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ComiQA: A Comic Quiz Sharing Service that Helps Users to Recollect the Content of Previous Volumes

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Abstract

It takes several months or years to release a new volume of a comic book after the previous volume. Therefore, when reading a long-awaited newest volume of a comic, it is sometimes difficult to recollect and understand the flow of the story, causing the readers to reread the previous volume or reread from the first volume to check the story. Re-reading can be fun when there is enough time. However, when there are many volumes of the comic or the time is limited, the reader will want to recollect the previous content as soon as possible to read the newest volume. One way to recollect the previous content quickly is to check its summary. However, a synopsis is often not enough to recollect everything and may become a spoiler if the reader has forgotten to read the previous volume. In this paper, we proposed and implemented a system that enables users to recollect the content of the previous volume by quizzes (question-answer pairs). We considered that just reading a question text would not be a spoiler. In addition, we released our system, "ComiQA," as a Web service and found the characteristics of quizzes made by analyzing the registered 1465 quizzes in our service. We also experimented to investigate and compare the degree of recollection of creating quizzes and writing reviews. We found that creating quizzes helps people recollect the episodes more effectively than writing reviews, and viewing the quiz leads to further recollection.

Keywords: Comic, QA service, Recollection ;

1. Introduction

In Japan, it often takes about three or four months, and sometimes several years, for the newest volume of a comic to be released after the previous volume has been released. Therefore, it is sometimes difficult for people to recollect the previous story when they want to read the long-awaited newest volume. As a result, to recollect the previous content, people read again from the previous volume, or in some cases, from the first one. Re-reading can be fun if they have enough time. However, when there are many comic volumes or if time is limited, readers will want to quickly recollect the previous content so they can read the newest volume as soon as possible.

Comics often include a synopsis of the previous content at the beginning, allowing the reader to look back on the story. Based on this point, Devi et al. [1] conducted research on automatic synopsis generation. However, synopses often provide insufficient information, making it difficult to recollect the previous story. Moreover, people's memories are hazy, and it is not uncommon for them to inadvertently read the newest volume without reading the previous one because there are a vast number of comics published daily in Japan. In this case, the problem is that viewing the synopsis will become a spoiler. Spoilers may cause the reader to lose interest in the next volume [2]. In addition, it is easy to obtain information on previous content by searching the Web. However, since the content on the Web is not organized, users might see the contents of an unread section, which would be a spoiler.

In this paper, to solve these problems we propose a method to support recollection of previously read volumes while preventing spoilers. Specifically, our method asks readers to post a quiz about a read comic. We defined a quiz as a pair of a question and an answer. This enables them to recollect the content of the previous volume by answering questions created by themselves or others. In addition, our method blurs parts of the question text to prevent spoilers in a list. Then, we implement this method as a Web service called "ComiQA" and discuss the characteristics of the quizzes registered in the ComiQA. In addition, we conducted experiments to verify whether creating and viewing quizzes on the content of comics encourages readers to recollect that content.

The contributions of this work are as follows:

- We realized a quiz-sharing service for a comic look-back, obtained 1464 quizzes and analyzed the characteristics of the quiz dataset on comic content.
- We clarified that quiz creation and confirmation promote recollections of the content of the previous volume.

2. Related Work

2.1. Studies of Comic and Novel Comprehension Support

Devi et al. [1] proposed a method for summarizing comic stories using deep learning. This allows users to understand the story quickly and clearly. Mori et al. [3] hypothesized that the abstract based on how far the reader has read the novel effectively reminds the reader of the story. They considered where the sentences should be selected for the abstract. Through the experiment, it was confirmed that an abstract in which the sentences were selected from the period just before the bookmark was better than an abstract generated from all parts of the past story. However, the synopsis is only a supplement and is often not sufficient as a means of recollection.

Imaizumi et al. [4] investigated the identification of a group of featured characters during an arbitrary period to recognize the comic storyline. This was found to be sufficient for understanding the main characters of the story. Lei et al. [5] hypothesized that the frequency of a character's appearance could be used to recollect the content of a previously read comic volume and realized a system that visualizes information on the frequency with which characters appear without explicitly indicating the content. Mori et al. [6] proposed a method for representing characters' directed relationships based on their speech contents in a comic. Elson et al. [7] used a character relationship diagram to show how closely the characters in literary fiction are related. However, it is difficult to say that the content that can be recollected only by character information is sufficient.

We propose a method to support content recollection directly through quizzes. It is considered that recollections can be further supported by including information other than the relationships between characters in a quiz.

2.2. Studies on the Effects of Spoilers

Incorrect information presented during recollection may lead to exposure to the content of unread sections, which may result in spoilers. Tsang et al. [8] found that movie spoilers made consumers more reluctant to watch the movies. Rosenbaum et al. [9] have investigated the factors behind the impact of spoilers on novels by approaching the issue from a cognitive science perspective. As a result, they found that the amount of reading experience is a factor that determines the positive and negative effects of spoilers, with those with more reading experience

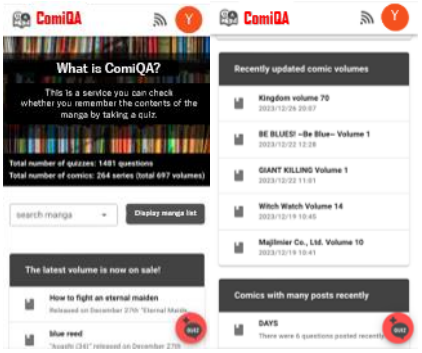
experiencing a decrease in enjoyment due to spoilers and those with less reading experience experiencing an increase in enjoyment due to spoilers. Maki et al. [10] found that reading through a comic to the end, even after being exposed to spoilers, resulted in the same enjoyment as if the spoilers had not been seen. On the other hand, they suggested that receiving a spoiler may decrease interest in reading the rest of the comic. Spoilers can be prevented when checking the question by devising the question text.

3. ComiQA

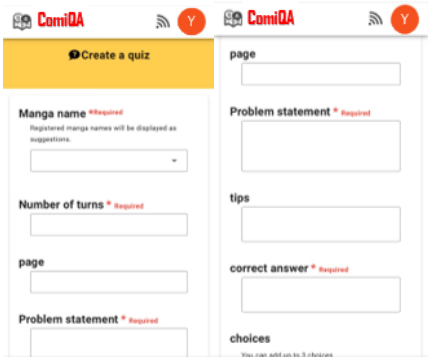
3.1. Method

In this paper, we propose "ComiQA," a system that helps users recollect previous volumes of a target comic while considering the prevention of spoilers. When buying the newest comic volume, we sometimes reread the previous volume to recollect the content. However, as mentioned above, re-reading the previous volume takes work and time. Moreover, if users who have not read the previous volume read that synopsis, it could lead to spoilers. The important factors for a user who purchases a new book when checking the previous volumes are: 1) easy and quick confirmation; 2) recollection is easy; 3) no spoilers. Considering these factors, we propose a method presenting the content to be recollected through quizzes. It is thought that spoilers are unlikely to occur by just viewing the questions.

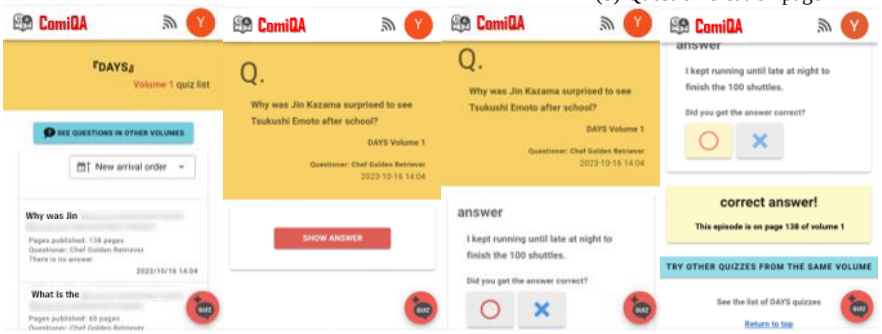
Our method asks a user to create a quiz (question-answer pair) along with a hint after reading a comic, and then post it to our system. Afterwards, when the user is going to read the newest volume of the comic, our system asks questions and lets the user think about the content of the previous volume. If the quiz is unknown, the user can easily remember that they have not read the previous volume yet. We expect that the user will be able to recollect the previous volume by thinking about the answer to the question.



(a) Top page



(b) Question creation page



(c) Quiz list and quiz viewing page (the question is blurred to prevent spoilers in the quiz list)

Fig. 1. Screen snapshots of the ComiQA system.

3.2. Implementation and Usage

We implemented our system using JavaScript (Nuxt.js), Go (Echo), Firebase, and MySQL. Figure 1 shows images of the system in action.

When users access the home page of our system, they are presented with a list of recently updated comics, comics with many recent submissions, and so on, from which they can access the quiz list. It is also possible to search for comics by keyword. Only a part of the question text is visible when accessing the quiz list of a particular comic volume. Checking the author and the date makes it possible to determine whether the quiz is spoiler-free. When a quiz's page is accessed, the question text for that quiz is presented, and the buttons "Show Hint" and "Show Answer" are presented. Clicking "Show Hint" will show the hint, and "Show Answer" will show the answer. The answers are not automatically graded, but the user is asked to self-report whether the answer is correct or incorrect. The user is also presented with information such as where the episode appears in the volume and different quizzes from the same volume. If the user fails to answer any of the quizzes in that volume, they can check the quizzes in the previous volume to determine how much they have already read and how much they have recollected.

Quizzes can be created by clicking the icon in the upper right corner of the screen, logging in with a Google account, and clicking the QUIZ button in the lower right corner of the screen. Only Google-authenticated users can create quizzes. The user must enter the quiz title, volume number, question text, and correct answer. Additionally, users can enter additional pages, hints, choices, and comments. The schema of the quiz data is ID, question, answer, user ID, comic volume ID, page, hint, comment, and time stamp.

3.3. Analysis of Quizzes

We released our system as a Web service on October 15, 2021, and 1460 quizzes (question-answer pairs) had been registered for 696 comic volumes on March 24, 2024.

We classified these 1460 questions into "When," "Where," "Who," "What," "Why," "How," and "Which" as shown in Table 1. The total number of responses was 1460 since some questions were duplicated or could not be classified into one of the pre-defined categories. Examples of each type of quiz are given in Table 2. Table 1 shows that questions related to "What" accounted for half of the total, followed by questions related to "Who." Questions on "What" and "Who" are like "When Suzume was invited to the grandfather's house, what was inside the treasure chest prepared at the house? (title: The maid only eats!)," or "Who did Master Leo rely on to pursue Arte? (title: Arte)" These questions have been created more often because they are easier to create. On the other hand, "When" questions were the least frequent, followed by "Where" and "Which." "When" and "Where" require information that is difficult to remember unless it is impressive. For example, questions linked to events, such as "On what day did the incident happen in which the Ume family caused a stir on Twitter? (title: Nibunnoikuji)" were easy to

Table 1. Types of questions and number of questions.

Question Types	Number of questions
When	7
Where	61
Who	307
What	820
Why	140
How	69
Which	56
Total	1456

Table 2. Types of quizzes and examples.

Question Types	Title and number of volume	Question	Answer
When	Nibunnoikuji [vol.6]	On what day did the incident happen in which the Ume family caused a stir on Twitter?	14 February.
Where	Togeoni [vol.4]	Where is the highest mountain on earth, where the Hitokotonushi is said to be?	Moon.
Who	Arte [vol.14]	Who did Master Leo rely on to pursue Arte?	Veronica.
What	The maid only eats! [vol.3]	When Suzume was invited to the grandfather's house, what was inside the treasure chest prepared at the house?	Eel.
Why	Galaxy next door [vol.1]	Why did Kuga have an unexplained fever?	Because of the physical distance between Goshiki and Kuga.
How	DAYS [vol.1]	How did Tsukushi get to the venue of the futsal match?	He ran.
Which	MIX [vol.18]	Which won the match between Seinan High School and Meisei High School?	Meisei.

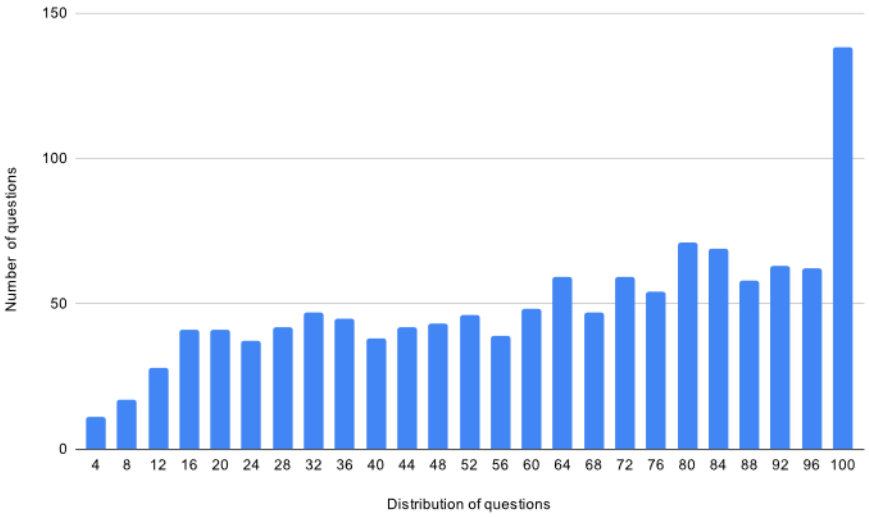


Fig.2. Page where the question was created.

remember because this episode was related to St. Valentine's Day. However, it is not easy to create such questions. In addition, most of the questions based on "Which" asked about winning or losing, for example, "Which won the match between Seinan High School and Meisei High School? (title: MIX)." Since such scenes are limited, the number of questions using "Which" was limited.

Figure 2 shows an analysis of the pages on which questions were created. In this figure, the horizontal axis shows where the quiz was created when the total number of pages was divided into 25 parts, and the vertical axis shows the number of questions created on that page. Figure 2 shows the quizzes are widely distributed within the volume, but many are made at the end. This is likely because the end of a volume is often a lead-in to the next volume and is important, and users hope to memorize its content. The questions at the end of the volume are like "What is the name of the manga artist who appeared at the end of the volume as an episode that will be discussed in the next volume? (title: Aoi Hono)" and "In the scene at the end of the volume, who collapsed on the roof of a building surrounded by villains? (title: Hero Company)." In this way, the content at the end of the volume tended to be used as a quiz in the volume that ended with a lead-in to the next volume.

4. Experiment

4.1. Experiment Setting

To clarify the usefulness of our system, we experimented by comparing the following two groups.

- **Quiz group:** A group of participants who created questions and their answers after reading a comic and recollected its content by answering the questions after one week.
- **Review group:** A group of participants who wrote their reviews with impressions after reading a comic and recollected its content by reading their reviews after one week.

The experiment's participants were people who read comics regularly because a person who does not read comics at all would not be appropriate as a collaborator in the experiment. The memorability of a comic's content is influenced by various factors such as genre, the complexity of the story, and the number of characters. In this experiment, we limited the study to sports comics with a sports theme to control these factors. Comics in multi-person sports have more characters than comics in other genres. For this reason, we selected the following six comics (BE BLUES!, GIANT KILLING, Goodbye My Clamor, Harigane Service, God's Volleyball, and Burning Kabaddi) featuring sports played by more than one person.

Next, we obtained their recollected information by requesting them to report it verbally. In the pre-experiment, the participants were asked to write down what they recollected, but because of the time and effort required to input information in writing, they did not write any trivial or uncertain information. This could not be said as a strict recollect because the recollected information was organized and discarded in the mind. Therefore, we asked participants to speak freely about their recollected information, and we then analyzed their utterances in this experiment.

4.2. Experimental Procedure

The experiment had two steps: a reading step in which the participants read four comics they had never read out of the six designated comics, and a recollection step in which they recollected the content of the comic one week later.

1. **Reading step:** Participants in the quiz group were asked to create two questions and their answers for each comic they read. Participants in the review group were asked to write a review of about 200 words with their impressions of each comic read.
2. **Recollection step:** Participants were asked to recollect the comics they had read one week after the reading step. First, without reading anything, the participants gave their recollections verbally, which were recorded within three minutes. Next, participants in the quiz group were asked to check their questions and the answers they had prepared in the reading step. Specifically, the participants were asked to read the question, think about the answer, and confirm their answers. ComiQA was used to present the quizzes. On the other hand, participants in the review group were asked to read their reviews. Afterward, both groups again spoke about their recollections.

4.3. Result

We recruited 20 participants, 10 in the quiz and 10 in the review groups. To compare how well the quiz and review groups could recollect the content, we assigned a score to each answer and calculated the percentage of scores. Specifically, the author selected several episodes beforehand, and the percentage of the episodes that were mentioned correctly was calculated. Examples of pre-selected episodes were match episodes and episodes that would lead to the next volume and beyond.

Figure 3 shows the scores before and after confirmation for the quiz and review groups. Confirmation means that the quiz group answers the question, and the review group reads the review. The after-confirmation score is the total of the episodes recollected before and after viewing questions. The quiz group had higher scores before and after

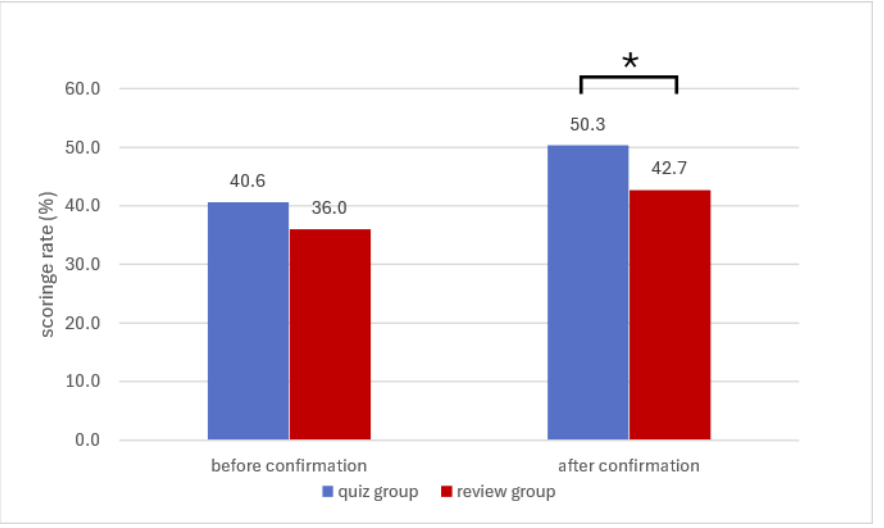


Fig.3. Scores before and after confirmation.

Table 3. Examples of participants-created quizzes.

Title	Question	Answer
BE BLUES!	What is the Saitama proxy case?	The incident of Yuto and Yuuki swapping places in an official match.
God's volleyball	What is in the box that must not be opened?	Tambourines and other support items.
GIANT KILLING	How old is the main character, Takeru Tatsukami?	35 years old.
Burning Kabaddi	What is the last name of the main character?	Yoigoshi.

confirmation than the review group. Paired t-test was conducted using the mean score for each comic. The results showed no significant difference before confirmation, but there was a significant difference after confirmation ($p<0.05$).

5. Discussion

5.1. Effects of Quiz Creation and Confirmation on Recollection

Table 3 shows examples of participants-created quizzes. Participants who scored higher in the quiz group made questions such as “What is the Saitama proxy case? (title: BE BLUES!)” and “What is in the box that must not be opened? (title: God’s volleyball)”. These questions were linked to memorable episodes in the comic and were considered easy to recollect. Although the score was low before answering the questions, some participants recollected the episodes before and after the episode the questions they answered was created from. On the other hand, the participants who recollected fewer episodes created quizzes such as “How old is the main character Takeru Tatsukami? (title: GIANT KILLING)” and “What is the main character’s last name? (title: burning Kabaddi).” These results indicate that quizzes that are episodic are appropriate for stimulating recollection. Furthermore, after answering the question, the participants who created the quizzes from the later episode scored higher than those who created the quizzes from the first or the middle. This suggests that viewing quizzes created from the later episode may lead to the most recollection. Therefore, it is important to have a system that encourages users to create quizzes related to episodic memory and quizzes from later episodes in ComiQA.

5.2. Effects of Review Creation and Confirmation on Recollection

On the other hand, the review group recollected fewer episodes than the quiz group after confirmation. Some participants with low scores focused on specific events and could recollect those episodes in detail, but they could not recollect any other episodes. Participants who wrote reviews concentrating on the characters' personalities and the story's background rather than on the content also had low scores. These results suggest that writing reviews containing one's impressions promotes recollection of impressive episodes, and one's feelings are insufficient to help recollect other information.

5.3. Effects of Quizzes Created by Others on Recollection

We found that viewing a quiz created by the participants promoted recollection. However, quizzes created by others may be effective for better recollection. In addition, it takes several months until the newest volume is released. Therefore, we investigated whether quizzes created by others were effective for recollection after several months had passed. Specifically, we conducted an experiment in which participants were asked to tell us their recollected information five months after reading it, before and after answering two quizzes created by others. As in Section 4.3, we calculated the percentage of scores based on how many pre-defined multiple episodes were correctly described.

As a result, the score before answering the questions was 30.9%, whereas after answering the questions, the score increased to 40.0%. In the recall experiment held one week after reading the comics, the average number of episodes recollected was 5.7 before answering the questions created by the participants themselves and 7.0 after answering the questions. On the other hand, in the recollect experiment held five months after reading the comics, the average number of episodes recollected was 4.3 before answering the questions created by others and 5.6 after answering the questions. As a result, by answering questions created by others, participants could recollect the same number of episodes as before answering one week after reading the comic. In addition, the average increase in the number of episodes recollected by answering the questions was the same as 1.3 in both cases of answering the question created by the user and the quizzes created by others. This indicates that quizzes created by others also promote recollection of episodes.

6. Conclusion

In this paper, we proposed and realized a quiz-type look-back system that supports recollection when reading the newest comic volume. Then, we analyzed the quizzes registered in the long-term operation of "ComiQA." We conducted experiments to verify whether creating and answering questions on the content of comics encourages readers to recollect the content.

First, from analyzing 1464 quizzes registered in the ComiQA, we found that many questions were "What" and "Who" questions, while few were "When," "Where," and "Which" questions. Also, many were about the end of the comic. The experiment comparing the quiz group with the review group showed that the quiz group had an average score of 40.6% before and 50.3% after answering questions, while the review group had an average score of 36.0% before and 42.7% after reading the review. These results indicate that creating and answering a question on the content of a comic book helps the participants recollect the events of that volume. We also found that the most effective quizzes for recollection were those that were episodic. Furthermore, in an experiment in which participants were asked to recollect the content of the comics using quizzes created by others five months after reading the comics, an average of 30.9% of the participants recollected the comics before answering questions and 40.0% after answering questions, indicating that quizzes created by others were also practical for recollecting the content of comics. Quizzes created from the latter episodes were shown to be potentially effective for recollection, suggesting that it is important to induce users to take quizzes from the later episodes in ComiQA.

It isn't easy to pick out scenes and create quizzes for recollection. Therefore, in the future, we plan to support users by making it easier to create quizzes. This includes encouraging users to create quizzes on later episodes and considering the implementation of automatic quiz generation. Additionally, we will consider the risk of encountering spoilers when viewing the quiz questions.

Acknowledgment

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References

[1] Devi, M. S. K., Fathima, S., and Baskaran, R. (2020). "CBCS - Comic Book Cover Synopsis: Generating Synopsis of a Comic Book with Unsupervised Abstractive Dialogue." *Procedia Computer Science*, **172**: 701-708.

[2] Maki, Y., and Nakamura, S. (2017). "Do Manga Spoilers Spoil Manga?" *The Sixth Asian Conference on Information Systems*, 258-262.

[3] Mori, H., Yamanishi, R., Nishihara, Y., and Fukumoto, J. (2017). "The Difference of Word Importance before and after Bookmark for Novel Abstract in Each Reading Progress." *Procedia Computer Science*, **112**: 1246-1253.

[4] Imaizumi, K., Yamanishi, R., Nishihara, Y., and Ozawa, T. (2021). "Estimating Groups of Featured Characters in Comics with Sequence of Characters' Appearance." *International Proceedings of the 2021 International Joint Workshop on Multimedia Artworks Analysis and Attractiveness Computing in Multimedia 2021*, 13-18.

[5] Lei, K., Nishihara, Y., and Yamanishi, R. (2022). "Comic Contents Retrieval Support Interface Us-ing Speech Frequencies of Characters.": *Lecture Notes in Computer Science*, **13306**: 33-44.

[6] Mori, R., Yamanishi, R., and Matsushita, M. (2021). "Representation of Characters' Directed Relationships in Comics with Speech-roles." *Procedia Computer Science*, **192**: 1541-1549.

[7] Elson, D. K., Dames, N., and McKeown, K. R. (2010). Extracting social networks from literary fiction. In Proceedings of the 48th Annual Meeting of the Association for Computational Linguistics (ACL '10). Association for Computational Linguistics, 138–147.

[8] Tsang. A. S. L. and Yan, D. (2009) "Reducing the Spoiler Effect in Experiential Consumption." *Advances in Consumer Research*, **36**: 708–709.

[9] Rosenbaum, J. E. and Johnson, B. K, (2016) "Who's afraid of spoilers? Need for cognition, need for affect, and narrative selection and enjoyment." *Psychology of Popular Media Culture*, **5(3)**: 273–289.

[10] Maki, Y., and Nakamura, S. (2018). "A Consideration to Estimate Spoiling Pages in Comics". *International Symposium on Affective Science and Engineering ISASE2018*, **4**: 1-6.