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Novel Writing Support System by Target Readers' Story Arcs and Characters' Emotional Changes

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Abstract: Writing includes such elements of communication skills as expressing authorial intention in an understandable way that is acceptable to readers. Our research introduces a writing activity that cultivates communication skills by introducing a method for writing novels that are liked by the estimated target readers. An aspect of novels that may reflect individual preferences is the emotional experience produced by them. Therefore, this research proposes a method for creating novels that are liked by target readers from an emotional viewpoint. We first adopt story arcs as a representation of a reader model that expresses the emotional changes that readers are expected to experience from a novel. Second, we define the candidates of emotions for designing scenes from the viewpoint of the emotions of characters. Last, we develop a support system that not only suggests candidates for story arcs and characters' emotions but also provides feedback when the emotions selected for characters fail to support the selected story arc.
Keywords: Communication skills, novel writing, story arcs, characters' emotions

1. Introduction

Students need "21st Century Skills" to succeed in the information age. Their importance as well as methods for teaching and cultivating them have been proposed (Griffin and Care, 2014). One category of the 21st Century Skills is the ability to communicate with others. This skill consists of various sub-skills; precisely representing what a student wants to convey, changing how one talks based on the communication targets, and understanding the intentions of others; such sub-skills must be cultivated to improve communication. Writing is an activity that needs two of these skills, such as precisely representing what a student wants to convey, and changing how one talks based on the communication targets (expected readers). We believe that if authors can obtain a method for designing writings based on their theme and their target readers, they can improve a part of their communication skills. Therefore, we introduce a writing activity as a training method for cultivating a part of communication skills. The objective of our research is to develop a support system with which authors can create the outline their writings based on themes and target readers. We focus on the writing of fictional novels, where authors need to design everything in a novel such as the settings, and the scenes.

When writing a novel, authors often create a skeletal outline of a novel, which is called plot (Hunter and Begoray, 1990). In writing training, students need to create a plot that can expresses their theme and that are liked by their target readers. Several methods have been studied to support plot creation. Nishihara and Miura (2015) proposed a system that simplifies the creation of plots by defining the candidates of character behaviors and showing the results of changes in the novel's world affected by them. Akimoto and Ogata (2011) established a method that automatically generates a novel from characters and their roles based on Propp's Character Theory (Propp, 2010). These studies enable authors to construct novels with consistent stories based on Propp's Character Theory. Also, Watanabe and Arasawa (2014) analyzed components of novels and developed a novel-composition support system by having authors fill in the components. However, these studies ignore themes and target readers.

Our study develops a system that encourages students to write novels based on their themes and target readers. We previously proposed a support method for deriving a story that can express intended

themes (Ashida and Kojiri, 2018) and effectively derived the settings and scenes that can convey themes. The current research seeks to create the novels to be liked by the expected target readers. Cheong and Young (2006) proposed a system that automatically generates a story that readers might like using planning techniques. It assumes that the suspense that readers do not know what will happen next is one element that satisfies readers. It defines suspense as the number of possible scenes that readers can assume and developed a system that generates a story that evokes an enjoyable level of suspense by arranging the given scenes using inference techniques. This system requires authors to create scenes beforehand without considering their target readers. However, because the liked scenes are different based on the readers, created story are not always liked by the target readers. In addition, it automatically creates a story and does not support authors to create stories.

This research supports authors who want to create a sequence of scenes that will be enjoyed by their target readers. One factor that may satisfy them is the emotions they experience while they are reading. From this viewpoint, our research introduces a story arc that expresses the expected transition of readers along with the story and proposes a method that utilizes the story arc as a reader model. In addition, since readers usually empathize with specific characters, the emotions of characters should reflect the story arc. This paper proposes a method that supports authors who are establishing the emotions of their characters based on the reader model and provides feedback if gaps are found between the characters' emotional changes and the selected story arc.

2. Approach

The steps for creating scenes to compose a story that follows the reader model and approaches for supporting each step are shown in Figure 1. Zillmann's Mood Management Theory (Zillmann, 1988) reported that "people acquire various emotions from the media and actively select media in consideration of the emotions that they want to acquire." Choosing a novel is similar; readers select novels based on the emotions that they want to experience, including happiness, sadness, excitement, and anticipation. The feeling after reading is often derived both from a novel's last scene and the aggregation of scenes; authors first need to select the emotional changes that their target readers are expected to experience as they read.

In this step since many authors lack experience consciously imagining their expected readers, explicitly defining a reader model is difficult. We define it as the emotional changes experienced by readers while they are reading a novel. To support authors who want to develop reader models, we establish several possible patterns of emotional changes as candidates for reader models from which authors can select.

Emotional changes in readers are produced by the flow of specific scenes. Readers often empathize with characters while they are reading (Oatley, 2002). In this paper, as one of the empathizing, we assume that readers experience the same emotions of characters; thus the characters' emotional changes throughout the scenes should be defined carefully to derive the expected emotional changes in target readers. However, in this step, some authors fail to understand that they must consider the characters' emotional changes or know which emotions should be defined to follow a reader model. We propose a support method that presents candidates for the character's emotions and provides feedback if the defined characters' emotions do not elicit the intended reader emotions in the reader model.

When the emotions of the characters are determined, authors are expected to establish concrete scenes that can express them. Our research currently does not support this step.

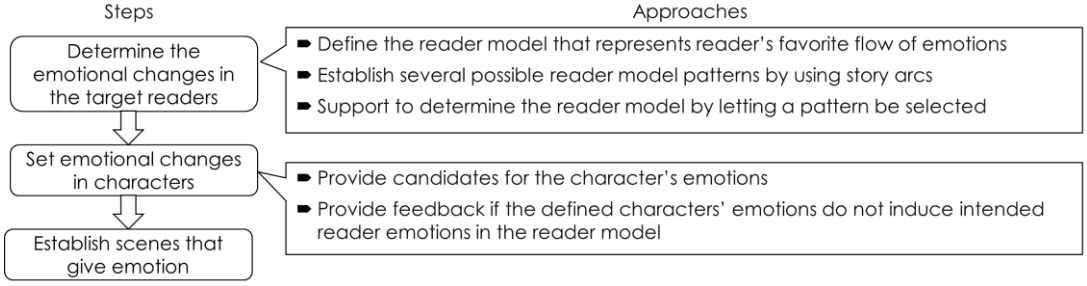

Figure 1. Steps for designing story and approaches of support system

3. Determination of Reader Model Using Story Arcs

Since authors often experience difficulty scrutinizing the emotional changes of readers, a simple representation of a reader model is desirable. Although many emotions exist, Cohn et al. (2009) argued that "happiness" is representative of positive emotions and "unhappiness" represents negative emotions, and emotional changes can be represented by the levels of happiness. Therefore, this research adopts the levels of happiness to represent the simple reader model.

A story arc expresses a story's outline from an emotional aspect (Fig. 2). The horizontal axis corresponds to the story's progress, and the vertical axis indicates the happiness level expressed by the story at that point. Reagan et al. (2016) reported that the story arcs of stories written in English can be classified into six types by clustering a huge number of story arcs using machine learning techniques. We adopt the six story arcs defined by Reagan et al. as candidates for reader models.

Table 1 lists the types of story arcs defined as candidates of reader models along the basic story structure, which consists of introduction, development, turn, and conclusion. This structure is often used in Japanese creative writing. The model represents the types of story arcs by their transitions, not by the absolute values of the happiness levels, because we believe that how readers feel reflects the differences in the story's emotions. We provide authors with candidate reader models that allow them to choose the one that is most likely to be preferred by their target readers.

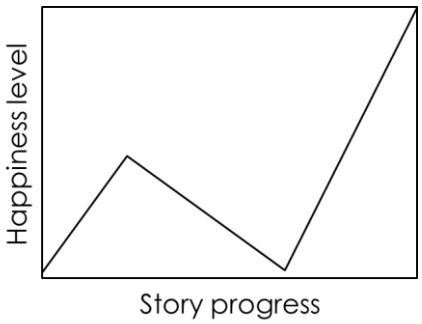

Figure 2. Example of story arc

Table 1. *Types of Story Arcs as Reader Models*

Types	Changes in happiness levels in story arcs		
	Introduction to development	Development to turn	Turn to conclusion
Type 1	Increase	Increase	Increase
Type 2	Decrease	Decrease	Decrease
Type 3	Increase	No change	Decrease
Type 4	Decrease	No change	Increase
Type 5	Increase	Decrease	Increase
Type 6	Decrease	Increase	Decrease

4. Determination Support of Characters' Emotions Following Reader Models

4.1 Candidate Emotions

To create preferred stories for target readers, authors need to design the emotions of characters based on selected reader models. For supporting authors who want to set the character's emotions, we provide candidates of emotions and encourage authors to select from them.

Plutchik (2001) proposed a model of human emotions called Plutchik's wheel of emotions. This model argues that human emotions can be expressed by both basic and complex emotions that occur as a combination of basic emotions. Figure 3 shows the eight basic emotions placed on a wheel. Those at the opposite pole are unlikely to occur simultaneously. The combination of two basic emotions other than the one at the opposite end creates a complex emotion called a *dyad*. In this research, eight basic emotions and 24 dyads are provided as emotion candidates.

Readers often feel emotions from empathized characters (Oatley, 2002). However, they do not always empathize with the protagonist. Some readers may prefer friend of the protagonist, or the cool villain. Our research allows authors to create characters that give the emotional changes of a reader model for each section of the story, including introduction, development, turn, and conclusion. Then it provides candidate emotions to authors and helps them consider the emotions of the characters for each section of the story to fit the defined reader model.

Figure 3. Basic emotions of Plutchik's wheel of emotions (Plutchik, 2001)

4.2 Feedback Based on Story Arcs and Setting of Characters' Emotions

4.2.1 Changes in Happiness Level by Emotional Changes

The selected characters' emotional changes should adhere to the reader model expressed by the story arc. However, since there are eight basic emotions and 24 dyads, authors do not always select the appropriate ones. Therefore, we propose a support method that compares the story arcs of the selected reader model and the happiness changes produced by the selected emotional changes and provides feedback to the authors when these two elements do not correspond. We conducted two surveys for determining the changes in happiness levels based on the selected emotional changes.

In the first survey, ten university students were given 32 words that represent emotions and ranked them based on happiness levels, where 1 is the highest and 32 is the lowest. Figure 4 shows the results. In Figure 4, The emotional words were arranged by their mean ranks from all the participants. The blue circles correspond to the mean ranks and the error bars show the standard deviation. Based on these results, we divided these emotional words into two groups: the happiness group, which consists of *joy* to *surprise* and the unhappiness group, which is formed by *sentimentality* to *despair*. However, ranking the emotional words within each group is difficult.

The second survey analyzed the ranks for each pair of emotional words within the happiness and unhappiness groups. Ten university students and an associate professor participated. We asked them in the second survey to group the emotional words into two or three classes based on the happiness levels.

Then for every pair, if the relations of the differences in the happiness levels are identical for more than six participants, these relations were set as their relative ranks. We set 35 relative relations in the happiness group and 102 in the unhappiness group.

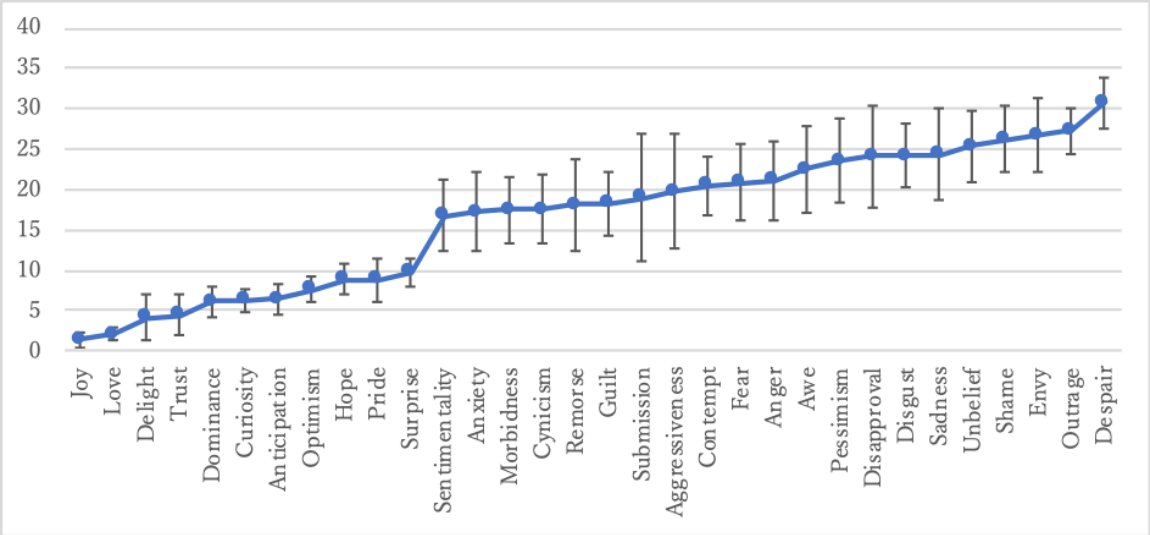

Figure 4. Ranks of emotional words by happiness levels

4.2.2 Feedback Generation

Based on the differences in the happiness levels between two emotional words defined by the surveys, the system provides feedback when the selected characters' emotional changes are inappropriate for the reader model. That is, for two sections of the story, such as introduction, development, turn, and conclusion, the system compares the transition of the happiness levels between the empathized characters' and those in the selected story arc and comments if their transitions are not the same.

Next we explain an example of feedback generation. Assume that the author selects the Type 4 story arc in Table 1 as a reader model and defines the emotions of character A and B, as shown in Figure 5. The transitions of the happiness levels derived from the characters' emotions and the reader model are shown in Table 2. If an author believes that the reader has empathy for character B, character B's transition of happiness levels between the turn and the conclusion does not correspond to the reader model, which indicates *increase* and character B's emotional change shows *decrease*. Therefore, the system provides feedback: "*Note the happiness level contradiction between the reader model and character B's emotions in the turn to the conclusion*."

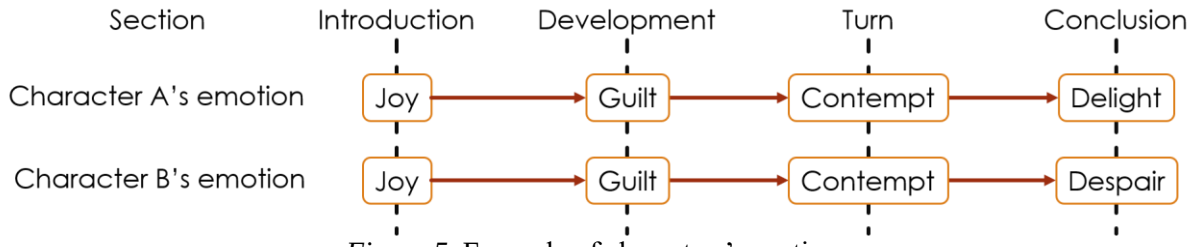

Figure 5. Example of characters' emotions

Table 2. *Transitions of Happiness Levels by Characters' Emotions and Reader Model*

		Changes in happiness level		
		Introduction to development	Development to turn	Turn to conclusion
Character's emotion	Character A	Decrease	No change	Increase
	Character B	Decrease	No change	Decrease
Reader model (story arc)		Decrease	No change	Increase

5. Prototype System

We developed a prototype system with which authors can select story arcs as reader models and define the emotional changes of their characters. We implemented our developed system as a new module of a plot creation support system that we developed in previous research (Ashida and Kojiri, 2019). Our system defines the plot's format and provides an interface for organizing it based on the format. The system is implemented used HTML and JavaScript.

The system's interface of the system is shown in Figure 6. The upper half is *the story arc selection part* and the lower half is *the character's emotion setting part*. In the former, six types of reader models can be selected from *the list of story arcs*. When one reader model is selected from the list, its corresponding graph is depicted below.

In the character's emotion setting part, the characters are created by *the add character button* and the characters' emotions can be inputted for each section. 32 emotional words are provided by the *list of emotions*. When the basic emotions are selected, the selected emotion on the Plutchik's wheel above is highlighted. If a complex emotion is selected, the two basic emotions that compose the selected emotion are highlighted. The text areas below the list of emotions are used for organizing the ideas of the scenes. A character with whom the readers might empathize is defined at *the relationship setting button*.

When the feedback button is clicked, the selected story arc and the selected emotional words are compared. When differences are detected in the changes of the happiness level, the feedback in Figure 7 is presented in *the feedback area* in Figure 6.

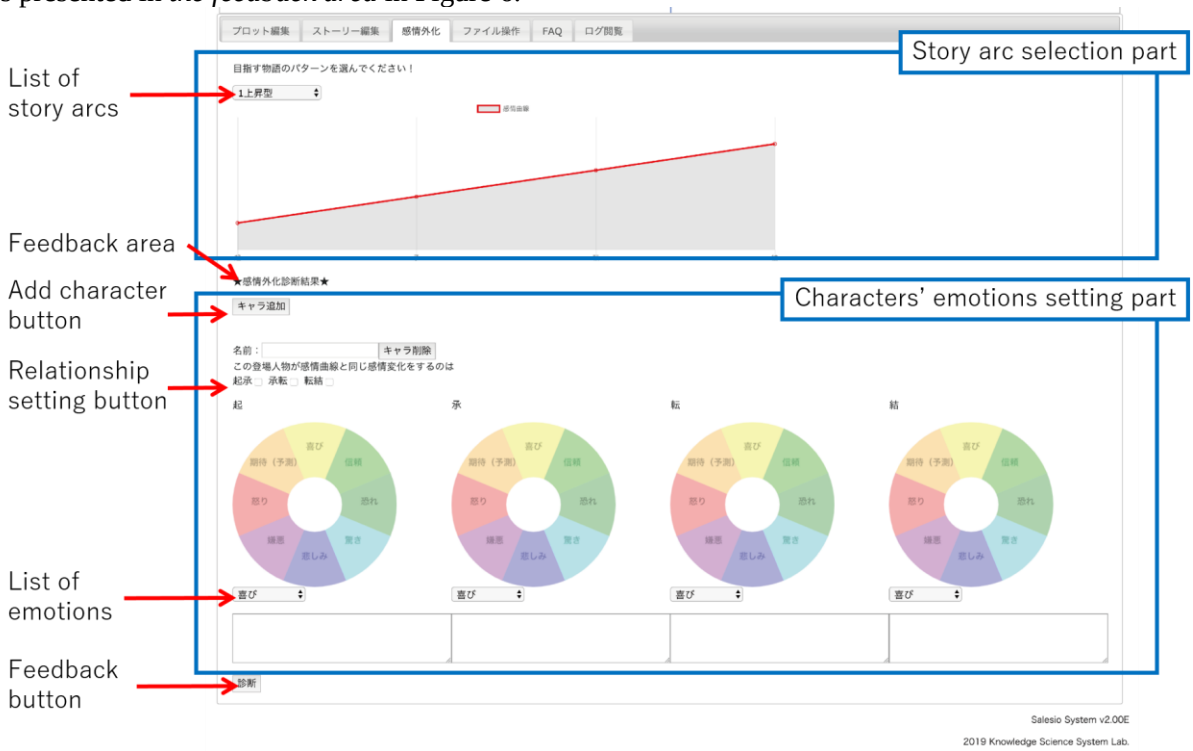

Figure 6. Interface of prototype system

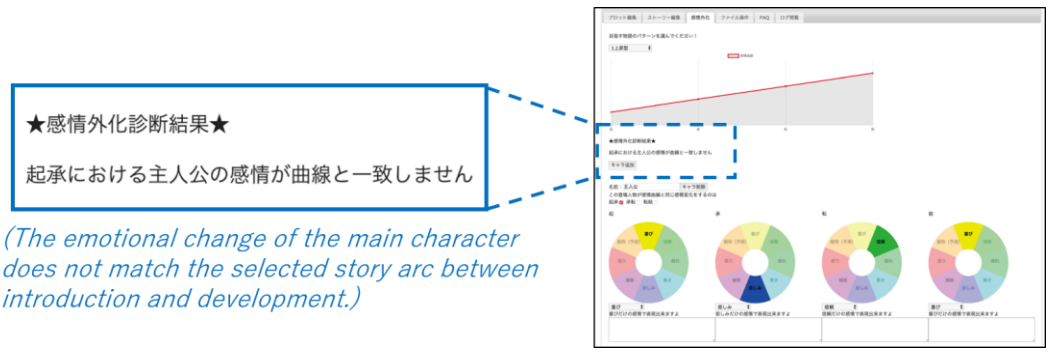

Figure 7. Example of feedback message

6. Experiment

6.1 Evaluation Experiment

6.1.1 Experimental Setting

To evaluate the effectiveness of our developed system for plot creation, we conducted an evaluation experiment with 11 university students. According to the pre-questionnaire, we found out that the participants' writing experience and motivation were different. They were divided into two groups: an experimental group of six participants and a control group of five participants.

The following is the experimental procedure:

1. Determine target readers;
2. Create a plot;
3. Answer questions about the created plot;
4. Answer a questionnaire.

In Step 1, the participants determined an age group and gender for their targeted readers from the following choices. The age group choices were children, junior- or senior-high school students, and adults. The gender choices were male and female. In Step 2, the control group participants created a plot using only the plot creation interface of the plot creation support system, which provides its format (Ashida and Kojiri 2019). The experimental group participants determined the story arc and their characters' emotions with the developed system before using the plot creation support system. In Step 3, they explained why they created the scenes in their plots. For Step 4, the questionnaire items shown in Table 3 were given to the experimental group and those in Table 4 were given to the control group. Regarding author confidence in the created plot, Item 1 is shared by both groups. We asked this question to check whether the proposed method helped create plots that are preferred by the target readers. Items 2 and 3 in Table 3 evaluate whether the story arc's setting and the characters' emotions contributed to the plot creation. Item 4 in Table 3 questions the appropriateness of the feedback provided by the system.

Table 3. *Questionnaire Items for Experimental Group*

Item	Question	Choices
1	Are you confident that your created plot will be preferred by your target readers?	1. Yes. 2. I have some confidence. 3. I have very little confidence. 4. No.
2	Did choosing a story arc help you create the plot?	1. Yes. 2. No. 3. Can't decide.
3	Did setting the characters' emotions based on the selected story arc help create the plot?	1. Yes. 2. No. 3. Can't decide.
4	Was the feedback proper?	1. Yes. 2. No 3. I received no feedback.

Table 4. *Questionnaire Items for Control Group*

Item	Question	Choices
1	Are you confident that your created plot will be preferred by your target readers?	1. Yes. 2. I have some confidence. 3. I have very little confidence. 4. No.

6.1.2 Results

First, we evaluated whether our proposed system contributed to the smooth creation of plots. If they can be created smoothly, Modification of scenes can be reduced. Table 5 shows the number of times that scenes were modified, the total number of scenes, and the average number of modifications per scene. Participant D is blank because we failed to obtain his log data. The results show that the average number of modifications per scene for the experimental group is significantly less than for the control group: *t* test ($t(5) = -2.698$, $p < 0.05$).

The questionnaire results are shown in Tables 6 and 7, indicating the number of participants who selected each choice. According to the answer for Item 1, all the participants in the experimental group were confident of their plots to some extent, while some in the control group were not. Items 2 and 3 in Table 6 show that most of the participants in the experimental group found that selecting the story arc and the characters' emotions supported their plot creation.

These results indicate that our system, especially its functions for selecting story arcs and characters' emotions, contributed to the smooth creation of plots in which participants felt confident. According to Item 4 in Table 6, only one participant in the experimental group answered "no." This suggests that the method of feedback generation helped some of the authors. Since the number of participants of our experiment was small, further experiments are needed to verify the effectiveness of the system's feedback.

Table 5. *Results of Evaluation Experiment*

	ID	Number of times scenes were modified	Number of scenes in created plot	Average number of modifications per scene
Experimental group	A	20	19	1.05
	B	11	13	0.85
	C	12	13	0.92
	D	-	14	-
	E	8	12	0.67
	F	5	10	0.50
Control group	G	20	15	1.33
	H	12	11	1.09
	I	18	13	1.38
	J	29	19	1.53
	K	38	14	2.71

Table 6. *Questionnaire Results of Experimental Group*

Item \ Choices	1	2	3	4
1	1	5	0	0
2	4	2	0	
3	5	0	1	
4	2	1	2	

Table 7. *Questionnaire Results of Control Group*

Item \ Choices	1	2	3	4
1	0	3	2	0

6.2 Verification Experiment

6.2.1 Experimental Setting

We experimentally verified whether the authors created plots that represent the selected story arc using our system. Five university students participated as *reader participants* to differentiate them from the participants in the first experiment.

The reader participants were asked to read the plots created by the participants in the experimental group of the former experiment and to select the happiness level transition that they felt by the plots from the given choices for each section, such as introduction to development, development to turn, and turn to conclusion. The given choices were increase, decrease, no change, and cannot answer. We evaluated whether the selected transitions of the happiness levels correspond to the story arcs selected by the authors of the plots as reader models.

Since the age-group and gender of each reader participant did not correspond to the target readers of the plots, we did not verify whether they preferred the created plots.

6.2.2 Results

Table 8 shows the number of reader participants whose selected happiness level transitions are the same as those of the story arc transitions that the authors selected. The accuracy rate indicates the ratio of correct answers among the total number of answers. Based on the accuracy rates, participants A, B, E, and F created plots that provided the expected transitions of emotions to the reader participants.

We examined the correlations between the accuracy rates and the answers for Items 2 and 3 in Table 6 by setting the following values to the answers: yes = *1*, no = *0*, and can't decide = *0.5*. We identified a very strong correlation between the accuracy rate and the answers to Item 2 ($r = 0.94$) and a strong correlation between the accuracy rate and Item 3 ($r = 0.60$). These results indicate that those who utilized the selection of the story arc and the characters' emotions created plots that influenced the reader participants as the author intended. However, we failed to prove whether stories, which were created from the plots, are preferred by the target readers. Thus, we must conduct further experiments to investigate whether the stories created using our system satisfy target readers.

Table 8. *Results of Verification Experiment*

Plot	Number of correct answers			Accuracy rate
	Introduction to development	Development to turn	Turn to conclusion	
A	5	2	5	80%
B	1	5	5	73%
C	5	1	0	40%
D	1	0	5	40%
E	1	5	5	73%
F	4	5	5	93%

7. Conclusion

We proposed a method that creates plots for novels that are preferred by target readers. To represent reader models, we defined a story arc as an element that expresses the emotional changes that readers are expected to experience while reading the novel. In addition, for designing scenes from the viewpoint of characters' emotions, we defined the emotion candidates and the differences in their happiness levels.

We also developed a support system for creating plots based on the determination of reader models by selecting story arcs from multiple story arc patterns and setting characters' emotions by providing emotion candidates. Our experimental results suggest that the proposed system can support the smoothly creation of a plot that authors are confident about and that the created plots can express the selected story arc. However, our current experiments were conducted with too few participants. We need further experiments to verify our proposed system's effectiveness.

This system allows authors to freely set the emotions for each character. However, emotional dependencies are often found between characters. For instance, if a mother and child share a good relationship, the mother tends to feel happy when her child is happy. If such emotional dependency is ignored, deriving concrete scenes might be difficult. In our future work, we need to establish a method that allows authors to consider character relationships and possible emotions based on defined relations.

Acknowledgement

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