



28th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems (KES 2024)

A Study on Anxiety Reduction of Reader-dependent “*Jirai*” Expressions in Comics

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Abstract

Since comics are diverse, there are some depictions that readers like and some that they do not like. If readers find a part of a comic that they dislike, they can continue reading it even if they can skip that part, but there is a possibility that they will stop reading it entirely if they actually read it. Therefore, we propose a method for allowing readers to enjoy comics without worrying about depictions that they do not like. To realize this method, we developed a system that allows readers to flag depictions they dislike while reading comics and conducted data collection experiments. We also implemented a system in which *jirai* (content to be avoided) flags and announcements are given to readers while reading a comic, and we examined the feasibility of the system by operating it for about four weeks. We confirmed that the flagging and *jirai* announcements were performed during the system operation. In addition, the evaluation of *jirai* judgments for comics using the Vision API showed that while there is potential for AI to make judgments, there are still difficulties in judging detailed depictions.

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Peer-review under responsibility of the scientific committee of KES International

Keywords: Comic; Jirai; Dataset;

1. Introduction

People have a sense of dislike for various things, such as insects, fire, sharp edges, and heights, and such dislikes exist in comics as well. Even if they rarely encounter such things in real life, they are likely to encounter them in comics because comics depict various worlds and the actions of people who have different codes of conduct. In Japan, the word “*jirai*” is often used in social networking services and in everyday conversations to describe this kind of content to be avoided. In this study, we also define “*jirai*” in comics as “depictions that are offensive and that make people avoid reading them because they are unacceptable.”

To investigate the characteristics of *jirai*, we surveyed 1,000 people (500 males and 500 females) in a “Questionnaire for comic book lovers” on Yahoo! Crowdsourcing and received 876 appropriate responses for analysis.

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From the analysis, 53.4% of the respondents indicated that they had some depictions that they disliked in comics. When categorizing the responses to the question, “Please answer what evokes disgust upon just viewing the pages of the manga they are featured in,” grotesque or cruel depictions were mentioned quite often, at 30%. In addition, many of the things that are considered disgusting, such as sexual (7.7%), blood (4.9%), insects (3.4%), murder (3.8%), and clusters of small holes or bumps related to trypophobia (0.4%) were also mentioned. These indicate that there are many readers with a variety of *jirai*.

When readers see a *jirai* depiction such as insects, blood, or stimuli that induce trypophobia, they are afraid it will reappear, so their motivation to continue reading will lower. However, such depictions are not a problem in and of themselves but rather result from the reader’s dislike of them; in other words, they are highly reader-dependent. It would be inappropriate to regulate the depiction itself because the author intends to depict it. Even for highly reader-dependent *jirai*, if the subject matter can be inferred from the cover, title, or category, readers can easily avoid reading it. However, if something is not the main theme of the comic but only a part of it, it is not easy to notice its existence before reading. For such comics, it is thought that readers can enjoy them as long as they overlook parts that involve *jirai*, so it is essential to have a system that avoids reader-dependent *jirai*.

This research focuses on the problem of reader-dependent *jirai* in comics that reduce the motivation to read and aims to enable users to read comics without worrying about the existence of *jirai*. In this study, we propose a method for sharing flags of *jirai* depictions with readers. Specifically, if a user with a bug *jirai* sees depictions of bugs while reading a comic, he/she adds a *jirai* flag to this page. Other users who fear seeing bugs can easily skip the page by using our system because our system warns that “bugs will appear on the next page,” one page before the bug appears (see Fig. 1).

In this study, we create a prototype system to flag *jirai* and investigate individual differences and tendencies in flagging through experiments. We also verify the usability of our system through long-term experiments. In addition, we investigate the possibility of adding flags to *jirai* depictions with OpenAI Vision API. In this study, we define “*jirai*” in comics as “depictions that are offensive or irritating and that make people avoid reading them because they are unacceptable.”

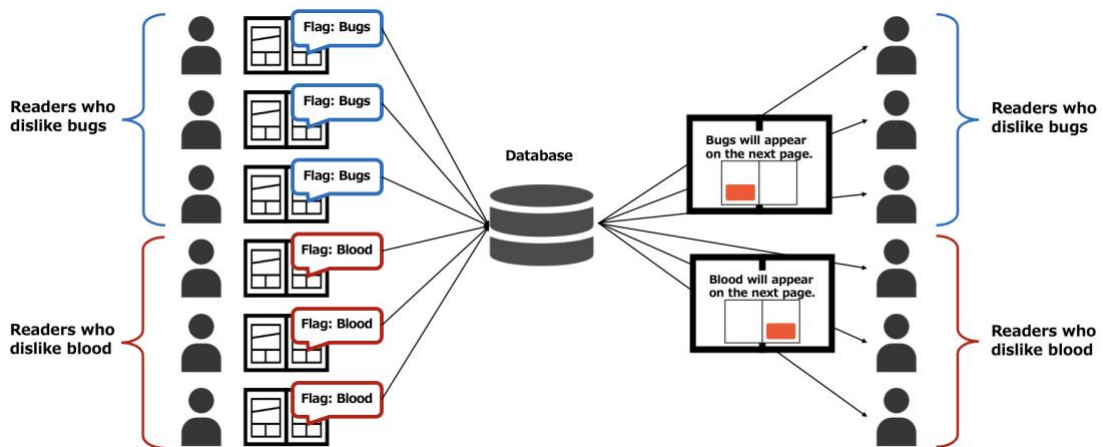


Fig. 1. Image of proposed method.

2. Related work

2.1. Research on comics

Comics are not only enjoyed by people but have also attracted attention as an object of research and use in engineering fields. The Manga109 dataset [1][2] is a large dataset of 109 comics drawn by Japanese manga artists, annotated with panel positions, character names, dialogue positions, and string information on each page. Sakurai et al. [3] have extended the dataset to map dialogues to speakers for speaker estimation of dialogues appearing in comics.

While constructing such datasets is important for developing comics research, the data on reader-dependent *jirai* expressions collected in this study may have the potential for use in research other than this study.

In their research on comic retrieval and recommendation, Park et al. [4] have conducted character personality estimation for comic retrieval support based on character personalities. For comic retrieval support based on content information, Park et al. [5] also analyzed reviews on the Web using TF-IDF and hLDA topic models and constructed a topic-based retrieval system. This system enables recommendations that match the user's preferences by presenting comics with the same topics as those selected at a time. Daiku et al. [6] conduct story analysis using genre classification of comics, aiming at a retrieval system based on readers' interests. Narita et al. [7] propose a frame retrieval method based on sketches to realize an intuitive retrieval system for desired comics. In a similar study, Matsui et al. [8] realized a sketch-based comic-specific image retrieval using the Manga109 dataset [1][2], and the proposed method performed best compared to existing methods. These studies focused on readers' preferences and interests and did not focus on expressions they disliked. This study aims to realize a system to support comic reading, in which users can read comics without worrying about reader-dependent *jirai*.

2.2. Research on disgust

The *jirai* in comics, which we focus on in this study, are those that are felt as unpleasant. There are various studies on disgust and discomfort, and Haidt et al. [9] listed seven categories as evoking disgust: food, animals (such as snakes and cockroaches), bodily secretions, sexual deviance, bodily injury, unsanitary conditions, and contact with dead bodies. They also stated that they feel an aversion to social moral deviations, such as criminal acts. Disgust for aggregates is thought to be related to fear of skin diseases and infectious diseases [10], and it is predicted that aggregates of natural objects are more likely to be associated with such feared objects, such as diseases, and thus the disgust is intensified.

Wang et al. [11] proposed a method to recognize horror videos based on visual features, audio features, and color emotional features to prevent children from watching horror videos. Papadamou et al. [12] constructed a classifier to identify content on YouTube that is inappropriate for young children. These classifiers deal with video content that some people may find objectionable, such as horror and violence. This study is an approach to depictions that are not inappropriate but are still objectionable. It helps people enjoy the comic more by warning them of *jirai* expressions in the comic.

2.3. Research on the effects of presenting information in advance

Many studies have investigated the effects of information announcements. Ozawa et al. [13] showed in an experiment using rats that when fear is anticipated, specific brain activity suppresses the fear of later experiences and prevents the formation of excessive fear memories. Ono et al. [14] conducted an interview-based study to determine how the presentation of information on the benefits and risks of hydrogen vehicles would change the acceptability of building a hydrogen station in the vicinity of the respondents' residence. The results showed that the acceptability of building a hydrogen station would increase. Schmitz et al. [15] also assessed fear and anxiety aversion using predictable and unpredictable stimuli. They found that predictable aversion stimuli were more likely to induce anxiety than no aversion stimuli but less likely than unpredictable stimuli to cause anxiety. These studies suggest that warning information about *jirai* in comics may be less likely to induce anxiety or may increase acceptance.

3. Individual differences in *jirai* flagging

3.1. Experiment

The criteria for flagging are considered to differ from user to user. To clarify the degree to which flagging varies from person to person and to verify whether it is possible to assume that even people who do not have reader-dependent *jirai* will be flagged by people who do have *jirai*, we first developed a system that allowed users to flag *jirai* while reading comics easily. Then, we clarify whether the flagging of *jirai* is manageable for users reading comics.

The flow of the system developed for the experiment is as follows. When a user logs in to our system, a list of registered comics is displayed. Users can select a comic they want to read from the list. When a user encounters a *jirai*, the user can register a *jirai* flag by clicking on the page to display a modal window. This window has a pull-down form for selecting the flag, and the flag can be assigned by selecting the appropriate *jirai* from the form.

Using this system, we conducted an experiment in which users were asked to assign flags while reading a comic book. Preliminary experiments showed that the *jirai* flag for insects was the most common, and since most participants were young women who did not like insects, the flags to be registered were limited to insects. In addition, we selected the following two comics in which insects appear, although insects are not the main theme.

- Koyoharu Gotouge, “Demon Slayer” [16]
- Taiga Sassa, “Isabella Bird in Wonderland” [17]

Note that we asked the participants to read only volume 4 of the “Demon Slayer,” in which the insects appear, rather than volume 1. Because of the possibility that the participants might perceive the insects as *jirai* in a context-dependent manner, we considered it necessary to conduct the experiment on people who understood the flow of the story. Therefore, we recruited participants who had read up to the third volume of “Demon Slayer” or watched the anime.

The participants in the experiment were 11 undergraduate and graduate students (3 males and 8 females). The experiment was conducted online, using PCs owned by the participants. First, after explaining how to use the experimental system, the participants were asked to assign flags while reading a comic book. The participants were instructed to assign flags to depictions they thought were hard to read for those who disliked insects. If the participants themselves disliked insects, they were asked to assign a flag to the page containing the scene in which they felt disgusted. After each comic book was read, the participants were asked to fill out a post-reading questionnaire, and after reading both comic books, they were asked to fill out a post-experiment questionnaire. In the post-reading questionnaire, we asked for impressions of the comic, if they wanted to read the next story, and if there were any pages they did not want to see. In the post-experiment questionnaire, we investigated their liking or disliking of insects and the ease of use of the system. In addition, we conducted a 15-minute interview later to investigate in detail what criteria the participants used to assign the flags and how much they disliked insects.

3.2. Results

First, the average score for the post-experiment questionnaire question, “Was tagging with the system used in the experiment laborious? (5: easy - 1: laborious),” was 4.09. This result suggests that flagging is easy to do with this system.

Figs. 2 and 3 show the number of people who assigned the “Beware of insects” flag to each comic page. Note that the labels on the horizontal axis of the figure indicate a portion of the number of pages to which many participants assigned the flag. From the figures, it can be seen that the number of pages flagged with *jirai* differs significantly among the comics. Many participants assigned the flag to extreme pages, such as when the insects occupied most of the page or were approaching the characters.

To examine the difference in the assignment of the flag depending on whether the experimental participants had *jirai* or not, we focused on determining whether the insects appearing in the comic were disliked by the experimental participants. In post-experiment interviews, when asked if they disliked insects (spiders) when they first read Demon Slayer (or watched the anime), participants who responded that “the appearance of spiders was memorable and felt disgusting,” or those who said they “read it while squinting” or “skimmed through it,” were considered to have a sensitivity to insects and were categorized into the group with *jirai*. On the other hand, those who responded, “I read the book while thinking that it might be impossible for people who do not like insects” or “I could read the book normally,” were considered to have no *jirai* and were classified into the group without *jirai*. As a result, we classified participants A to D into the group with *jirai* and the participants E to K into the group without *jirai*. Table 1 shows the average and standard deviation of the number of flags for each group. The table shows that the number of flags assigned by each participant varied from comic to comic, with Demon Slayer having more flags than Isabella Bird in Wonderland. The standard deviation for Demon Slayer is also large, indicating that the number of flags varies from person to person. Figs. 2 and 3 show that while many people flagged some pages, several pages were flagged by only

one person, indicating that the description perceived as *jirai* varies among participants. However, there were no differences in the number or range of the flags depending on the presence or absence of *jirai*.

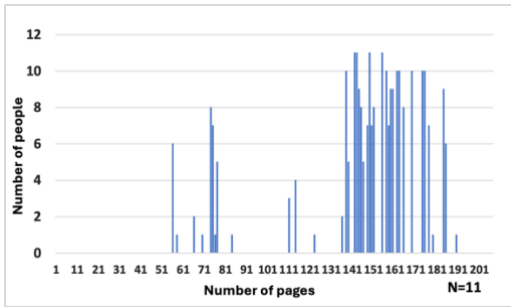


Fig. 2. Number of people flagged per page (Demon Slayer).

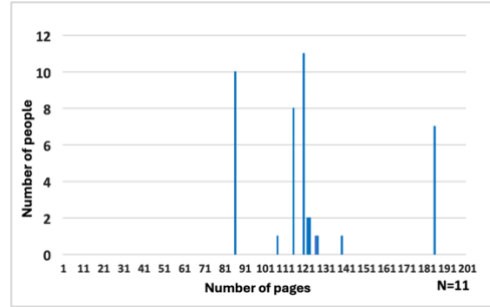


Fig. 3. Number of people flagged per page (Isabella Bird in Wonderland).

Table 1. Number of *jirai* flags.

	Average (Standard deviation) of the number of <i>jirai</i> flags	
	Demon Slayer	Isabella Bird in Wonderland
Group with <i>jirai</i> (A~D)	21.25 (9.74)	3.25 (1.26)
Group without <i>jirai</i> (E~K)	25.29 (7.09)	4.71 (2.14)

4. Evaluating system practicality through long-term use

4.1. System

On the basis of the previous experiments, we implemented a system that enables flags to be assigned and *jirai* locations to be announced along with an actual comic viewer service. Fig. 4 shows an image of a comic viewer system using the proposed method. The system is limited to six types of *jirai* that can be flagged and announced: grotesque, bullying, insects, animals (animals that suffer severely), sexual, and painful (painful-looking). This was done to prevent confusion in the flagging and was selected from the responses to the questionnaire in section 1.

When a user finds a depiction they dislike while reading a comic on the target Website, they can click on the page to open a *jirai* registration screen in a separate window (see Fig. 5). They then select the appropriate *jirai* and its position and press the submit button to send the data to the database. Then, the user can continue reading as usual. The *jirai* announcement function allows the user to select from the six types of *jirai* that they want to be announced in advance from the registration page and register them by pressing the submit button (see Fig. 6). As the user reads through the comic, a separate window automatically opens when the user reads one page before the page containing the registered *jirai*, and a warning of the *jirai* is displayed (see Fig. 7). This window displays the content and location of the *jirai* that will appear on the next page. The window can be closed by pressing the button at the bottom, and the user is left to decide how to read the subsequent pages. For example, if users want to avoid the announced *jirai*, they can read the page while squinting or skip it by speeding up the page feed.

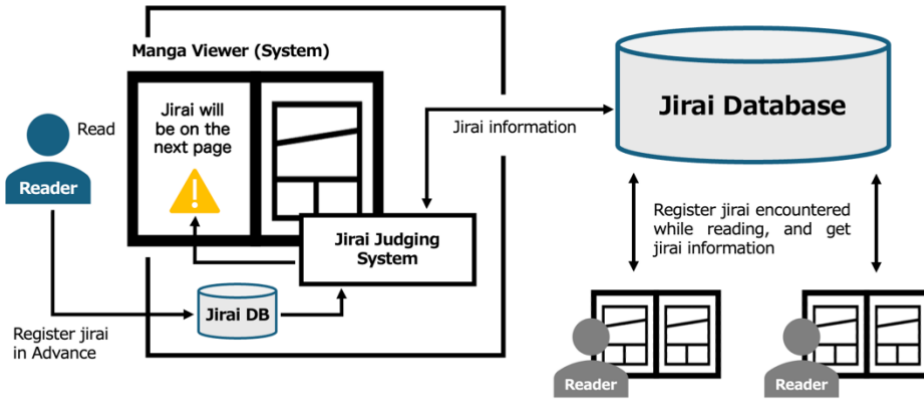


Fig. 4. System overview.

The screenshot shows a form titled 'Page 0 of "Comic Titles"'. It asks 'What kind of Jirai do you have?' and instructs the user to 'Please register one kind of Jirai at a time.' There are six buttons: 'Grotesque', 'Painful', 'Animals', 'Bullying', 'Sexual', and 'Bugs'. Below this, it asks 'Please select its location.' and notes 'Multiple selections are possible.' There are four buttons: 'Upper left', 'Upper right', 'Lower left', and 'Lower right'. A 'Submit' button is at the bottom.

Fig. 5. Jirai flag assignment interface.

The screenshot shows a form titled 'Announcement Registration Page'. It asks 'Please select the kind of jirai you want to be announced' and instructs the user to 'Please submit one at a time'. There are six buttons: 'Grotesque', 'Painful', 'Animals', 'Bullying', 'Sexual', and 'Bugs'. A 'Submit' button is at the bottom.

Fig. 6. Jirai registration Interface.

The screenshot shows a light blue box with the text '△You will find "blood" in the following position on the next page△'. Below the text is a diagram of a page layout with a black rectangle indicating the location of the word 'blood'. A 'Close' button is at the bottom.

Fig. 7. Announcement interface.

4.2. Experiment overview

Using the system, we asked users to read comics continuously and collected feedback through questionnaires. We verified the system’s practicality, the announcement’s impact on the reading experience, and how users read the next

page. The system operated for approximately four weeks, from October 24, 2022 to November 21, 2022. First, we introduced and explained how to use the system and then instructed the participants to read comics published on Shonen Jump+. In the previous experiments, the participants were limited to the comics they could read, but in this experiment, there were no restrictions on the target comics. However, because we wanted the participants to use the system continuously to some extent, we asked them to read at least seven comics a week. We also asked the participants to answer a questionnaire every week after reading a comic book using the system. Furthermore, after the four-week operation, we conducted a post-experiment questionnaire to ask for their overall impressions of the system.

4.3. Results

The participants in the experiment were 17 university students (8 males and 9 females). Two participants did not respond to the post-experiment questionnaire and left the system after the first week. As a result, 15 participants (6 males and 9 females) used the system for approximately four weeks, and 373 comics were read during the entire period. The largest number of comics (270) were read by only one person, but more than 100 were read by two or more people. The number of flags collected during the entire operation period was 393. Table 2 shows the number of flags assigned and the number of people who registered the *jirai* as a warning target for each type of *jirai*. The table shows that “grotesque” was the most frequently assigned flag and that the number of people who registered it as a warning target was also the largest. In addition, four participants registered all six types of flags as warning targets. Furthermore, the number of announcements was examined, and 105 announcements were made during the operation.

Table 3 shows the number of comics read and the number of announcements made per week. The table shows that the number of announcements was lower in the latter half of the period than at the beginning of the experiment. Fig. 8 shows the timing from when the participant read the comic, when the flag was assigned, and when the warning was presented for the five comics (from A to E) that had the most announcements. In the figure, the start of the reading is indicated by a black dot and labeled “reading,” flag assignment is indicated by a blue circle and labeled “flagging,” and announcement presentation is indicated by an X mark and labeled “announcement.” The figure shows that a flag was not given or announced for some participants, and it can be seen that the announcement is made depending on the presence of a *jirai*. Also, when asked how they read the next page, the most common response was “Read as usual.” However, some also tried not to look at the page; some turned it faster than usual, and some read it after preparing themselves for the *jirai*.

Table 2. The number of *jirai* flags assigned and registered as a warning.

Flag	Number of flags assigned	Number of people registered as a warning target
Animals	15	5
Painful	103	9
Bullying	25	7
Grotesque	203	14
Insect	14	7
Sexual	32	6

Table 3. The number of *jirai* announcements per week.

	Period	Number of comics read	Number of <i>jirai</i> announcements
First Week	October 24 to October 30, 2022	146	66
Second Week	November 1 to November 6, 2022	104	19
Third Week	November 7 to November 13, 2022	93	11
Fourth Week	November 14 to November 21, 2022	121	9

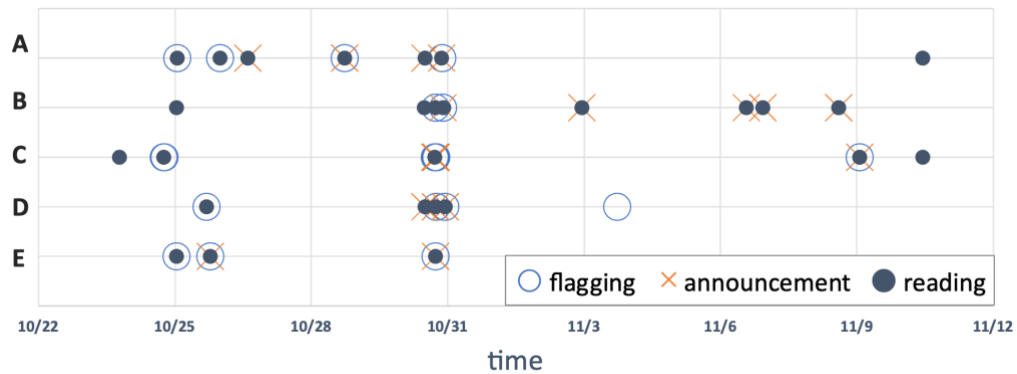


Fig. 8. Timing of reading start, jirai flag assignment, and announcement.

4.4. Discussion

To announce a *jirai* that is highly reader-dependent, it must be flagged by other users. In this experiment, since users were instructed to read any comic they liked, there was a high possibility that they read comics other users have not flagged the *jirai* beforehand. Thus, there was a possibility that the *jirai* would not be announced. However, over 100 works were read by two or more users, and 105 warnings were given during the entire operation period. One of the experiment participants also commented, “Because there were so many manga, I was worried about whether other people’s flags were assigned, but surprisingly, many notices were given, which gave me a sense of confidence in the system.” Based on these facts, a certain number of announcements are expected to be made even when this system is introduced to existing applications.

From Fig. 8, we can see dots indicating “only reading” are plotted. While some participants registered a flag because they felt uncomfortable, others did not feel any particular discomfort and continued reading without registering the flag and without receiving any warnings. This suggests that we can collect reader-dependent *jirai*, in which some readers do not mind a depiction while others find it offensive and announce the presence of that *jirai*. In addition, it can be seen that the flags and the announcement are concentrated at the same time period. This is likely because many participants used the system around the deadline for the weekly questionnaires.

We counted the number of announcements and found that the number decreased with each passing week. The number of participants who answered “Yes” to the question “Did you receive *jirai* announcements?” in the weekly post-reading questionnaire also decreased weekly. This is thought to be because more comics were read at the beginning of the experiment, and the number of comics read decreased each week.

The most common response to how the next page was read with a warning was “Read as usual (51%),” but some participants read the comics after dealing with the *jirai* in some way, such as by trying not to look at the target depictions (26%) and turning the pages earlier than normal (17%). In the post-reading questionnaire, there were responses such as “I thought it was good that there was a warning so that I would not be surprised when I opened the page” and “I was prepared for scary depictions because of the genre, but they were more unpleasant than I expected, so the warning helped me prepare myself for reading the book.” Furthermore, in the post-experiment questionnaire, one respondent commented, “The warning about grotesque depictions was very helpful because it allowed me to brace myself when reading the next page.” These results suggest that the warning of *jirai* could influence the reading behavior of users and support them in reading the next page.

On the other hand, the following comments were raised: “I lost concentration every time a notice appeared, and when I thought there was a scene I didn’t like after that, I wanted to close the comic there” and “I felt a little uncomfortable reading a work with many *jirai* scenes because they appeared in the middle of reading.” To minimize the number of announcements, the system presented announcements together when flags were registered in multiple places on a page, but when flags were registered on multiple pages, announcements were given on each page, which may have interfered with the user’s concentration while reading.

5. Jirai flagging by Vision API

To avoid *jirai* in comics by giving warnings, assigning a flag to the comic in advance is essential. However, the assignment of flags by humans is problematic because it is difficult to maintain consistency due to individual differences in perception and the risk of missing a *jirai* part. In addition, it takes manpower to cover a large amount of comic content. To solve these problems, we turned our attention to AI. We believe that AI can process comic image data and annotate the parts that are likely to be *jirai*, thereby enabling the assignment of flags to a wide range of comics without human bias or fatigue. Specifically, the OpenAI Vision API (GPT-4 Turbo) analyzes comic image data and assigns a flag if *jirai* is present. Thus, we evaluated the flag accuracy using the Vision API. For the analysis, we selected two comics that contained depictions of insects from the comics in the Manga109 dataset. The two are as follows.

- Masakazu Ooi, “Joouari” [18]
- Tatsuki Nouda, “Garakutaya Manta” [19]

The double-page spreads of the comics have been loaded as single images, and the number of images is 96 and 102, respectively. We evaluated the accuracy by the following procedure. First, the author read the comic and manually annotated the pages with insects. Then, the Vision API loaded the comic images and judged whether insects were depicted on the pages or not. The authors’ judgments were used as correct data, and we analyzed the accuracy rate, recall rate, and precision rate of Vision API’s results for each comic. The results are shown in Table 4. The table shows that Vision API could identify insect depictions with more than 70% accuracy in both comics. However, it tended to flag quite a few pages, resulting in lower precision in both comics. For example, it flagged an illustration of a ship’s silhouette seen from above as an insect, and it incorrectly flagged an octopus as an insect. Joouari is a comic in which insects appear on as many as one-third of the pages. Although the authors’ judgment sometimes differed from theirs depending on the size and style of the insects, the pages with prominent insects were judged with a high degree of accuracy. On the other hand, in Garakutaya Manta, insects appear on only three pages. The Vision API correctly identified two of those pages as containing insects. The one page that was misjudged was a page with a relatively small insect. In addition, the precision was low because it flagged many depictions (a total of 9 pages) that were not insects. It was suggested that improving the AI’s recognition accuracy could replace human flagging, but human flagging is essential for detailed judgments such as the level of *jirai*.

Table 4. Accuracy of Vision API.

	Accuracy	Recall	Precision
Joouari	72.16%	70.59%	58.54%
Garakutaya Manta	90.29%	66.67%	18.18%

6. Conclusion

In this study, we focused on depictions that readers personally dislike in comics and defined them as “reader-dependent *jirai*.” To solve the problem of readers not being able to predict the appearance of reader-dependent *jirai* and thus not being able to enjoy a comic, we proposed a method in which readers are asked to flag *jirai* depictions while reading a comic, thereby announcing the location and existence of the *jirai*. To realize the method, we investigated whether the flags overlapped among participants in an experiment. As a result, it became clear that the flags overlapped among some depictions and participants, although the assignment of the flags varied depending on individual criteria. Then, we implemented a system and verified that a large number of flags and announcements could even be given to a few people based on long-term experiments. The results also showed that the system could help readers prepare mentally for *jirai*, which is highly reader-dependent. In addition, we tested the automatic flagging of the *jirai* by using Vision API and showed that it could identify bugs with high accuracy.

In the future, we will improve these problems and make the system more user-friendly by making it compatible with smartphone applications. We hope this research will allow many readers to enjoy reading various comics.

Acknowledgements

This work was partly supported by JSPS KAKENHI Grant Number JP22K12338.

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