Plot-creation support with plot-construction model for writing novels

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\textbf{ABSTRACT}

When starting to write a novel, an author often creates a structure for it, which is called the plot. The format of plots is not defined, and authors create plots using their own format. Unfortunately, plots often do not include sufficient information and thus authors may be unable to complete their novel. This study aims to support novice writers in creating a sufficient plot. We first analyse the items that support writing a novel and create a plot-construction model. We then propose a support method for creating plots by incorporating the concept of a story, which corresponds to the events ordered along the time sequence of the narrative world. Third, we define the format of the plot and the story and implement the support method. We conducted experiments to evaluate the validity of the plot and the story and the effectiveness of the system, and found that the structures of the plot and the story of already published novels could be adequately constructed. In addition, our system helped authors create plots for specific genres. As the number of participants in the experiment was small, we need to conduct further experiments to demonstrate the validity and effectiveness of our system.

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1. Introduction

The so-called ‘twenty-first century skills’ are now regarded as important skills to succeed in twenty-first century society and various new learning/education methods have been proposed to cultivate these skills (Griffin, McGaw, & Care, 2012). Writing novels requires the twenty-first century skills of creativity, logical thinking, and presentation. Therefore, we believe that novel writing is good training for cultivating the twenty-first century skills. However, some authors, especially beginners, cannot complete the novels they have begun to write. One reason may be that the contents to be written are not sufficiently organized in advance.

Before writing a draft, authors consider the novel’s possible content and order and then summarize these as a plot. The plot is a novel’s framework and describes the contents that must be expressed, such as the novel’s settings, which contain characters and places, and...
the important events that occur. Since a plot description’s format is not formally defined, its details depend on the individual author. Some authors fail to develop sufficient information for writing a novel, and sometimes the plot’s contents are not appropriately connected or are contradictory. As a result, authors give up and abandon their novels. To overcome this problem, it is important to support authors in completing their novels.

A novel is a specific type of document. From the viewpoint of creating documents, several researchers have focused on document creation by generating sentences from given contents. For example, several studies tried to create fake scientific papers automatically (Bartoli, De Lorenzo, Medvet, & Tarlao, 2016; Conner-Simons, 2015; Stribling, Krohn, & Aguayo, 2005; Stuff, 2016). The main focus in creating documents such as scientific papers is how to order the contents in a logical, and thus understandable, order. However, sentences in novels are not necessarily strictly logical, so this approach is not appropriate for writing novels. Liu et al. developed a system that generates new blog articles by combining texts using a corpus extracted from existing blog articles (Liu, Lee, & Ding, 2012). In addition, some studies have focused on generating novels in the style of a specific author by accumulating many of the author’s sentences and then having a system learn patterns from these sentences (Akimoto & Ogata, 2011; Sato, 2016). Furthermore, Hosaka et al. introduced the Vladimir Propp theory, which defines character types and roles, and a prototype structure of the Russian magic tale into a system as knowledge, and developed a method to generate narratives based on this knowledge (Hosaka & Ogata, 2004). Bui et al. developed a system that generates a narrative that includes new scenes and viewpoints based on an inputted narrative by using evolutionary computation. This system divides the given narrative into events and generates a new coherent narrative by combining events using a genetic algorithm (Bui, Abbass, & Bender, 2010). The systems developed in these studies were intended to produce documents or novels rather than assist human authors. In addition, their aim was to create documents or novels that are similar to existing ones. We assume that the difficulty of writing novels is creating an original concept; simply combining information from existing novels does not lead to an original story. In order to write novels featuring original stories, it is important to develop the authors’ ability.

Creating an original story requires sufficient creativity to induce ideas for the contents. As idea-inducement support, Nakajoji, Yamamoto, and Ohira (1999) insisted that understanding differences of impression makes it possible to induce new ideas. They developed a system for tagging artefacts by impression words and comparing them to others. Kainuma, Miyashita, and Nishimoto (2006) developed a system that provides a virtual space, like a scene in a novel created by the author, in which several users can write comments. The idea of this system is to acquire hints for the characters’ conversations or behaviours that may occur in the scene. This approach requires collaborators, so it is not suitable for an individual deriving ideas on his/her own. Moreover, it does not support the user in organizing ideas to form a plot.

Watanabe et al. analysed the components of novels and developed a novel-writing support system by having authors fill in the components (Watanabe & Arasawa, 2014). However, in order to derive the components of novels, authors might have to consider ideas that do not appear in the novel, for example, a message that an author wants to flow through his/her novel. We must clarify what ideas the author should consider in deriving the components, even if they do not appear in the novel.
Our objective is to propose an effective method to support a novel’s creation, especially for beginners. In order to achieve this objective, we need to answer the following research questions: ‘What format of the plot is necessary for representing a novel?’ and ‘What kinds of ideas does an author need to derive in creating the plot and what supports are effective at inducing these ideas?’ Our research proposes one answer to these questions. Note that this research does not establish a correct method for writing a novel; we simply propose one supporting method for plot creation.

First, we propose a plot-construction model that represents the plot structure and helpful ideas to consider in creating plots. This model consists of the plot, the story, the message, the strategy, and the reader model. Among these, we focus solely on the relationship between the plot and the story and, consequently, propose a support method for constructing the plot by introducing the story. The story represents the events that are ordered along the time sequence of the narrative world. However, the order of events in a plot is not always identical to that in the story and intriguing plots are sometimes created by changing the order of events from that in the narrative world. Thus, having authors think about the sequence of events in their plot while observing the story’s events might help them create the plot. We then developed a system based on this support method. Through an evaluation experiment, we verified the validity of the structures of the plot and the story, and the effectiveness of the proposed support method. The effectiveness of the other elements in the plot-construction model remains an issue for our future work.

This paper is an improved and extended version of our previous work (Ashida & Kojiri, 2017). Specifically, we have extended our work to include new experiments, concrete examples, and related works, and provide a deeper discussion based on the research questions.

The rest of our paper is structured as follows. In Section 2, we propose our plot-construction model, which involves elements the author should consider in creating a plot. We set forth the method for supporting authors in creating a plot in Section 3 and introduce the developed system based on this method in Section 4. Section 5 presents the experiments conducted to evaluate the support system. We provide our conclusions and discuss future work in Section 6.

### 2. Plot-construction model

According to Hunter and Begoray (1990), authors construct a novel’s structure – the plot – before writing sentences. This is the planning phase. If the plot’s contents are insufficiently described, authors may have difficulty writing sentences that are consistent with the existing contents and thus give up completing their novels. Therefore, preparing a sufficient plot is crucial to completing a novel. Since authors create plots using their own formats, they have difficulty noticing a lack of content.

To support plot-creation, we must clarify the structure of the plot. The plot is the novel’s framework and contains scenes as a hierarchical structure. The scenes in the first layer correspond to the basic structure of the novel. Currently, we adopt ‘introduction, development, turn (turning point), and conclusion’ as the basic structure in the model. Upper-layer scenes include those of lower-layer scenes, which means the lower scenes contain more detailed content. The most detailed scenes are called actions. When the planning
phase is completed, these actions are converted into sentences. Scenes and actions have settings that describe the characters and the places where scenes occur. The settings of upper-layer scenes are inherited by lower-layer scenes. In the lower scenes, additional settings that are unique to them are also described. Within the same hierarchy, there is an order of scenes. Thus, we define that the leftmost scene comes first in the novel and the rightmost scene is last.

In order to support the creation of the plot, we define the kind of elements that authors consider and their relationships, and form them as a plot-construction model (Figure 1). In addition to the plot’s structure itself, the model consists of a message, a story, a strategy, and a reader model.

In terms of telling things to people, novels are similar to presentations. The difference is the method, such as by sentences or by slides. As Erren et al. insisted, it is important to consider who is the audience and what to tell the audience in the presentation (Erren & Bourne, 2007). Of course, the contents of the slides should be changed accordingly. Our plot-construction model follows this affirmation. That is, the message corresponds to ‘what to tell,’ the reader model represents ‘who is the audience,’ and the strategy indicates ‘how to tell.’

On the other hand, Akimoto and Ogata (2011) described the existence of a time sequence of events in the narrative world. They insisted that readers reconstruct the time sequence of events in the narrative world when reading novels; therefore, authors should be conscious of the time sequence of events when writing. The story in our plot-construction model represents actions that occur along the time sequence of the narrative world. Similar to the plot, a story consists of actions and scenes that summarize such actions. Every action or scene also has its setting, but no element expresses the basic structural components of novels, such as introduction, development, turn, and conclusion. There is naturally a correspondence between the actions in the plot and those in the story, but not all of the actions in the story need to exist in the plot. Also, the order of actions in the plot and that in the story are not necessarily identical. Differences in order can be viewed as an interesting aspect of novels. The actions introduced into the plot from the story are decided by the author’s strategies.

[Figure 1. Plot-construction model.]
We used Little Red Riding Hood as an example that represents our plot-construction model. This fairy tale was created for children, so its reader model is preschoolers. One of its obvious messages is that evil people are ultimately punished. Figures 2–4 show the story and the plot of this fairy tale’s first part; the girl is sent by her mother to visit her grandmother. Figure 2 shows the story of this part. In plots, authors can describe different actions by changing viewpoints. Figure 3 shows a plot from the mother’s viewpoint and Figure 4 shows a plot from the girl’s viewpoint. According to these plots, the way of describing the scenes differs according to the viewpoint. These scenes occur in the house of the young girl and it can be inferred that the grandmother’s house is far from the girl’s house. Thus, the setting establishes that the place is the young girl’s house, which is far away from the grandmother’s house, and the characters are a young girl and her mother.

3. Plot-creation support

In order to support the creation of a sufficient plot, it might be effective to provide the plot format for inputting the plot according to the defined plot structure. In addition, since the plot-construction model represents the components to think about in creating the plot, successful completion of the plot can be assisted by the derivation of five elements: the plot itself, the story, the message, the reader model, and the strategy. Our aim is to develop a support system for deriving these elements. The message, the reader model, and the strategy are generally considered in the first stage and the story is addressed while creating the plot details. Our current target is authors who are able to start conceiving plots, but cannot complete their novels. Such targets may face difficulties creating plot details. Therefore, our current research supports plot creation by motivating authors to consider the story. Support in developing the message, reader model, and strategy remains as future work.

Some authors create plots with insufficient content and without awareness of the story’s existence. Checking the plot from the sequence of events in the narrative world, such as the story, may highlight such insufficiency. Authors can be supported by defining the plot and the story format, and providing an environment for representing them and associating them with each other. In other words, they may become aware of content insufficiencies or conflicts. Therefore, we propose a system that represents the plot and the story while associating their actions with each other.

Figure 5 shows the overall framework of our system, which includes an interface in which the author can input a plot and a story and associate the two. It also contains the author’s plot and story data.

This interface provides an environment in which authors can input plot and story content. Since plots are represented as a hierarchical structure, they must also be expressed with a tree structure in the interface. Plots consist of two types of nodes:

![Figure 2. Example of story in Little Red Riding Hood.](image-url)
actions and scenes. Both nodes have their own settings. The contents of the plot should be created by discriminating these two types and the settings should be attached to both types of contents. On the other hand, in stories, actions are arranged along a time sequence. Being able to understand the actions in the story enables authors to check the validity of their plots. Therefore, the interface provides an environment to insert actions into the story and allows authors to relate actions in the plot with corresponding actions in the story. By organizing the information with this interface, authors can create a plot while considering the actions that occur in the narrative world.

Table 1 shows the form of the nodes in the plot. Name is the unique name of the node. Type indicates the type of node, such as basic structure, scene, or action. Position represents the position of the node in the tree structure. The position is represented by a hierarchical level and a coordinate in the interface. Contents represent a detailed description of the node and Setting indicates the setting’s information, such as place and existing characters, in which scenes and actions occur. If the node type is an action, a corresponding story action may exist, so Correspondence indicates the corresponding story action node.

Table 2 shows the form of nodes in the story. Here, Name, Contents, and Setting are the same as those in the plot. A node does not have a Type because the story consists of only action nodes.

Table 3 shows the form of the setting, which is attached to plot nodes and story nodes. Name is the unique name of the setting. Type shows the type of contents, such as a character, a place, and other elements. Property contains attributes and values of the setting type. For example, if the type of setting is a character, then name, year, weight, and so on are candidate attributes. Several settings of different types are attached to the nodes in the plot and the story.

4. Prototype system

We developed a prototype system to support plot creation. Representations of the story’s time sequence and the plot’s hierarchical structure are implemented in vis.js (http://
visjs.org/), and the other functions are implemented in JavaScript and jQuery (https://jquery.com/). The system is formed as a single-page web application. It operates only on the client side, not on the server side.

The system’s interface consists of the key parts: plot, story, node-editing, and plot/story linking (Figure 6). The plot part is for creating the plot’s hierarchical structure. The story part is used for arranging the time sequence of the actions in the narrative world. In the node-editing part, the contents of each plot and story node can be input and edited. In addition, the file operations of saving and reading, FAQ functions, and tutorials are prepared for each tab.

When the system is started, a root node and its child nodes, which correspond to the novel’s basic structure (such as introduction, development, turn, and conclusion), are shown in the plot part (Figure 7). Authors can create the plot using this system in two ways. One is to create the plot structure directly in the plot part and use the story part if they cannot develop sufficient ideas. By organizing already derived actions along the time sequence, authors may notice conflicts of the existing actions or the lack of actions. The other is to first consider the story in the story part and design the plot from the story. In this case, the author can divide the tasks of deriving ideas and considering the order of actions. In order to support both methods, our system provides functions for creating the plot and the story, and copying existing nodes in the plot or the story to the other.

As a function for creating the plot, authors can add a new empty node by clicking on the existing node to which the new node will be attached. The plot part in Figure 6 corresponds to a situation where the author has created the plot shown in Figure 3. The nodes of the basic structure of the novel, scenes, and actions are discriminated by colours. The nodes of the basic structure are depicted as yellow nodes, scenes as red, and actions as different colours.

![Figure 5. Overall framework of plot-creation support system.](image)

Table 1. Form of plot nodes.

| Title of information   | Description                                                                 |
|------------------------|-----------------------------------------------------------------------------|
| Name                   | Name of the node                                                           |
| Type                   | The kind of node: basic structure, scene, or action                         |
| Position               | Position of the node in the plot                                           |
| Contents               | Detailed contents of the node                                              |
| Setting                | Setting of the node                                                         |
| Correspondence         | Information on a corresponding story action (action nodes only)             |
Table 2. Form of story nodes.

| Title of information | Description                              |
|----------------------|------------------------------------------|
| Name                 | Name of the story action                 |
| Time                 | Timing of occurrence in the story action |
| Contents             | Detailed contents of the story action    |
| Setting              | Setting of the story action              |

Table 3. Form of setting.

| Title of information | Description                                                                 |
|----------------------|------------------------------------------------------------------------------|
| Name                 | Name of the setting                                                          |
| Type                 | The kind of setting: character, place, or others                              |
| Property             | Attribute name and value making up the setting, Multiple for one setting      |

Figure 6. System interface.
and actions as green. Positions can be changed within the same hierarchy by dragging the nodes and moving them in the horizontal direction. In addition, the plot tree can be zoomed out or in by a mouse-wheeling operation.

The contents of each node are input and edited in the plot edit tab of the node-editing part (Figure 8). When a node is selected in the plot part, the details of the scene or the action and its setting are displayed in the plot edit tab. The setting of the parent node is inherited by the child node; when creating a new node, the setting of its parent node is set as its initial state. Figure 8 shows the content inputting for the node ‘I ask the girl to visit her grandmother.’ Authors are led to consider name, type, content, and setting in this tab. The position information of each node is determined by the node position information.
in the hierarchical structure of the plot part. The selected plot nodes can also be removed with the ‘delete node’ button in this tab. Authors cannot create, delete, move, or change the nodes of the novel’s basic structure, such as introduction, development, turn, and conclusion.

Actions in the story are expressed on a timeline that corresponds to the horizontal axis in the story part in Figure 6. The timeline represents the time flow from left to right based on the numbers on the axis. Since grasping the order of actions is more important than the occurrence time of each action, the values on the time axis do not represent a concrete year, day, or time. They are simply numbers on a scale that authors can use by freely interpreting them.

When the timeline is clicked, a new node is added to the clicked position. By clicking on the created story node, the author can input and edit its contents. Contents are displayed in the story edit tab of the node-editing part. The format of the story edit tab of the node-editing part is the same as the plot edit tab of the node-editing part as shown in Figure 8.

The function for copying existing nodes from the plot or story to the other is accomplished by the plot/story linking part in Figure 6. The detailed interface of the plot/story linking part is illustrated in Figure 9. When a plot scene node and a story action node are selected and when the ‘insert in the plot’ button is clicked, the selected story action node is inserted into the plot as a child node of the selected scene (Figure 10). When an action node in the plot is selected, the timeline bar is set, and the ‘insert in the story’ button is pushed, the selected action node is introduced into the story (Figure 11). Since story actions may appear more than once in the plot, the actions of the story and those of the plot have a many-to-one relationship. This relationship is stored as correspondence information of the plot node explained in Section 3. To make it easier for authors to grasp the relationship between the actions in plots and stories, the corresponding actions in the plot or the story are highlighted by selecting the action and clicking the ‘story/plot highlight’ button. If authors have created the same nodes both in the plot and the story, they can indicate that both nodes represent the same action by selecting both nodes and clicking ‘make story plot relationship’ button.

5. Evaluation

We conducted two experiments, the first to investigate the validity of our plot-construction model, especially the plot and story elements, and the other to evaluate the effectiveness of the proposed system for plot creation.

Figure 9. Plot/story linking part.
5.1. Experiment 1

5.1.1. Experimental setting

To verify whether the plot and the story in the proposed plot-construction model can construct the plot and the story, participants were asked to create a plot and a story of existing novels using the developed system. The participants were three undergraduate students.

The participants were instructed on how to use the system. After touching the system and learning how to use it, they were given a novel printed on paper and asked to create the plot and the story. We used the following two novels, assigning Novel 1 to one participant and Novel 2 to the other two participants.

Novel 1. ‘Deluxe Safe,’ a short story by Shinichi Hoshi

Novel 2. ‘Urashima Taro,’ an old Japanese fairy tale

During the creation of the plot and story, the participants were allowed to refer to the printed novels. There was no time limitation, so participants were either able to create the plot and the story or they gave up.

After the exercise, the participants were asked to answer a questionnaire, shown in Table 4. Item I asked about the participants’ prior creative writing experience. Item II asked whether the participants were able to identify the basic structure of the given novel. Item III asked about the participants’ ability to discern the plot of the given novel without the system. Item IV asked whether the participants were able to create the plot and story of the given novel using the system.

Representation of the plot and the story differed for each participant, so we cannot define the gold standard of the prepared novels. We considered the structures of the plot and the story valid if the participants were able to represent the plot and story of the existing novels using our system, the represented actions in the plot follow the order of the actions in the novel, and those in the story follow the time sequence of the narrative world. If the participants gave up, or they could not represent the plot and the story of the existing novels correctly, the structures of the plot and the story were considered invalid.
5.1.2. Results

We compared the created plots and stories with the given novels. For all participants, the order of action nodes in the plot corresponded to the order in the novel. In addition, the story action nodes were allocated along the occurrence order in the narrative world. Thus, all participants were able to create the plot and story of the given novel. These results indicate that we could provide one possible structure of the plot and of the story to represent the novel.

Table 5 shows our questionnaire results. Participants A and B had experience in writing short stories, while participant C had none. All participants replied that they were able to locate the basic structure. Participants B and C were able to identify the plot before using the system. Participant A, who could not identify the plot and story before using the system, replied that ‘Before using the system, I could not identify the relations between scenes and actions. However, by using the system, I could understand the relations and creating the plot became easier.’ All participants replied that they could express the plot by using the system. Therefore, these results indicate that the participants were able to organize the plot and the story by using the structures of the plot and the story in the plot-construction model.

Several opinions were obtained regarding the usability of the system. Most participants requested an ‘undo function’ and a ‘multiple delete function.’ The ‘undo function’ returns to the former situation and the ‘multiple delete function’ deletes several nodes at the same time. Our current system allows users to delete only one node at a time. In order to help

| Table 4. Questionnaire items. |
|-------------------------------|
| Items                        | Contents                                      | Choices                                      |
| I                            | Have you ever written a short story?           | (1) Yes, I have.                             |
|                              |                                               | (2) I tried to write one once, but I could    |
|                              |                                               | not finish it.                               |
|                              |                                               | (3) I thought about writing a short story.    |
|                              |                                               | (4) No.                                      |
| II                           | Could you locate the introduction, development,| (1) Yes, I could find them easily.            |
|                              | turn, and conclusion from the given story?    | (2) Yes, I could find most of them.           |
|                              | If you found this difficult, please describe   | (3) No, I could only find a few of them.      |
|                              | the difficult part.                            | (4) No, I could not find them at all.         |
| III                          | Could you identify the plot and story before  | (1) Yes, I could.                            |
|                              | using the system?                             | (2) I could identify them partially.          |
|                              | If you found this difficult, please describe   | (3) I could only barely identify them.         |
|                              | the difficult part.                            | (4) No, I could not identify them at all.     |
| IV                           | Could you create the plot and the story in the | (1) Yes, I could create them easily.          |
|                              | system?                                      | (2) I could create them partially.            |
|                              |                                               | (3) I could only barely create them.          |
|                              |                                               | (4) No, I could not create them at all.       |

| Table 5. Questionnaire results. |
|---------------------------------|
| Items                          | |
| Participant | I | II | III | IV |
| A           | 1 | 2 | 4 | 1 |
| B           | 1 | 1 | 2 | 1 |
| C           | 4 | 2 | 2 | 2 |
users concentrate on creating plots and stories, the usability of the system is important. Therefore, we should add these functions to improve usability.

5.2. Experiment 2

5.2.1. Experimental setting
We experimentally evaluated the effectiveness of our developed system for plot creation. The objective of this experiment was to evaluate whether beginning authors could complete plots using our system. Whether a plot is complete or not is subjective, so we evaluated whether the authors were able to complete the plots based on the questionnaire responses, rather than the quality of the created plot. In addition, we did not evaluate the effectiveness of our system for writing sentences.

For this experiment, we asked nine undergraduate/graduate students who were interested in writing short stories to create plots using our system. We first defined plot and story and explained how to use our system. Next, we asked the participants to create plots. Time was limited to one hour, but we allowed additional time if requested.

After creating a plot, participants filled out questionnaires with the items shown in Table 6. Items I and II asked about the participants’ experience reading or writing novels. Items III and IV asked about the effectiveness of our system for creating a plot, and item V asked about the system’s overall usability.

5.2.2. Results
Table 7 shows the questionnaire results, indicating the number of participants who selected each choice.

As illustrated in the table, six participants had never written novels and three had not completed a novel they had started. Many participants read books daily. These results suggest that our participants are beginners at writing novels, but do read them.

### Table 6. Questionnaire items.

| Item | Contents | Choices |
|------|----------|---------|
| I    | Have you ever written a novel? | (1) Yes, I have.<br>(2) I tried to write one, but I couldn’t finish it.<br>(3) I thought about writing a novel.<br>(4) No. |
| II   | Describe your book reading habits. | (1) I read them daily.<br>(2) I read them if I have the time.<br>(3) I do not read them much.<br>(4) I do not read them at all. |
| III  | Were you able to smoothly create a plot? If not, explain why. | (1) Yes<br>(2) No |
| IV   | Which part of the system was useful for plot-creation? (multiple answers are allowed) | (1) Story part<br>(2) Plot part<br>(3) Plot/story linking part<br>(4) Node-editing part (setting) |
| V    | Was the system easy to use? | (1) Yes<br>(2) No |
Six participants smoothly created plots using the system. Two who failed to create a plot responded that ‘The system did not give me new ideas.’ Another participant answered that ‘I got some ideas for writing a novel, but I could not connect them well.’ Our system does not support the creation of new ideas. Therefore, these three participants were not the target users that our system assumes.

Seven participants replied that the plot part was helpful for creating plots. During the experiment, five participants did not use the story part or, if they did use it, the orders of the actions of the plot and the story were the same. One participant said, ‘I understood the actions in the narrative world while making a plot without describing the story,’ while another commented that ‘I did not have to use the story part because the sequence of the plot’s actions is the same as those in the narrative world.’ On the other hand, four participants used the story part and changed the orders of the plot and story actions. All of the plots created by these participants were mysteries.

Seven participants gave the system’s usability high marks. Two participants complained that ‘Understanding how to use the system was difficult because it had too many buttons’ and ‘Using the system was too complicated.’ We should improve the interface so as not to disturb the authors. Appropriate interface design in human–computer interaction has been studied (Bevan, 2001). Also, a usability evaluation method called the ‘Cognitive walk-through’ has been proposed (Lewis, Polson, Wharton, & Rieman, 1990). In the future, we should apply these studies and design an interface that authors can operate more naturally.

5.3. Discussion

In the following sections, we discuss research questions based on our experimental results.

5.3.1. ‘What Format of the plot is necessary for representing a novel?’

In order to answer this question, we evaluated our experiments to determine whether the participants were able to create plots using our system without any difficulties. If the format is inappropriate, participants encounter difficulties in representing their ideas to the plot of our system.

In experiment 1, participants were able to create a plot and a story for the given novels. In experiment 2, participants with ideas were able to formulate plots using the system. Also, many participants reported that the plot part was useful. These results demonstrate that the structure of the plot given by our system sufficiently represents a novel’s structure.

In addition, one participant in experiment 1 commented that he understood the components of the novels and that creating the plot became easier with the system. Thus,

| Table 7. Questionnaire results. |
|---------------------------------|
| Item | Choices |
|------|---------|
| I    | 1 2 3 4 |
| II   | 0 3 2 4 |
| III  | 4 3 1 1 |
| IV   | 6 3 2 1 |
| V    | 1 7 2 1 |
showing the format of the plot itself helps some participants recognize the structure of the novels and encourages them to derive the components of the novel.

In sum, although we did not compare this plot format with other formats, we believe that we can provide a sufficient plot format to represent a novel.

5.3.2. *What kinds of ideas does an author need to derive in creating the plot and what supports are effective at inducing these ideas?*

We view the story as a supporting element for developing a plot. In addition, functions for creating the story and copying the action nodes of the story or the plot to other nodes are developed for inducing both the story and the plot. If these ideas are correct, authors may create plots smoothly using our system.

The questionnaire results for experiment 2 indicate that not many participants selected the story part or the plot/story linking part as useful. Furthermore, five participants did not use the story part at all. Therefore, the story is not a supporting element for all participants.

We believe that the effectiveness of the story part varies based on genre. Five participants who did not create a story wrote a plot whose sequence of actions was the same as the time sequence of the narrative world. Therefore, they did not need to consider the time sequence of the narrative world. On the other hand, four participants wrote mysteries. In a mystery, facts without their causal actions are presented to readers in the beginning and the causal actions that previously occurred are revealed later. How to hide earlier actions depends on the style and strategy of the author. Therefore, the story might be effective for creating a plot whose action sequences differ from the time sequence of the narrative world. In the future, we need further experiment to verify this assumption.

According to the response to questionnaire item III, the participants of experiment 2 may be unsuitable because they could not derive the novel’s basic idea. Our research focuses on authors who have basic ideas, but cannot develop the details. Detail ideas cannot be developed when the basic ideas do not exist. Therefore, in the future, support for deriving new ideas should be proposed. In the study of idea derivation support systems, several approaches have been proposed. Brainstorming is one method for deriving divergent ideas by gathering lists of ideas from group members (Parnes & Meadow, 1959); since this method requires a group, it is not appropriate for authors who want to write novels on their own. Having the system prompt the authors with questions is another approach for spurring ideas (Le & Pinkwart, 2014) and is effective for inducing ideas for individual authors. We therefore plan to introduce this question-based approach into our system. We need to define appropriate questions for developing the ideas of the novels and establish a system for creating the basic ideas, such as a message in the plot-construction model, by answering the questions.

6. Conclusion

In this paper, we proposed a plot structure and a plot-construction model that represents the necessary factors to consider in creating the plot of a novel. We also developed a plot-creation support system in which a plot can be created by using the format of the plot and the story in the plot-construction model. In the experiment, participants were able to
replicate the plot and the story of existing novels. This demonstrates the validity of the structures of the plot and the story and the effectiveness of providing a plot format. Furthermore, the effectiveness of organizing actions in the narrative world as a story was observed for specific genres, such as mysteries. However, the number of existing novels and the number of participants in the experiment were small. We need further experiments to evaluate the validity of the structures of the plot and the story and the effectiveness of the system.

So far, we have only evaluated whether novice authors can create a plot using our system. The quality of the created plots also needs to be evaluated, as well as the effectiveness of the system for writing sentences.

In the current system, plots are created by assigning subordinate nodes under superordinate nodes. This process corresponds to a top-down thinking process. Some authors, however, may develop a plot from the actions. Our system does not support such a bottom-up thinking process. To support this thinking process, we must improve our system to create a plot from action nodes as well.

This research also proposes the plot-creation process as a plot-construction model. This model was developed based on the concept of creating the presentation and that of reading the novel, but the validity of this model is not yet proved. We need to investigate the validity of this model, including messages, reader models, and strategies. If the model proves to be valid, we need to develop the system for supporting the entire plot-creation process. The message and reader model are often considered in the early stages of creating a plot. Therefore, we should introduce these parts in the system to further assist authors in developing ideas for their novels.

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