

# Supporting Improvisatory Story Creation for Children by Storing Their Storytelling

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**Abstract**—In workshops for children participating in production activities, it is important to review not only the production activities but also completed works. However, when works are created that have no tangible shape, such as oral stories, a record of the work is needed to enable review of the works. Currently, digital devices, such as video cameras are used to record such works. However, it is difficult for children to manipulate digital devices to record and review their storytelling. Therefore, in this paper we propose a recording system that children can manipulate and use to store their own works. Based on the opinions of the designer of the workshop, we iteratively developed the system. In order to verify the usefulness of the proposed system, we conducted an evaluation experiment comparing our app with the standard iOS camera application. As a result, it was suggested that the proposed system has useful functions for recording and viewing works.

**Keywords**—story creation; children; workshop; reviewing; computer interaction.

## I. INTRODUCTION

There is a workshop to support children's stories. Story creation workshops aim to help children develop their imagination and expressive power by allowing them to have fun while creating stories. One example of a story creation workshop is "PeKay's Little Author Workshop"[1]. In this workshop, children freely arrange characters and text using the software "PeKay's Little Author" to complete an original digital picture book. This system was developed by Asakura. Asakura designs and implements the workshops [2]. In these workshops, the children print the completed digital picture books with a printer. Also, at the end of the workshops, the children share their digital picture books with other participants through presentations. As seen in this example, it is important not only to produce works but also to review the works produced during the workshop by allowing participants to review their completed works by themselves or by showing them to each other. By reviewing, we can acquire new consciousness and expression techniques.

In story creation workshops, it is necessary to record the works to enable them to be reviewed. At present, digital equipment such as voice recorders and video cameras are generally used. However, these digital devices have not been developed for the purpose of reviewing works produced in story creation workshops. For this reason, there arises a problem that it is difficult to easily find a desired work from a large set of recorded data in story creation workshop where work is recorded a plurality of times. Therefore, in this research, we target the story creation workshops for children, and support

the review of the produced story. In this paper, we propose a recording system that considers the contents of activities by interviewing workshop designer for one workshop.

In Section 2, we introduce several examples of research that supports the creation of stories, and described the positioning of this research. In Section 3, we describe the content of "PeKay's Storytelling Picture Card Workshop" which we covered in this paper. In Section 4, we describe the design guidelines for the recording system were made by clarifying the problem of the recording of the work by the video camera in the "PeKay's Storytelling Picture Card Workshop" by interview with the designer. In Section 5, we describe the "prototype system Ver.1" and its problems. In Section 6, we describe the prototype system Ver. 2 which improved the problems of the prototype system described in Section 5. In Section 7, we describe the experiments we conducted to verify the usefulness of the proposed system. In Section 8 we describe the results and considerations of the experiment. In Section 9, we describe conclusions, including future prospects.

## II. RELATED STUDIES

In this section, we introduce several examples of research that supports the creation of stories for children, and described the positioning of this research.

### A. Supporting children's story creation

Many approaches have been employed to support children's story creation. Vaucelle et al. developed a doll-type system "DollTalk" that records and reproduces children's utterance contents and movements [3]. DollTalk aims to objectively review and improve the stories produced by children by allowing them to listen to their stories in a voice different from their own voices. Vaucelle et al. also developed a type of doll device called "Picture this!"[4]. In these devices, sensors and cameras are built in dolls, and by speaking using dolls and props, it is possible to create video works with simple operations. Ryokai et al. developed "StoryMat", which can create stories by recording story utterances and toy movements while children are moving toys on mats [5]. In this system, when a child plays on the mat, the previously recorded story is played as an animation. This allows children to create stories in collaboration with others. In these studies, by using dolls and props, they take the form of play seen in early childhood as a basis and support the creation of children's stories with natural flow.

Sato developed a system that allows adults and children to create stories in a way that they read stories from one another



Figure 1. PeKay's Storytelling Picture Card

[6]. In this system, the introductory part of a story in which the main character is in trouble is expressed with letters and text, and it is conveyed to the child by parental talk. The child arranges texts and characters and thus creates a continuation of the story, providing a solution of the problem, and tells it to the parent. Annany developed a caterpillar-type recording system called "TellTale"[7]. The system consists of five bodies and one head, each of which has the role of a recording device and a reproducing device. Recording speech individually by using the five bodies, the user can create various stories by switching the order of combination. In these studies, the goal is to cultivate the ability to think about stories and the whole composition.

Bonsignore et al. developed a mobile application called "StoryKit" that can be used to create and share stories [8]. In this system, the user can make a story using the collected images, texts, and sounds. Also, because it is a mobile application, the user can create a story while collecting photos outdoors, without being confined to one place. Furthermore, stories can be shared with other people easily by sending a URL. In this study, it is a feature that it is possible to make stories such a diary and share them with others.

#### B. Position of this research

In previous research, as a creative support for children's stories, they provide new activities through their systems. However, we support the creation of children's stories by supporting existing creation activities.

In addition, Nakae et al. are assisting in creative activities workshop by recording the activities [9]. In this research, they focus on the production process, but we focus on the created works and support reflection.

From the above, in this research the purpose is located in both "support for story creation" and "support for workshop".

### III. TARGET WORKSHOP

In this work, we developed a recording system that takes into consideration the activity of "PeKay's Storytelling Picture Card Workshop". Development of the system was realized through cooperation with TamiieAsakura (GoodGrief Co., Ltd.) who designs and conducts this workshop. Here, we will briefly outline "PeKay's Storytelling Picture Card Workshop". The participants of this workshop are children aged 5 to 10, who create stories using "picture cards". The picture cards are divided into six genres: "character", "toy", "food", "vehicle",

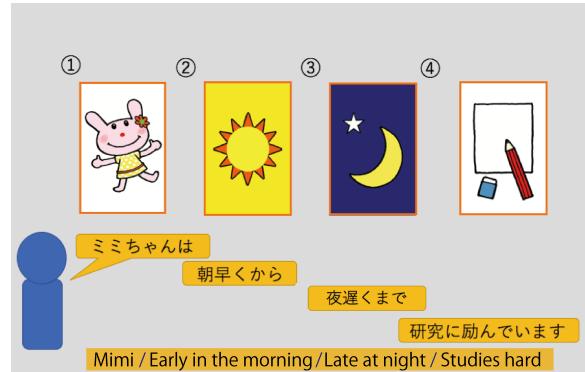


Figure 2. Work example

"place", "weather" (Figure 1). There is a total of 43 cards, including 8 character cards and 7 cards for each of the other categories. Using these picture cards, participants can create stories with the pictures functioning as prompts. The basic steps in the story creation procedure are summarized below.

- 1) Select a card freely.
- 2) Place the selected card on the desk and consider the story while changing its position.
- 3) Talk while presenting a card.

An example of the work created according to this procedure is shown in Figure 2. There are several possible ways to select a card. For example, besides choosing a card freely, it is also possible to randomly select a card, limit the number of cards, and so forth. Also, since one work can be made in a short time, many works are made through the workshop. In addition, the facilitator uses a video camera to record the state of utterance of the child's story, and the work is recorded in the form of a video. At the end of the workshop, as a general review, all the participants watch the work.

### IV. DESIGN GUIDELINES

We interviewed Asakura to determine the design guidelines for the recording system. Three interviews were conducted on March 2, May 21, and September 13, 2017. In the interview, we asked about the problem of the video camera used for the recording of the work. The results of the interviews are organized and presented below. The following three points were cited as problems. (A) Because a child moves during recording of a work, the card to be presented may not be visible to the camera. (B) When a child faces the camera, he or she should not speak shyly. (C) When viewing the work, the appearance of the child is displayed as part of the work, and this can interfere with concentrating on the content of the work. These problems are thought to be due to the fact that the facilitator is recording the story work of the child and that the presenter and the recollector are separated. Therefore, in this paper, to solve these problems, we propose a recording system for children to operate themselves and record the creation of their stories.

To implement this system, four design guidelines were set with reference to Asakura's opinions. First of all, for children, it is considered difficult to tell a full story at one time. Therefore, a story may be divided into segments and recorded in stages. Second, to enable the child to intuitively operate the system, the operation can be performed with simple interaction. Third, it is necessary to prevent extra information

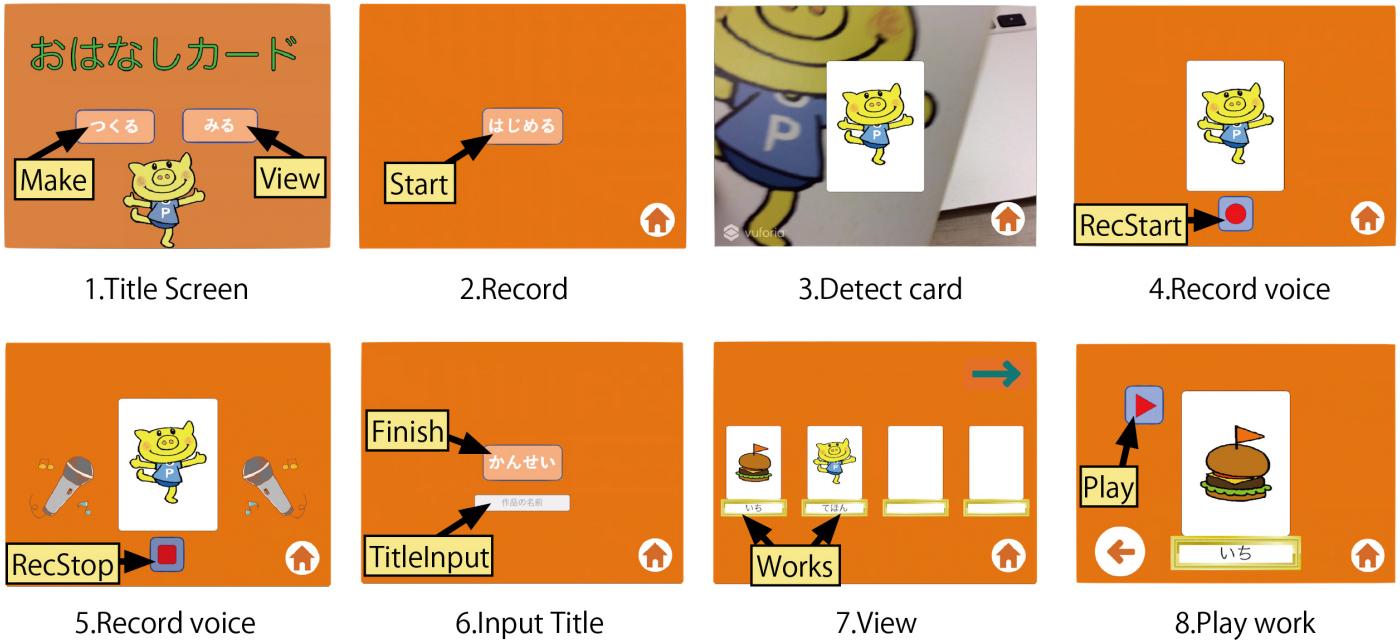


Figure 3. Prototype System Ver.1 ; When you tap Works with “1.TitleScreen”, you can go to “7.View” and watch the works on images 7-8.Then, when you tap Make, you can go to “2. Record” and record the work on images 2-6.

from entering the story work, because there is a possibility that it may interfere with viewing the work intensively if the work contains extra information. The extra information here refers to information that is not related to the story, such as a part of the body of the child or the surrounding landscape. Finally, since many works are recorded, it should be easy to identify an individual work.

## V. IMPLEMENTATION OF PROTOTYPE SYSTEM VER.1

In this Section, we describe the "prototype system Ver.1" developed based on design guidelines and its problems.

### A. System overview

We implemented a prototype system Ver.1 (hereinafter Ver.1) based on the design guidelines described in Section 4. To satisfy design guideline (1), the ability to divide stories and record in stages, we alternately repeat the selection of cards and the recording of sounds so that the story work is recorded in stages. To satisfy design guideline (2), according to which the operation should be able to be performed with simple interaction, all screen transitions were realized by tapping a button. In addition, regarding the card selection method, image recognition that automatically discriminates by holding the camera over the card was adopted. To satisfy design guideline (3), to prevent extra information from entering the story work, we adopted a slide show format in which images and sounds are switched correspondingly to reproduce the work. Finally, to satisfy design guideline (4), that individual works should be easily identified, we made it possible to record and display the title of each work. The above contents are organized and the functions implemented are summarized below.

- Image recognition function of the card to be used
- Audio recording function

- Work piece reproduction function in slide show format
- Title input function

Ver.1 with these functions was implemented as an iOS application on an iPad. Figure 3 shows the screen transition diagram of Ver.1. For development of the system, Unity.Ver.5.4.1f1, which can easily correspond to various platforms was used [10]. In addition, image recognition was realized by characterizing the image of each picture card and registering it as a marker using Vuforia.Ver.6.5 of SDK [11].

### B. Problems of Ver.1

To clarify the problems of Ver.1, we had a discussion with Asakura. The discussion took place on November 8, 2017. We considered the following problems.

- 1) Operation in the horizontal screen may force the use of both hands.
- 2) The operation required to shift from the recording of a work to viewing will increase due to the title screen.
- 3) Since the number of cards that can be recorded at a time is limited to 4, the range of expression of the work is narrowed.
- 4) Because the story is divided for recording, there is a possibility of forgetting the contents already recorded during the recording.
- 5) At the time of card selection, it automatically transitions to sound recording screen at the moment of recognizing the card, which causes erroneous operation.
- 6) Buttons are located at the lower right or the lower left, and the hand with the terminal unintentionally touches the button, possibly causing a mistake in operation.

By improving these problems, improvement of system operability is expected. In Section 6, we will explain the prototype system Ver. 2, which incorporated improvements to address these problems.

## VI. IMPLEMENTATION OF PROTOTYPE SYSTEM VER. 2

This Section introduces the prototype system Ver.2 (hereinafter Ver. 2). In Ver.2, the following changes were made.

- 1) Changed the top screen to the work list.
- 2) Changed so that the list of works recorded on the top screen can be seen.
- 3) Made it possible to freely select cards to be used from 1 to 12 cards.
- 4) Add the previewing works function.
- 5) Add the redoing function Image recognition and recording.

The first change has been implemented to solve the problem clarified in the previous section “Operation on the horizontal screen may force use of both hands.” This made it possible to operate the device with one hand and to have a card and a recording system at the same time. The second change has been implemented to solve the problem that “the operation required to shift from the recording of the work to the viewing will increase due to the title screen.” This change made it possible to operate the system smoothly (Figure 4-1). The third change has been implemented to solve the problem that “the number of cards that can be recorded at a time is limited to 4, so the range of expression of the work becomes narrow.” The fourth change was implemented to solve the problem that “because the user records the story by dividing it into parts, the user may forget the content that was already recorded in the middle of recording.” With this change, it was possible to record works while confirming the contents (Figure 4-6). The fifth change was implemented to solve the problem that “it automatically transitions to the sound recording screen at the moment of recognizing the card at the time of card selection, which causes erroneous operation.” The redo function allows the user to redo operations as many times as necessary until the user taps the button to select a card or start a voice recording (Figure 4-3,4).

## VII. EXPERIMENT

In this section, we describe the experiments we conducted to verify the usefulness of the proposed system.

### A. Outline of experiment

To verify the usefulness of the proposed system in the work record of “PeKay’s Storytelling Picture Card Workshop”, we compared it with the standard camera application of an iOS terminal (hereinafter referred to as “camera application”). Although the proposed system is targeted at children aged 5-10, it is expected that there will be large differences among individuals in the ability of children. Therefore, in this paper, we investigate the functionality of the proposed system by targeting students of the same university which are thought to have less differences in abilities before conducting experiments for children. For this time, we covered 6 university students, including 3 males and 3 females. Two tasks were to be carried out by the experiment participants. The first was to select cards according to three kinds of rules, and to create six

works of two pieces each. The second task was to record the created works three by three, using the camera application, and Ver.2 in order. After completing the recording of the works, the participants were given a questionnaire form with question items to fill out. Also, the participants were orally asked questions about actions at the time of recording the work. To record the operation contents of the system, we obtained permission and photographed the subject’s hand with a video camera. The picture cards used for the experiment were limited to 33 pictures with a high recognition rate of the image recognition function, and an iPad was used as the experiment terminal. The time required for this experiment was about one hour per person.

### B. Experimental questionnaire

This subsection will briefly explain the questionnaire about the recording of the work, which was done after the experiment. First, we asked the experiment participants to respond to the questionnaire that asked the questions about the two types of recording systems. The contents of the questionnaire are presented below.

- |    |  |
|----|--|
| Q1 | Have you experienced any inconvenience in recording with the camera application? Yes, No   |
| Q2 | Please tell me the reason for Q1. (Free description)   |
| Q3 | Have you experienced inconvenience during recording with this application? Yes, No   |
| Q4 | Please tell me the reason for Q3. (Free description)   |
| Q5 | Did you feel that a function that can save titles is necessary? Yes, No  |
| Q6 | Please tell me the reason for Q5. (Free description)   |
| Q7 | Please tell me about the function that you feel is unnecessary. (free description)   |
| Q8 | Please let me know if you have thought of any additional functions that you feel are necessary for this system. (free description) |

We also orally asked questions about the conditions and procedures during the experiment. At that time, We asked all the experiment participants, “You recorded the work with two kinds of systems, which one do you like better? Why?”.

## VIII. RESULTS AND DISCUSSION

This section will consider the experimental results obtained from the questionnaire from the viewpoint of the recording works, the viewing of the works, and the problems of the proposed system.

In response to the questionnaire, three of the six participants said that it is difficult to tell a whole story at once for recording using the camera application. On the other hand, regarding recording using Ver.2, two of the six participants answered that they did not experience any inconvenience because the contents were arranged by dividing and recording the story in segments. These findings suggest that the function of dividing and recording the story in parts for each card used, which was implemented in Ver.2, was able to alleviate the burden of telling the user’s story at once. Also, in this experiment, both systems allowed recording to be redone. However, in the recording by the camera application, the

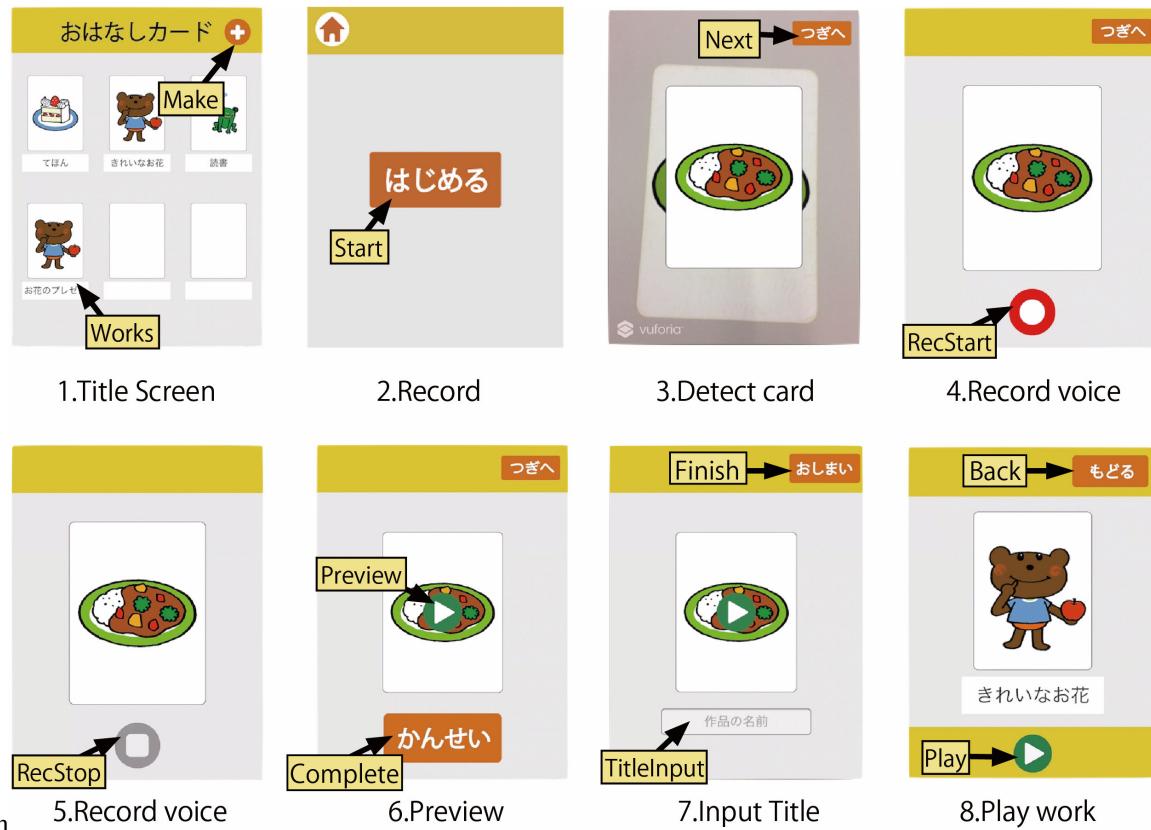


Figure 4. Prototype System Ver.2 ; When you tap Works with “1.TitleScreen”, you can go to “8.Playwork” and watch the work.Then, when you tap Make, you can go to “2. Record” and record the work on 2-7 images.

recording was not redone. On the other hand, in the recordings made using Ver.2, five participants re-recorded parts of their recordings, modifying their speech errors and expressions. We asked the experiment participants who redid their recordings only when using Ver.2, the reason for this. Regarding recording by Ver.2, one participant made the following comment: “I thought that I wanted to improve the quality of the work because I could re-record my voice at each stage.” Regarding recording by the camera application, a participant made the following comment: “When redoing the recording of the work, it was necessary to redo the recording from the beginning of the story. When I tried recording again, I felt it was likely that I made mistakes again and compromised.” These responses suggest that recording mistakes can be reduced by allowing the user to re-record parts of a story more easily when stories are divided and recorded in parts. In addition, this function was used to eliminate coughing and discontinuation, forgetting the contents of utterance, changing contents of utterance, and changing expressions in a story. Also, the number of times that the work-previewing function was used is summarized for each experiment participant, it was A: once, B: 4 times, C: 10 times, D: 3 times, E: 3 times, and F: 5 times. This function was used to check the contents of the work being recorded, and to confirm whether the recorded sound was recorded correctly.

In the viewing of the works recorded using camera application, five participants found that the appearance of hands, shadows, and screen blur interfered with the viewing quality. However, regarding the viewing of the works using Ver.2,

the image and the sound switched correspondingly, so the participants had the general opinion it provided a clean impression and good viewing quality. These opinions suggest that the function of playing the work in a slideshow format is effective for viewing this kind of work. Also, in response to the title input function, five participants answered that “the title function is necessary to distinguish between works that have the same cover.”

During the experiment, all of the participants made some errors in operating Ver.2, such as accidentally pushing a button, unintentionally changing the screen, and proceeding to the next screen. To address these problems, a button could be added to allow the user to return to the previous screen. Thus, the user would be able to redo a recording even in the case of an operation error.

## IX. CONCLUSION

In this study, we developed a work recording system that children can operate. The system was specifically designed for participants in “PeKay’s Storytelling Picture Card Workshop”, in which children create stories. By referring to the opinions of the designer and provider of the workshops, we designed the system considering the activities of the workshop. As a development procedure, we interviewed the workshop provider and developed a prototype system Ver.1 based on the design guidelines identified through the interviews. In addition, we developed Prototype System Ver.2, which addressed the problems of Ver.1, which were identified by conducting discussions.

Moreover, in order to verify whether prototype system Ver.2 is an appropriate system for “PeKay’s Storytelling Picture Card Workshop”, we conducted an evaluation experiment of the function with the participation of 6 college students. As a result, it was suggested that the proposed system has useful functions for recording and viewing works. However, the subjects of “PeKay’s Storytelling Picture Card Workshop” are 5 to 10-year-old children, and it is expected that there will be differences in system evaluation between university students and children. Therefore, we will improve the proposed system, and conduct an evaluation experiment of the system with children as the participants.

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