat with children playing either alone or in pairs, it was found that children in both scenarios incorporated story elements and linguistic devices from the stories told by the mat.

The idea of mediated collaboration is an interesting one, and one that we will touch on later in this paper. However, StoryMat has inherent within it one important constraint: the storyteller must hold down a button on a toy rabbit while telling the story, thus creating the need to include it as a character. The StoryMat system is certainly not alone in this; many other systems also incorporate a specific character around which the story must unfold. Rosebud [11] requires a particular physical toy to act as an index to its stories, PETS [8] features a soft and huggable robot that acts out stories as children tell them, and PageCraft [4] incorporates sensor-tagged building blocks and shapes, the positions of which are reconstructed on-screen.

Other researchers have explored ways of bringing a more flexible range of objects into the experience of storytelling. For example, StoryRoom [18] was developed to allow children to create an interactive physical storytelling space, including the development of their own props, which could then be programmed using sensors and actuators. While this ambitious project was not always successful in facilitating a meaningful integration of technology into the resultant stories, other more recent attempts have fared better.

Notable here is Pogo [7], which allows objects (including oneself) to be captured using photography or video, augmented through drawing, and included within the story. Sounds and voices can also be incorporated, and the story can be recorded and played back.

Other systems also taking a flexible approach to the creation of story characters include Picture This! [22], a device which positions a children's toy as the camera person, Vuelta [14], which allows the creation of animated characters from real-world objects, and I/O Brush [20], which permits colours, textures and movements found in everyday objects to be 'picked up' and drawn with. The adaptability of drawing is also evident in Jabberstamp [19], which allows children to embed their voices and other ambient sounds into their drawings, and KidPad [1], which aims to encourage collaboration through the provision of extra features, such as additional colours, when children perform certain joint actions.

Focusing on the collaborative aspect of KidPad, difficulties were reported in getting children to perform these joint actions [1]. However, while KidPad was implemented using PCs with multiple mice, more recent attempts at stimulating cooperation are built around devices that are easier to share. For example, StoryTable [5] 'enforces' cooperation through the inclusion of multi-user actions at an interactive table, although the researchers do report having to play a rather active role in guiding the development of stories. Research into use of tabletops for more general learning activities suggests that multi-touch offers the advantage of allowing children to talk more about the activity in hand and less about turn-taking, when compared with single-touch [12]. However, coordination still needs to be managed, even if it is not made explicit in talk, and physical objects have been highlighted as one resource with which children can 'fight' for control [16]. Social behaviours such as these have been described as 'offline' interface actions [10], and are important not only in supporting collaboration, but also in planning and thinking of ideas before they are executed.

Our aim with TellTable was to develop a multi-touch system that freely supports collaboration, that can be used without guidance, and that does not place constraints on the use of props. It shares many elements with the systems already described: like StoryTable, it is an interactive multi-touch tabletop, like Pogo, photographs of real-world objects can be incorporated into a story, and like many of the above, elements can be drawn, photographed, and the story recorded and played back. Also important was that the application was sufficiently easy and robust to be deployed in the field. We wished to build on the existing literature, which has aided our understanding of how technology can be used to support storytelling, by looking at the ways in which such technologies might establish themselves in the context of a school. Previous field research has explored how surface technologies are adopted by school communities [e.g. 3], but not where storytelling is the focus. Consequently, we were interested to see how TellTable would be used when placed in a school library,

and wished to examine how behaviours such as mediated collaboration might emerge in the field. Before we describe this study, we will first detail the TellTable system.

TELLTABLE SYSTEM

Design Goals

TellTable is a system to support children in creatively composing and sharing stories on an interactive table. In designing the functionalities and interfaces of TellTable, we were guided by the following goals:

Keeping in touch with the physical: Instead of dragging children away from the physical world, we hoped to design a system that would encourage them to explore, discover and play with physical objects and environments, and to use their hands to directly create things on the table.

Enriching current practice: The activities supported by and interactions with the system were directly inspired by and designed to be consistent with the ways in which children currently create artefacts and tell stories. However, we additionally sought to provide increased possibilities for the process of storytelling.

Encouraging free expression: We aimed to allow children to freely express their imagination and to draw inspiration from unforeseen sources. Although it is inevitable that user activities will be to some extent shaped and structured by the system design (and indeed, the use of high-level constraints is thought to foster creativity [2]), we aimed to minimise additional restrictions by avoiding reliance on pre-produced content and predefined story structures.

Sharing and self-expression: Storytelling is inherently a social activity about expressing oneself and sharing ideas with others. We sought to encourage sharing of not only the stories but also of story elements such as characters and props, while preserving a sense of self-identity and ownership.

Playfulness, simplicity, and immediacy: With children as target users, we aimed to emphasise playfulness and simplicity in the design of both the software user interface and the physical devices. In addition, the system was designed to allow children to immediately create content without requiring sophisticated planning or construction.

System Description

TellTable was developed based on Microsoft Surface™, a commercially available multi-touch interactive table (Figure 1). The table is 55 cm in height, and the tabletop measures 108×69 cm, allowing several children to comfortably interact with it while sitting or standing.



Figure 2. System interfaces. (a) Make mode. (b) Tell mode.

The design of TellTable was an iterative one that involved in-house testing with children, and which is described in detail elsewhere [13]. Following this process of refining the interface, the resulting system consists of two interaction modes: ‘Make’ mode (Figure 2a), in which story elements can be created; and ‘Tell’ mode (Figure 2b), in which stories can be recorded and replayed. Children can switch between the two modes as often as they want.

Make Mode

In Make mode, children can create story elements either by using photos as raw materials or by creating drawings from scratch. For the latter, a blank canvas is generated by pressing the ‘Blank’ button on the tabletop. For the former, photos can be taken using either of two physical capture tools, onto which a camera module, which is linked to the table, can be magnetically attached (Figure 3). The choice of tools enables children to switch between different ways of capture as needed: the handheld tool allows them to freely move around while photographing various objects in the surrounding environment, while the situated tool, which also contains the microphone/speaker for story recording/replaying, can be positioned anywhere on the tabletop using a suction cup. The situated tool is especially useful for taking self-portraits, especially when several children are to be included in the photo. The tabletop displays a real-time software viewfinder to provide feedback when framing photos, and image capture is triggered by using physical buttons on the capture tools or by pressing one of two software buttons on the tabletop. The first of these buttons triggers immediate capture, while the second initiates a countdown before the photo is taken; again, this is helpful for the taking of self-portraits.

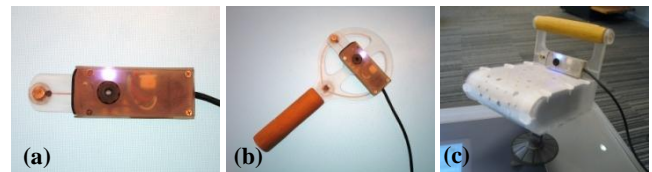


Figure 3. Capture tools.

(a) Camera module. (b) Handheld tool. (c) Situated tool.

After capture (Figure 4a), the photo becomes the starting point of a story element. Children can cut out unwanted parts of the photo by outlining the object/region of interest with their fingers (Figure 4b), and can also decorate and add new parts to it by finger drawing in a variety of colours (Figure 4c). Finger erasing is also supported. Additionally, different story elements, either photos or drawings, can be pasted together to compose new elements (Figure 4d). Children can switch between these actions of ‘cut’, ‘draw’, ‘erase’ and ‘paste’ by using interface buttons that are displayed beside each element, allowing them to be performed in any order, repeated as needed, or avoided altogether. As these actions are specific to each element, different elements can be worked on simultaneously, and all elements can also be manipulated using standard multi-touch operations including moving, rotating, and scaling. These lightweight and intuitive interactions allow children

to create a large variety of characters, props and scenery, limited only by their own imaginations.

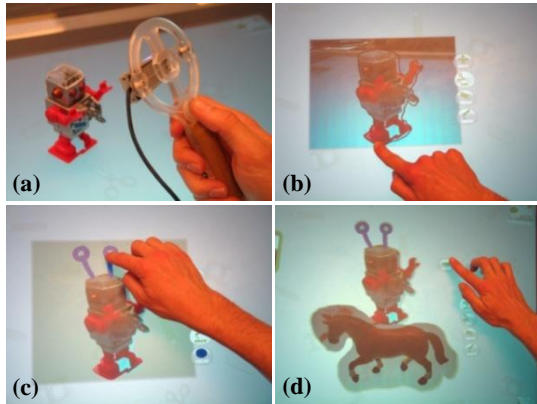


Figure 4. Making a story element. (a) Taking a photo of a physical object. (b) Cutting out the object. (c) Drawing on the object. (d) Pasting together with another object.

Depending on its intended usage in the story, the completed story element can be saved either as an object (a character or prop that can be manipulated) or a background (a picture that remains static as the underlying setting), by dragging it into the ‘objects box’ or ‘backgrounds box’, respectively (top-left and top-right in Figure 2a). By pressing on the relevant icon, a list of all saved objects or backgrounds can be opened, and a story element brought out for further editing before being saved again afterwards. Both the old and new versions of the element are kept, to ensure that nothing is lost and to encourage divergent creativity. This is especially important in a shared environment where children can access and reuse elements previously created by others. For the same reason, deletion of saved elements is not enabled in the interface, although children can discard unsaved elements by dragging them into the ‘waste bin’ (bottom-right in Figure 2a). System administrators can delete saved elements offline if necessary.

Tell Mode

After all story elements have been created, children can switch to Tell mode to tell and record their stories. Similar to when in Make mode, they can bring in saved story elements by selecting from the objects or backgrounds list. Once selected, the background covers the entire tabletop and replaces the previous one. Objects can be manipulated freely on the tabletop, but if needed they can also be pinned (and unpinned) to the background by double tapping on them, so that they remain static. Multiple clones of the same object can be brought in, a frequent ingredient of children’s story plots as we observed. Before telling the story, children can bring in and arrange story elements to set the stage, and when ready, press the Record button. At this point, the system asks the children who are telling the story to take an ‘autograph’ self-portrait photo using the capture tool. This photo, along with a screenshot of the initial stage setup, is used to generate the cover page that visually represents the story to be told (Figure 5), creating a sense of authorship.

Recording starts immediately after this autograph photo is taken. Children can manipulate the characters and props

using multi-touch operations (moving, rotating, and scaling), and simultaneously narrate the story or dub the characters using their own voices, in a manner similar to that in which they tell stories using toys. During the story, both objects and backgrounds can be brought in at anytime, allowing children to introduce new characters/props and seamlessly change scenes. An object can be dragged out across any side of the tabletop to make its exit. Both the movements of the story elements and the accompanying voices are recorded by the system to form the story. Children can press the Stop button to finish recording.



Figure 5. Cover page of a story titled ‘Chicken-Chi’.

By pressing the ‘Stories’ icon, children can open a list of all recorded stories, represented by their cover pages, and select a story to replay on the tabletop. The story can be paused or stopped during replay. A tutorial video demonstrating usage of the system can also be opened by pressing a specific button. Using screen-capture software, stories can be converted into video files offline, to be replayed on a normal computer.

Some special considerations were taken into account in the lower-level user interface design. For example, to emphasize playfulness and ease-of-use, interface buttons are large blobs with different distinct shapes and audio feedback. To avoid mode errors, Make mode is visually differentiated from Tell mode by a background containing graphics of crafting tools, as well as by different button layouts. Considering tabletop usage, all global interface buttons (e.g., mode switch, recording) are distributed on the short sides of the tabletop to reduce accidental triggering (e.g., by children’s sleeves), as most children approach the tabletop from the long sides. Furthermore, although element creation and manipulation can be conveniently done from any side of the table, we deliberately positioned and oriented the global interface buttons so that they are most easily operated from one particular long side. This was to support the notion that one child or one group of children would be in control of the activities at a time, with the aim of reducing conflict and confusion.

STUDY METHOD

TellTable was deployed in the library of a private primary school in the UK for just over two weeks (11 working days). The school has approximately 350 pupils, and these children had access to TellTable for 9 of their morning breaks and 8 of their lunchtimes during the deployment. Each of these periods was divided into Junior School (Grades 3 to 4) and Senior School (Grades 5 to 8) intervals

of 30 minutes each, so for every break it was typical to have at least two groups of children use the table, one Junior and one Senior. In addition to the children who used the table in their free time, an English teacher organised for their class of 16 pupils to use it across two lessons (in groups of 4). Altogether, 66 children used the table, comprising 32 boys and 34 girls. They were from Grades 3 to 8; denoting an age range from 7 to 13 years. Many others spectated while the system was being used.

The library was chosen as the location for TellTable because it was established as a focus of activity for all age groups and was a lively place full of toys as well as books. Some of these toys were placed in a cardboard box next to TellTable, to serve as an initial source of inspiration during storytelling. The library was run by a full-time librarian who was familiar with the children and, in the context of the school being a small one, knew their reading habits but also their personalities, friendships and extra-curricular interests. This was especially the case if they were, as she put it, “library children”. TellTable was positioned to the right of the librarian’s desk, in an area where there was sufficient space for children to gather around it and where it could attract attention without being intrusive; we did not want the library to become a room *for* TellTable. Children came to the library of their own accord to read or play during their break times, and could book time in advance to use the table through the librarian due to its popularity. The fact that the library was open to all made it an ideal place to observe emergent behaviours of the community, the kind that would not occur in a lab setting.

The location of TellTable also allowed the librarian to play a subtle part in guiding the children’s use of it; in particular she helped them to manage their time (e.g. by warning them that they had five minutes until lessons began) and made sure that those who had booked were indeed using the table (and that others were not muscling in). In addition to the librarian, who was almost always present, there was at least one researcher at the sessions; normally there were two. Our aim was to simply observe use of TellTable, but we also sometimes guided its use. Most commonly, we supplemented the librarian’s attempts to aid in time-management, and occasionally also gave some assistance on how to perform certain operations.

A final feature of the library worth mentioning is that it contained eight laptop computers at the back of the room, which were available for children to research on the internet for class projects. From the third day of the deployment we started to upload all of the stories that had been created to two of these laptops, so that they could be accessed by anyone using the library, even when TellTable was being used or was switched off. This also meant that the stories created would still be available after the TellTable deployment had ended. The tutorial video was also put on these laptops, so that children who were interested could watch it before using TellTable. A video camera was set up to record activities at the laptops, while a second camera recorded interactions around TellTable.

During the final two days of the deployment, we interviewed the librarian and nine of the groups of children who had used the table (for six of the groups, all members were present). These interviews took place at the table and began with us watching their story again together, followed by a number of semi-structured questions including how the children felt about TellTable, how they prepared for their slot, whether they watched any other groups, and if they had viewed their stories on the laptops afterwards. It had quickly become apparent during the deployment that interactions at the surface were only part of the story regarding usage of TellTable; evidence of preparation was manifest, as were indications of inspiration being drawn from the stories of others. Consequently, we also used the interviews to focus on activities that would not have been visible at the table, such as those pertaining to the formation of ideas and word-of-mouth.

The interviews were transcribed and examined along with the field notes for findings relating to planning, the process of working at the table, and reactions to stories. Some of the usage videos were also examined so that we might better understand signs of preparation, responses to stories when played back, and the management of collaboration around the interface. Findings relating to three aspects of the usage (before, during and after) were categorized for subthemes, allowing us to explore similarities and differences in the ways that the children prepared for and used the table, and what they thought of their experience.

THE EXPERIENCE OF USING TELLTABLE

In total, 31 unique complete stories were created during the field deployment. As part of this process, 195 objects were created along with 50 background scenes. The general impression of the system was overwhelmingly positive, with all of the children reporting that they had enjoyed using the table: “*I wish I had this at home*”. Here we will consider three reasons as to why these children found the experience of using TellTable so compelling. Our observations of the deployment along with the feedback we gained through our interviews suggest that it fostered creativity, allowed children to incorporate themselves into their stories, and supported social interaction.

Fostering Creativity

The field trial indicated that TellTable afforded a good deal of flexibility in the creation and telling of stories, while retaining an important degree of simplicity in use. Comments included, “*I felt it was quite free-style, making, creating stories*”, and “*Literally you can do anything you like*”, attesting to our design goal of encouraging free expression. Children relied upon drawing and photography to create both objects and backgrounds, and were also successful in combining the two. Photos alleviated the burden of drawing but also allowed children to draw inspiration from the physical world and incorporate it into the digital world they were creating. On the other hand, drawing could be used to create imaginary characters and scenery that could not be photographed, and augment content created from photos. Objects that served as subjects

for photos included toys, both from the cardboard box and from around and outside of the library, pictures in books, and other features of the library environment (see Figure 6 for an example of children photographing a range of objects, Figure 7a for a background made from a photo of the library so that the story seemed to happen *in situ*, and Figure 7b for a background drawn over a close-up photo of a red chair seat, which is used as a base colour). Often objects were photographed to become a similar object within the story. For example, the library's 'Eddie the teddy' (Figure 8a) was used because other children would recognise him, while some feathered birds were repeatedly photographed and modified by various groups to become different characters in various stories (Figure 8b).



Figure 6. Various objects being photographed by the children.

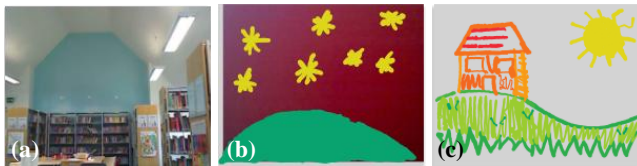


Figure 7. Story backgrounds created by children.

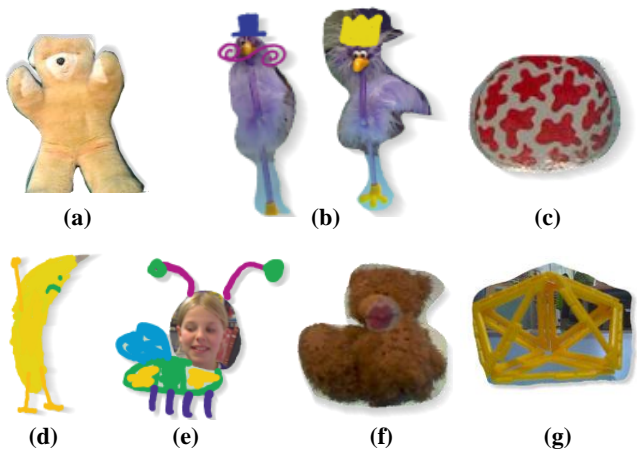


Figure 8. Story characters and objects created by children.

In other cases, photos were repurposed to become something altogether different. The top of a mushroom photographed from a book was used as a "spotty" egg in one story (Figure 8c), and the library carpet became some textured "grassland". In another example, a photo was used to create a colour not available in the colour palette. Here, a group of boys who were drawing a banana took a photograph of something brown so as to trim it and turn it

into the banana's brown tip (Figure 8d). These examples of usage of real-world objects substantiate our design goal of incorporating physical elements into the creation of stories.

Incorporating Identity

As mentioned above, children enjoyed the flexibility permitted by being able to combine photography and drawing. This was often undertaken as a way of placing themselves within stories, most typically by photographing their own faces and then drawing themselves a new body (39% of the characters created featured children's faces, see Figure 8e for an example). The possibility of creating characters to reflect themselves was appealing: "*As much as I love creating ... stories, I love to be in them as well*" (Grade 5 boy). Where this occurred, children often took on the role of editing (when in Make mode) and controlling (when in Tell mode) their own character, "*If you are in the story then you do your own character then somebody else does theirs*" (Grade 6 girl), and the characters in question often took on their names. This was seen as being very funny because "*you can laugh at each other*", and "*because you can include your friends and make them do silly things*" (Grade 6 girl). Furthermore, including yourself in a story became a way to broadcast your identity to other pupils in the school; as one Grade 5 boy related, "*And the best thing is everybody recognises you when you do the story*".

Another way of incorporating and broadcasting identity was through the use of voice. The children often reacted with great amusement on hearing themselves while replaying their stories, and would adopt various voices for different characters during the telling. This sometimes led them to adopt particular storylines, or to take on particular roles. One group of Grade 4 girls created some "lovey-dovey" characters, seemingly motivated by their aptitude for doing the appropriate "silly voices". In this case a lovey-dovey teddy bear was made even more lovey-dovey, by having one of the girl's pouting lips pasted to his face (Figure 8f). Other children also felt that TellTable compared favourably to other ways of creating stories, with one saying, "*Well I much prefer this because you can actually, you actually have different voices*" (the Grade 8 boy in question was comparing TellTable to Microsoft PowerPoint, which he used to create silent slideshow-based stories).

Supporting Social Interaction and Collaboration

The timeframe of the deployment, combined with TellTable's popularity, meant that access to it was somewhat limited. Partly because of this, but also because they were keen to use TellTable with their friends, children tended to sign up to use it together. This meant that they had to collaborate during the creation and telling of their stories, an activity that they undertook with varying degrees of success. While periods of focused and orderly collaboration were evident in most groups, so too were intervals where too many children were trying to do too many things at once. This often led to groups quickly adopting a turn-taking strategy, especially when creating objects and characters. One group of Grade 4 girls explained: "*So [O] takes a picture and I cut, then I took a*

picture and [E] cuts". Cutting in particular could easily go wrong if too many people were touching the interface, leading some groups to carefully manage this activity, making comments such as, "*Only one person touches at a time*", and "*Nobody touch the board*". If groups were unable to manage turn-taking evenly, there was the potential for children to dominate during these activities.

Attempts to take over were obvious when we were observing use of TellTable, and in some of the groups there were clear examples of children bossing others around when selecting which ideas to use in the story, choosing what to photograph or draw, and deciding whether to keep objects that had been created. The nature of the multi-touch interface meant that children could modify objects that their fellow group members were working on, and even discard them. In one example of playful disruptiveness, a Grade 3 boy repeatedly switched modes, opened and closed the object box, took photos so that they would appear on and obscure the display, and generally got in the way of the activities of his two friends. Interestingly, this kind of hindrance became part of the fun of using the table, for this (admittedly rather rowdy) group at least, and seemed more typical amongst younger children in general.

For most groups though, turn-taking was much less boisterous, and as already noted, was adopted during cutting in particular. Simultaneous use of the table was also evident, especially during tasks such as the drawing of backgrounds and filling in of blocks of colour (e.g., "*We can both do some grass*"). Indeed, it was often quicker for the groups to use the table in this way when drawing large pictures. The taking of photos also worked best when done as a collaborative activity. The placement of the viewfinder on the table meant that often within a group, one child would be the subject of the photo, one child would hold up the handheld capturing tool, and one would look at the viewfinder on the screen and tell them when to take the shot. However, we did wonder, especially within groups where it was obvious that one child had been fairly dominant, whether some of the participants would have preferred to use the table alone. Indeed, we saw plenty of examples of children moving one another's hands out of the way, or forcefully guiding each other to action.

When exploring this during the interviews however, there was unanimous agreement that TellTable was most fun when used with others. These statements were further supported by the observation that children who did in fact get the opportunity to use the table alone preferred to wait for others, or explicitly recruited partners at short notice. It seems that creating and telling stories with the table was seen as analogous to playing with friends, and the possibility of having to compete to interact with the table did not seem to detract from this. One group of Grade 5 boys even noted that "*when we were arguing we come up with interesting ideas*", and the variety of ideas generated was perhaps the most frequently given reason for the benefits of using the table with others. Having friends to work with also made it easier to control multiple characters

when telling the story, and meant that there were more voices and potentially more faces to be incorporated into it. Finally, working with others meant that the experience was shared. As one child commented, "*You can share all the fun and laughter with somebody. It makes it much better than just doing it by yourself*" (Grade 5 boy).

Having completed a story there was normally a sense afterwards that everyone had played a role. This was perhaps encouraged by the activity of telling the story, which despite taking up a minority of the timeslot (often only the final five minutes), tended to involve everyone and gave a sense that "*everyone got an equal part*" (Grade 5 boy). When telling the story, children took on roles as narrators, as being responsible for manipulating certain objects or characters, and as acting out character voices. These roles were sometimes assigned explicitly beforehand and sometimes emerged spontaneously, however the narrator was often also the child who had been most involved in developing the plot. During storytelling, the children seemed to explicitly adopt strategies to involve everyone, for example by making sure that every group member was photographed and incorporated into a character, or by accommodating preferences in other ways:

"[S] ... didn't really want to put a face [to a character], so we made him be a narrator, well we didn't make him, but asked him to."

"He wanted to be the narrator."

"But he moved around the teddy I think." (Grade 5 boys)

Some children did express a preference for using the table in smaller groups, for example of two or three members, as a way to limit competition and interference. Nonetheless, it is interesting to note that the design of TellTable did not specifically encourage [cf. 1] or enforce [cf. 5] collaboration, yet children still wanted to use it together.

THE WIDER STORY

If this had been a simple usability trial, the focus of our deployment would have been solely on the activities that unfolded at the TellTable interface. Indeed, and as already noted, much of the work that has explored the design of storytelling technologies for children has, unsurprisingly, focused on the activities of creating stories and narrating them; evaluations of such systems have often been located in usability labs or undertaken over very short timescales. As our field deployment progressed, we became increasingly interested in the way that children and teachers alike oriented to TellTable, how it gained a reputation within the school, how certain stories became well-known, and how members of the school community, other than the "library children", started to visit the library. We also grew to appreciate the fact that the work that went into creating stories sometimes began days before the children actually got to use the table, and their involvement often continued after their session. In this section, we wish to focus on the anticipatory activities that preceded children's use of the table and the wider activities that surrounded its placement within the school library.

Anticipation and Planning

The fact that TellTable would be available in the library had been mentioned at the school assembly the week before the deployment began. In addition to this, word seemed to quickly spread from children who used or saw it in the library early on in the study. Consequently, there was a good deal of enthusiasm surrounding the field trial. It is worth emphasising now that not all children prepared for their session, with some showing no indication of forethought regarding what kind of story they would like to create before they arrived for their scheduled slot. In these cases the resultant stories were often rather rambling, and seemed to sit somewhere between narrative and straightforward play. This is not surprising given that immediacy of creation was one of our design goals; we had aimed to support this type of activity. However, other children looked forward to their session with great anticipation, with one Grade 5 boy commenting, “*Ever since I booked it on Friday, I was wondering what kind of story I should make*”, and at the extreme end of this scale, a Grade 7 boy arrived with a pre-prepared script on which to base his narrative. In most cases though, children showed some signs of planning, mixed in with improvisation.

The most transparent evidence of preparation could be seen when children brought in objects from home to be included in their story. Examples included images that had been found online and printed off, toy horses, and an array of Lego characters. In the latter example, a boy was hoping to use a Lego man, the top half of a Lego man, and a toy car to create a story featuring a car crash. In this case, the boy’s group members did not agree to the proposed plot, but other examples of planning featured more obvious collaboration. As the librarian reported, “*We’ve had [I] doing research, taking pictures off the internet, copying them, they had to be in colour, and there’s a whole day beforehand he was really working on that with [J]*”. Here, a pair of Grade 7 boys put a good deal of effort into developing an idea for their story, working together and also involving the librarian in helping them to print off the pictures they wished to include.

In addition to printing off images to be photographed and included in their stories, there was also an example of children creating physical artefacts to be used as props. In this case, a set of triangles that can be connected were used to make some houses: “*I found that I’d made one house with gaps in the walls and one without, and then I thought well we could make a story using this because one person could be unhappy with their house*” (Grade 8 boy). This was used to inspire a story of a rich man and a poor man, one of whom had a house with holes in the walls (Figure 8g). In one final example of interest, a group of three girls in Grade 6 used the table to retell a story that they had previously created on paper in illustrated form. Here, it was interesting to see how the roles that had been assigned in the production of the pen-and-paper version of the story changed when TellTable was used as their medium for storytelling. Although the story was pre-planned and the attributed roles of the girls had been rather fixed in the

paper version, when using TellTable the plot evolved during the process of storytelling:

“You think ‘Oh gosh, what do I say now?’ and just make something up really.”

“Sometimes it comes out really good.”

Less tangible examples of planning could be perceived in the way that children arrived at the table with a pre-formed idea of their plot, talking about the characters and props that they would need, but without having already prepared them. In these cases, children would immediately set to creating these objects in a manner that suggested that the decision-making and negotiation had already been performed. For example, one group of Grade 5 boys had decided on telling the story of a Quidditch match prior to arriving for their slot: “*They said let’s do a football match and I thought it’s quite simple, so I suggested how about Harry Potter because I read all the Harry Potters a lot*”. Their behaviour offered a contrast to instances in which fundamental decisions about the plot were taken at the table, being inspired by nearby objects or influenced by suggestions from spectators.

It is worth noting that both planning and improvisation were valued by the children. One Grade 8 boy, who saw the story being told from a script, commented, “*I thought that was good, then he wouldn’t have to make anything up*”. However, other children felt that improvisation was “*much more fun, because then you get to act out the scenes spontaneously, on the spur of the moment*” (Grade 5 boy). Finally, and as implied in our observations of the boy who had prepared a Lego car-crash story, not all plans were realised. In one case, three Grade 3 girls spent three days playing with toys in library before their turn with the table, purportedly planning their story, but when their turn did come they seemed to improvise entirely.

Inspiration from Other Stories

The frequent incorporation of library toys and books points to the fact that few stories (perhaps only one or two) were planned in their entirety before they were created. However, while some children perhaps became overly focused on the objects around them as a source of inspiration, other resources were also used. As we have seen, inspiration was found in activities such as playing with toys (the serendipitous creation of two houses, one with holes in the walls), in novels (such as the Harry Potter series), in films, and in real life (in one example, the main character was a chicken named Eric, the storyteller’s real-world pet, who undertook a martial art entitled Chicken-Chi, inspired by the film ‘Crouching Tiger, Hidden Dragon’). The Chicken-Chi story (Figure 5) later became the favourite of a Grade 5 boy who could often be found around TellTable, and it went on to inspire him when he created his own story about karate masters fighting a teddy: “*I thought because we have the chicken and the fox in there [in Chicken-Chi] as well so I thought it would be much wackier if we defeated a teddy*”. Indeed, both stories featured martial arts, interesting background changes, and a similar structure. This was not the only example of children being inspired by one another’s work.

In a rather more subtle example, the children who developed the Quidditch-based story reported being inspired by a twist in another group's tale. In this case, the group had not originally planned to include a twist, but thought the unexpected inclusion of it to be "*really good*" and "*really funny*". The boy who improvised the change had decided to bring back a character that had already died, announcing in a dramatic voice, "*And the bear came back!*" He later reported how he got this idea from a story that he had seen earlier, which also featured a character being unexpectedly reintroduced. In another instance, the boys who created the story about the rich and poor men's houses reported how another group had been inspired by the way they had indicated that one man was rich by drawing a wad of banknotes in his hand. The second group had also illustrated an important element of someone's character through what they were holding: "*I saw someone use our idea ... they said they copied our idea of that, but that's fine, it's good, if it helps them*". These examples resonate with the mediated collaboration described by Cassell and Ryokai [6], except in this case the system was not explicitly designed to encourage such behaviours; they simply evolved over the course of the field deployment.

Finally, children also directly reused story elements created by other groups. The background that was created for the Chicken-Chi story (Figure 7c) was a popular example of this, and characters that had been generated by other groups were also reused, sometimes after having been altered. In this way, the object box in the TellTable interface was an extension of the objects in the library, serving as a potential source of inspiration. Admittedly, recycled objects did not always inspire new ideas in the plot; sometimes they were incorporated simply because that particular object was "*just what we needed*", or because the group in question ran out of time: "*We realised we hadn't got this thing, we were recording it, so I took someone else's person from the story box, and that worked quite well*". However, there were occasional examples in which characters were recognised within the TellTable object box, were known by name (especially if they featured children's faces), and were incorporated into a story. These included Eddie the Teddy, who made an appearance in the Chicken-Chi spin-off, and other schoolchildren, who in one instance featured as a villain in another group's story. Finally, it is worth noting that the children were largely happy for their ideas to be borrowed by others. As one Grade 5 boy put it, "*They say copying or using it is the best form of flattery*".

These findings emphasise the fact that stories were not created within a vacuum. In many cases, children using the table had awaited their turn in anticipation, watched stories created by others, or seen groups create and tell their own tales. Additionally, all users of TellTable could see the objects and backgrounds that other children had made in previous sessions. However, what these findings also point to is the way that children knew about each other's stories in the context of the school community. We will finish our discussion of the findings by exploring how some stories gained reputations and how the table attracted spectators.

Reputation and Spectatorship

First of all, it is worth re-emphasising that TellTable was deployed in a small school, and in a location that was accessible to all and frequented by a subset of children in particular. As such, news of the table quickly travelled by word-of-mouth, and the number of children visiting the library increased during its deployment. Furthermore, not only was the table newsworthy, but so were the stories. The tales featuring Chicken-Chi and the rich and poor men in particular were very popular. They were frequently viewed on the laptops at the back of the library, with some children watching them repeatedly, and their creators were also aware of their growing reputations. Boys from both groups reported that the headmaster had seen their stories, and both wanted to create a sequel (in fact, a sequel to Chicken-Chi was produced). Finally, the children were aware of specific children who liked their stories, with one telling us, "*There's one boy in particular who is a big fan of ours*".

Indeed, some of the more enthusiastic children played an interesting role in the field trial, with one noteworthy individual becoming particularly knowledgeable about the stories that had been created, the people who had made them and the process of developing them. This boy often gave advice on how to use the table (even before he had had his own turn), recommended which stories to watch on the laptops, and felt that he had contributed during the creation of the Chicken-Chi sequel. Taking the latter point first, he was not the only child in the library to offer suggestions or even to try to start using the table when it was someone else's turn. Children who had either used the table before or who had seen it being used were often keen to give advice to those who were supposed to be creating a story. This was sometimes viewed as helpfulness, with some spectators even being photographed and incorporated into stories as characters. At other times, spectators were felt to be interfering, and on a couple of occasions adults had to step in to make sure that they did not take over. Children also reported the need to guard the table while creating their story, "*We didn't want to hog it like all to ourselves but we didn't want everyone else to do it*" (Grade 4 girl).

However, children did enjoy it when spectators gathered around to watch their newly created stories. One commented, "*I felt quite proud with lots of people watching our story*", and another said, "*It's just a really good feeling, you know, that people like what you've done*". Spectators were particularly drawn to the table when stories had just been recorded and were being played back, and the laptops also became a social hub during the field deployment. Children who had created stories returned to view them using the library laptops, and some did so repeatedly: "*You couldn't get bored with it*" (Grade 6 girl). Indeed, some of the children were extremely enthusiastic about their stories, as demonstrated by their ability to relate every plot detail back to us at interview. While watching them back, it was typical for children to comment on funny sections, provide background information, forecast what was about to happen, and highlight who was doing what ("*That was me*", "*I was controlling this*", "*That was [O] saying, 'Stop it, stop it!'*").

Of course, these children were also keen to show their stories to others and for other children to replay them (“If someone plays it back, I feel like oh, cool, they really like my story”), and some of the increase in numbers within the library might be attributed to children watching stories created by their friends. Finally, it is worth noting that the fact that the story would be recorded and could be replayed to others meant that some children took more care over their stories. As one said, “It makes you think a lot about how to plan new stories” (Grade 5 boy). Just as we expressed in our design goal, sharing and self-expression became a major driving factor of the children’s creations.

CONCLUSION

To sum up, we would like to reiterate how the experience of using TellTable told us something more than how it could be used to support storytelling activities amongst small groups of children. While we learned some interesting lessons regarding the ways in which children took inspiration from physical objects for their story characters, took turns (or not) while collaborating, and took pride in the stories they created, we also found the context in which TellTable was deployed to be a fundamental part of the field trial. Children enjoyed sharing the experience of telling and watching stories with their fellow group members, but stories also became a way for them to broadcast their identities within the school community, through being photographed, having their voices recorded, and having their stories saved on the library laptops.

It was evident too that the community surrounding the table, from the librarian to the most enduring spectators, played a role in ensuring the reputation of both the technology and the stories. The anticipation associated with using TellTable led some children to carefully plan their stories, crafting objects and deciding on ideas in advance. Indeed, some of the stories were said to be famous, to have fans, to be inspirational to other storytellers, and drew spectators as important as the headmaster. This is perhaps why the sequel to the Chicken-Chi story prompted the development of a script: this particular storyteller had a reputation to protect. In conclusion, the deployment of TellTable revealed something more than how we might use technology to support storytelling. It also highlighted the place of creativity and shared objects within the school community, illustrating how these acted as vehicles for broadcasting oneself, for inspiring others and for learning from peers.

ACKNOWLEDGEMENTS

We would like to thank King’s College School, Cambridge for accommodating us during our field deployment, the librarian Morag King for her tremendous help while we were running the study, and of course the children and their parents for permitting their participation.

REFERENCES

- Benford, S., Bederson, B.B., Åkesson, K.P., Bayon, V., Druin, A., Hansoon, P. et al. Designing storytelling technologies to encourage collaboration between young children. *CHI*, (2000), 556-563.
- Boden, M.A. *The Creative Mind*. Routledge, 2004.
- Brignull, H., Izadi, S., Fitzpatrick, G., Rogers, Y. & Rodden, T. The introduction of a shared interactive surface into a communal space. *CSCW*, (2004), 49-58.
- Budd, J., Madej, K., Stephens-Wells, J., de Jong, J., Katzur, E. & Mulligan, L. PageCraft: Learning in context. A tangible interactive storytelling platform to support early narrative development for young children. *IDC*, (2007), 97-100.
- Cappelletti, A., Gelmini, G., Pianesi, F., Rossi, F. & Zancanaro, M. Enforcing cooperative storytelling: First studies. *ICALT*, (2004), 281-285.
- Cassell, J. & Ryokai, K. Making space for voice: Technologies to support children’s fantasy and storytelling. *Personal and Ubiquitous Computing* 5, 3 (2001), 169-190.
- Decortis, F. & Rizzo, A. New active tools for supporting narrative structures. *Personal and Ubiquitous Computing* 6, 5-6 (2002), 416-429.
- Druin, A., Montemayor, J., Hendler, J., McAlister, B., Boltman, A., Fiterman, E. et al. Designing PETS: A personal electronic teller of stories. *CHI*, (1999), 326-329.
- Engels, S. *The Stories Children Tell*. W.H. Freeman and Company, 1999.
- Fernaues, Y., Tholander, J. & Jonsson, M. Towards a new set of ideals: Consequences of the practice turn in tangible interaction. *TEI*, (2008), 223-230.
- Glos, J.W. & Cassell, J. Rosebud: Technological toys for storytelling. *CHI*, (1997), 359-360.
- Harris, A. et al. Around the table: Are multiple-touch surfaces better than single-touch for children’s collaborative interactions. *CSCW*, (2009).
- Helmes, J., Cao, X., Lindley, S.E. & Sellen, A. Developing the story: Designing an interactive storytelling application. *Interactive Tabletops and Surfaces*, (2009). To appear.
- Hourcade, J.P., Perry, K.B. & Moore, J.L. Vuelta: Creating animated characters and props using real-world objects. *CHI Extended Abstracts*, (2007), 2429-2434.
- Kelleher, C., Pausch, R. & Kiesler, S. Storytelling Alice motivates middle school girls to learn computer programming. *CHI*, (2007), 1455-1464.
- Marshall, P. et al. Fighting for control: Children’s embodied interactions when using physical and digital representations. *CHI*, (2009), 2149-2152.
- Mäkelä, A., Giller, V., Tscheligi, M. & Sefelin, R. Joking, storytelling, artsharing, expressing affection: A field trial of how children and their social network communicate with digital images in leisure time. *CHI*, (2000), 548-555.
- Montemayor, J., Druin, A., Chipman, G., Farber, A. & Guha, M.L. Tools for children to create physical interactive StoryRooms. *Computers in Entertainment* 2, 1 (2004), 12-12.
- Raffle, H., Vaucelle, C., Wang, R. & Ishii, H. Jabberstamp: Embedding sound and voice in traditional drawings. *IDC*, (2007), 137-144.
- Ryokai, K., Marti, S. & Ishii, H. I/O Brush: Drawing with everyday objects as ink. *CHI*, (2004), 303-310.
- Salovaara, A. Appropriation of a MMS-based comic creator: From system functionalities to resources for action. *CHI*, (2007), 1117-1126.
- Vaucelle, C. & Ishii, H. Picture this!: Film assembly using toy gestures. *UbiComp*, (2008), 350-360.