The Development of a Game-Based Storytelling Support System that Incorporates Creative Activity and Motion Control

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Abstract. In previous studies, we developed the Shadow Robot System, which makes use of papercraft models. So far, we have carried out workshops using this system at science museums across Japan. The system receives very favorable reviews from participants. However, these workshops have been unable to provide the collaborative work that is one of the key merits of a workshop setting. In response to this challenge, we extended the Shadow Robot System in this study to create a storytelling system. In this system, children are encouraged to work collaboratively to craft their own stories. The system serves to support children's story telling ability. In this paper, we first describe the details of the system we developed, and then explain the effects of the system on the children we observed during the course of our workshops.

Keywords: Papercraft · Children · Drawing · Storytelling · Video games

1 Introduction

The author's previous work includes the development of the Shadow Robot System [1], which incorporates experiential games and papercraft models, as well as the implementation of the system through events at various educational institutions. The Shadow Robot System allows children to design the texture (i.e. surface design) of a robot by drawing on a papercraft schematic. Moreover, by incorporating these designed robots as characters in a video game, we were able to harness the appeal of games to encourage children to actively participate in the creative process of papercraft modeling.

While events using this system received a favorable reception from participating children, the activities were limited individual tasks such as drawing, participating in video games, and creating papercraft models. As a result, the system failed to take advantage of the potential for teamwork and that is inherent in a group event. To remedy this issue, we attempted to develop a storytelling extension to the Shadow Robot System that allows children to create stories through a collaborative process and helps participants to explain them to each other.

Storytelling is defined as the process of creating original stories and communicating them to others [2]. This process is thought to be effective in promoting language development, organizational ability, and imaginative ability in children. The traditional

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storytelling process often uses physical objects such as puppets, dolls, or characters drawn on paper as stand-ins for the characters in the story. The description of the characters is one of the fundamental ingredients of a story, and the system that we developed divides the tasks that are necessary to create a story including the creation of the protagonist, antagonist, and setting, among a group of children.

2 Related Research

There have been a number of previous efforts to use ICT in a storytelling system, and these efforts have approached the problem using a variety of forms. In the Zootown [3] system, children place animal-shaped robots on a projection-capable table and manipulate movements such as walking and turning their necks. By projecting images onto the table that match a story, the system aims to spark the creation of new stories. In the Gentoro [4] system, a handheld projector is used to project a field onto a physical space. The story is performed on the projected image through the control of robots.

Kidpad [5] seeks to create a collaborative storytelling environment by using hyperlinks to connect dialogue with pictures drawn by participating children. Similarly, FeTe2 [6] makes it possible to create stories through network access to a virtual world. Jabberstamp [7] allows children to associate recorded dialogue with their own drawings, helping to create stories through the process of making the drawings.

The Story Mat [9] system uses a mat that displays interactive images. Children manipulate toys on top of the mat and can record the movements or dialogue to create a story. Additionally, children are able to play/edit the stories created by other children.

The primary difference between our system and those described above is the fact that we employ the design of videogame characters as a way to provide subject matter for the creation of new stories. While systems such as Kidpad [5] and Jabberstamp [7] are centered around drawing and attempt to support children's story-making endeavors in this way, our study seeks to provide children with a storytelling framework within which we encourage the children to exercise their creativity. Similarly, while systems such as Zootown [3] and Gentoro [4] provide a storytelling framework, these systems place robots within a physical space whereas our system is based on the virtual space of a videogame.

3 System Overview

By extending the Shadow Robot System to a storytelling context, we developed a system that we call the Shadow Robot System for Storytelling (SRSS). A schematic overview of the system is shown in Fig. 1. First, the children draw designs onto six papercraft schematic pages depicting elements such as the protagonist, antagonist, and buildings, while at the same time describing the scene or overall story with text. Next, the schematic pages are read into a computer using a scanner, and the appropriate sections are extracted as textures. In the game, these textures are placed onto pre-made 3D models to create the original characters. By taking screenshots during the game, the children are able to assemble the various scenes of the story that they created. At the end of the game, these

screenshots are assembled together and outputted as a single story paper. We expected that the children would use this story paper to explain the stories they created.

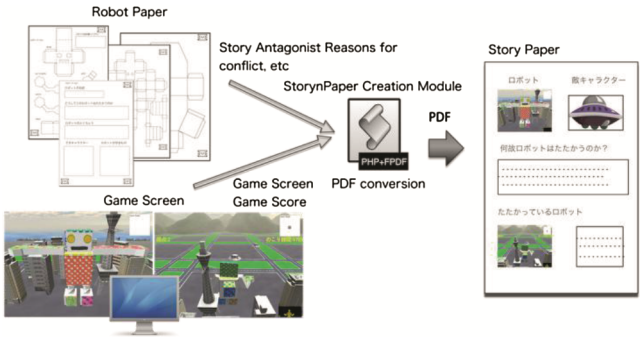

Fig. 1. Schematic overview of the SRSS system

4 Storytelling Workshops

4.1 Workshop Overview

We implemented a series of storytelling workshops using this system. The workshops were carried out on May 2nd and 5th, 2015, at the main branch of the Mitsukoshi Department Store as part of the workshop event titled "Play in the Future With Toshiba: Fight! Shadow Robots, Story-Making Edition." Each workshop lasted approximately 60 min and was held once a day. Each event accommodated 12 participants, for a total of 24 participants. Because the event was somewhat shorter than is the norm for such events, we anticipated that it could be difficult for the children to finish their stories within the allotted time. Therefore, we assigned one staff member to assist each group of three children. We administered a post-workshop survey to determine participant responses.

4.2 Workshop Execution

Once the workshop commenced, a supporting staff member directed the discussion among the children in each group to decide on the details of the protagonist and other characters that would appear in the videogame. Figure 2 shows pictures taken during the workshop. Once the story was decided upon, the support staff were put in charge of writing the text in the space reserved for describing the story while the children were put in charge of designing the robot and antagonist. While there was some variation in timing between groups, finishing all of the schematic pages took approximately 35–40 min. Once the schematics were scanned into the computer, the children took part in the game with great enthusiasm. Moreover, after the conclusion of the game, we observed the children reading the story papers and trading thoughts on the robots or characters that they created.

Fig. 2. Scenes from the workshops and Examples of story papers created by children

4.3 Survey Execution and Results

We collected information about the participants as well as impressions about the event after the workshop ended. The survey questions and results are shown in Table 1.

Table 1. Survey questions and results collected at the end of the workshop

	Question	Yes	No	Neither
Q1	Have you previously played a game using a computer?	100 %	0 %	0 %
Q2	Have you previously played games where you can control motionusing your body, such as with the Kinect or Wii?	67 %	33 %	0 %
Q3	Have you participated in storytelling before?	47 %	53 %	0 %
Q4	Did you have fun during today's workshop?	87 %	7 %	7 %
Q5	Please score your enjoyment of these activities on a scale of 1–5 (where 1 means the activity was boring and 5 means it was fun)	Score		
Q5-1	The game that you could control with your body	67		
Q5-2	Thinking up a story	60		
Q5-3	Designing the robot and the enemies	66		
Q5-4	Making things together with your friends	56		
Q5-5	Having the robots that you made appear in the game	64		

We obtained 15 survey responses, of which 11 were boys and 4 were girls. The average age of the respondents was 8.73 years.

From the questions asking about previous experience with computer games, we learned that all of the respondents had experience using some variety of computer-based game. The proportion of those who had experience with games that incorporate motion control, however, was around 70 %. Furthermore, the proportion of those who had no experience in story-making games was approximately 50 %. 90 % of the respondents stated that they enjoyed the workshop. Respondents were asked to name specific activities that they enjoyed in survey question 5, and the results are shown in Table 1. These

results revealed that the survey respondents most strongly enjoyed the activity wherein they used their bodies to control the motion of the game.

5 Discussion

We can conclude from survey questions 4 and 5 that, while the participants in our workshop enjoyed the activities, the main reason for this was the motion control aspect of the game. This result confirms those obtained from our previous studies of the Shadow Robot System, which forms the basis of our current system, and shows that the opportunity to participate in the game is a motivating factor for the children. Moreover, the fact that an equivalent amount of enjoyment seems to have been derived from the ability to freely design the robots and have the robots appear in the game is also consistent with our results from the Shadow Robot System. On the other hand, the lowest levels of enjoyment were indicated for the collaborative nature of the activities, which is an important characteristic of the workshop we designed for this study. It is possible that this is due to the fact that the overwhelming proportion of the children that participated in our workshop were meeting each other for the first time, and consequently they were unable to carry out adequate discussions with their group members. This inability to express their opinions to a satisfactory extent may have caused them to become unsatisfied with the collaborative activities themselves. However, the responses to question 5–2 do not show a pronounced decline in enjoyment, and some of the responses to the open-ended questions identified the process of creating the stories as a reason for their enjoyment. Furthermore, we observed the children reading their story papers after the conclusion of the game, and it appeared that they were happy with the stories they had created. These results suggest that the system we developed is effective in helping to foster storytelling in children.

6 Conclusions and Future Work

In this study, we developed the SRSS as a proactive method of stimulating the collaborative activities that are characteristic of the workshop setting.

The storytelling workshops that we implemented using this system were rated highly by the participants with regards to the gaming system, as was the case with the Shadow Robot System. Furthermore, we learned that the participating children were able to have fun while engaging in the storytelling process. However, with regards to the question of whether we were able to accomplish the core aim of encouraging collaborative activities among the participants, there are a number of areas that require improvement.

While the workshops that we implemented brought together children who had largely never met each other before and directed them to engage in the storytelling process by deciding on the characters that appear in the games as well as their backstories, it was difficult to accomplish all of these tasks in the relatively short time (60 min) that was available. Therefore, it is important in future iterations to set aside time for the children to introduce themselves to each other and to break the ice so as to make the collaborative activities easier.

The act of storytelling through the video game itself was quite popular with the participants overall. Therefore, the improvements described above are likely to result in an even more effective storytelling workshop.

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