Dolltalk: A computational toy to enhance children's creativity

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ABSTRACT

This paper presents a novel approach and interface for encouraging children to tell and act out original stories. "Dolltalk" is a toy that simulates speech recognition by capturing the gestures and speech of a child. The toy then plays back a child's pretend-play speech in altered voices representing the characters of the child's story. Dolltalk's tangible interface and ability to retell a child's story may enhance a child's creativity in narrative elaboration.

Keywords

Tangible interface, toy, children, performance, perspective-taking, narrative elaboration, motion and speech detection

INTRODUCTION

This research is founded on the belief that if children understand that language is important for communication, they will try to appropriate it in their own speech [1]. Similarly, we propose that children can discover by themselves what makes a good story by hearing their own stories told back to them in altered voices. Technological toys can facilitate this experience by recording children's stories and then offering children the opportunity to retell them. In the process it is hoped that children then improve their subsequent attempts.

RELATED WORK

Traditional toys such as puppets and dolls encourage children's storytelling in the form of pretend play [2]. Unfortunately, the majority of technological toys today does not provide the space for children to tell their own stories, but rather tends to tell stories to them. However, children can gain from the opportunity to create stories, not just to listen to them. They can further benefit from telling stories to a critical audience who can provide feedback. Recently, "storyspaces" to support children's voices have received significant attention at CHI [3]. Previous efforts [4], [5] have created systems to help children tell and review their stories. Storymat [4] is a system consisting of a marked mat and stuffed animals that tracks where on the mat the child is playing and plays back related stories from peers, as appropriate. Research with Storymat has shown that when children listened to and incorporated elements from their peer's stories, their own became richer. Similar results were found with TellTale [5], a toy made of body pieces of a caterpillar. Each body piece can record a sentence as well as an entire story. The child can put the pieces together and hear the story organized in the order the child has chosen.

DESCRIPTION

Continuing in this vein of research, we have built Dolltalk to allow children to record their stories and hear them back with the same content but with different voices. The recorded voice is processed so that the playback is the actual child's voice but in a different pitch that is unrecognizable to the child as his/her own. Because children can detect inconsistencies in a story told to them [6], we believe that children will be good critics when listening to their story told to them in somebody else's voice. This can help them elaborate upon original stories in a more advanced way.

Dolltalk is composed of a platform with tag sensors, two small speakers, one microphone, Max/MSP real-time sound analysis / processing software, and two dolls with accelerometers attached to them. Recording begins when a child removes the two dolls from the platform. Playback is initiated when the two dolls return back on the platform. Our recent research with the technological toy has shown that the presence of a virtual peer significantly increases a child's use of advanced linguistic expressions and helps a child to focus on storytelling [7]. We have incorporated a

virtual peer in Dolltalk; a young alien that appears on a monitor disguised in a soft brown felt material to guide children through the interaction in Dolltalk. A recent study has successfully used a puppet as a naï ve listener and the naï ve aspect of the puppet motivated young children in telling their stories [8]. Similarly, the alien has been created to tell children that it wants to hear about earth so that children are given a goal in their storytelling. Because children often use story elements during play (characters, settings, etc.) to organize the narrative and play [9], the alien asks the child to dress up dolls and tell stories about them to see how earthlings look. The construction of dolls and their physical representation may invite a child to think about the characters for her story. The process of dressing up the dolls may allow her to revise her ideas, focus on the story she really cares about. This cognitive process may enhance the coherence of the storytelling.

An early pilot study found that when children enact dialogues between dolls, they move naturally and unconsciously the one that is supposed to be speaking. Dolltalk is based on this observation. In our implementation, children are recorded only when they speak. Their sentences are segmented and indexed according to the motion of the dolls. Segmentation is done by analyzing the embedded accelerometer signal, combined with sound level detection. The computer thus knows which doll is supposed to be speaking and also keeps track of the timing of when the sentence started. Transformation of the voice is done by shifting the pitch - slowing it down or speeding it up- and with additional sound processing techniques. If no motion is detected, the system assumes the child is narrating and plays back this part of the speech with a neutral voice. Because no accurate speech recognition for children exists today, the combination of the motions and the voice presence of the child is a source of information used in Dolltalk to understand whose doll's story the child is telling.

Figure 1- Dolltalk 2001: the alien and the two dolls

USER STUDY

A user study was done with an early version of Dolltalk - Figure 2.

Figure 2- Dolltalk 2000

Pilot studies with twelve children at an elementary school, in suburb of Boston (USA), explored how five-year-old kids played with Dolltalk. This first version featured two stuffed animals: a lion and an elephant. Children were able to tell a story and play it back by putting the dolls at a specific place on the magic stage. Although no empirical data was collected at that time, the children appeared to enjoy their interactions with Dolltalk. They frequently repeated the playback and asked each other where the voices were coming from. They were surprised about the playback of their voices, believing that someone was in the room listening to what they were telling. This illusion of speech recognition seemed to encourage children to take distance from what they said and what they listened to during the playback. One of the children repeatedly said: "who said that? I never said that!"

This user study suggested changes that could improve the next version of Dolltalk. Although children enjoyed the activity, they appeared to need an audience, as a goal for the story, but also as guidance through the interaction. In addition, using less defined dolls appeared to contribute to the construction of more imaginative stories. These features are incorporated into Dolltalk 2001 and an empirical research study is currently being conducted to learn more about the implications of these new features.

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