



Interactive Visualization of Comic Character Correlation Diagrams for Understanding Character Relationships and Personalities

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Abstract. Comic character relationships are an essential aspect of understanding comic content. These relationships are often expressed in a character correlation diagram. However, existing diagrams with complex relationships can confuse users, and simple correlation diagrams do not show information on character personalities. Therefore, it is necessary to 1) make these diagrams more visually clear and 2) to display character personality information in addition to relationships without increasing the diagram complexity. This paper presents an interactive visualization system for character correlation diagrams that display complex character relationships and personalities. We propose a relationship labeling method based on FOAF and implement a user selection function to emphasize specified relationships visually. This paper also provides visualizations of character personalities chosen by the user. Consequently, users can understand both comic character personalities and relationships. This paper verified whether users could correctly find a specific relationship when asked.

Keywords: Comic character correlation diagrams · Visualization of relationship · Comic computing

1 Introduction

With the recent increase in the number of comics published, users have more choices. While this increase in choice is beneficial to the user, it has been noted that there is concern that too many choices may increase the psychological burden on the user [1].

Since comic characters provide essential clues for understanding story lines [7], there has been much research on automatic computational detection for comic characters, although users cannot understand comic contents from only detecting comic characters; the relationships among comic characters are also crucial to the development of the story. However, often many comic characters

appear in a work, leading to complex character relationships that can be difficult to follow. This paper proposes a visualization system that interactively presents the relationships among comic characters to the user to make their relationships easier to understand.

Several studies have examined to visualize the relationships among comic characters. Murakami [5], for instance, proposed a method for creating comic character relationships for comic content visualization. They developed correlation diagrams by identifying the main characters using the frequencies of characters and their relatedness and then added semantic relations to these diagrams. This diagram enables us to grasp the relationships among characters. However, it does not allow the users to know each character’s personality, and it is still challenging to understand their complex relationships with the method. Since character personalities are one of the characteristics of comic characters that express internal characteristics (e.g., cheerful, inhuman) and play an important role in content creation, differences in character personality often affect story development even in comics that follow the same concept [6]. It implies that it would be more beneficial to simultaneously present the characters’ personalities and relationships in a relationship diagram to understand the content of the comic. In addition, if the diagram shows too much information at once, it may become too complicated, hindering the user’s understanding. It implies that allowing the user to narrow down to the relationships he or she wants to confirm is desirable.

From these considerations, this paper proposes an interactive visualization method of the characters’ relationships interactively.

2 Data Set Creation

Various relationship types appear in a comic. To perform relationship categorization, we created relationship labels with reference to RELATIONSHIP¹ that expand the FOAF (Friend of a Friend) Vocabulary². FOAF [2] is a metadata type that explains a human relationship by connecting people through acquaintance relationships. Our method refers to the RELATIONSHIP [4] to create relationship labels for describing more precise relationships (e.g., lover or rival). We created nine relationship labels and categorized relationships that appeared in comics as those. We also created a relationship dictionary made from words with similar meanings to the labels. We assembled a dataset of comic character personalities and relationships from 25 works of romance comics at Mangazekan.com³. Since Wikipedia entries describe character activities and features, we extracted them from these entries. The targeted characters were selected by referring to the official website of each work. We extracted character personalities that matched the words in the “MOE elements dictionary” after extracting nouns and adjectives from Wikipedia using the Japanese morphological analyzer MeCab⁴. The

¹ <https://vocab.org/relationship/>.

² <http://xmlns.com/foaf/spec/>.

³ <https://www.mangazekan.com/>.

⁴ <https://github.com/jordwest/mecab-docs-en>.

MOE elements dictionary is a list of frequently appearing words in Anime culture that describe character appearance or personality [3]. Next, we analyzed the dependency structure of sentences in Wikipedia describing manga characters using CaboCha⁵, a Japanese dependency structure analyzer; a modifying word and its modifier words are extracted pairwise for each sentence. From these pairs, relationships were determined by focusing on character names and words registered in the relationship dictionary as clues. In total, 209 words of character personalities and 340 words of relationships were extracted.

3 Visualization Method

This study proposes a system that visualizes a correlation diagram of comic characters. Figure 1-(a) shows the appearance of this system. The correlation diagram was created using the vis.js⁶ JavaScript library.

The proposed system categorizes relationships and produces a correlation diagram with each relationship type shown by a different color to aid user comprehension. The system displays characters as nodes and their relationship as edges. In this system, nodes are colored in blue and red for men and women to let users know the characters' genders. For characters of unknown gender, the node color is the default color, light blue. Nodes for main characters, such as the hero or heroine, are displayed more extensively than other characters to indicate their importance. The edges also have particular colors for each relationship type (e.g., yellow for Friend Of, blue for Enemy Of).

This system intends to enable users to identify desired information about the relationships or personalities in a comic. The system enables this requirement by providing two functions to the user: showing detailed information and highlighting specific relationships on demand.

The user can see information about the character's personality by hovering the mouse over a node (see Fig. 1-(b)) and the relationship between them by hovering the mouse over an edge between characters(see Fig. 1-(c)). This function prevents showing much information simultaneously to the user. It helps users recognize comic characters' personalities and relationships on demand.

The system also has a checkbox to emphasize the relationship selected by the user. The checkbox lists the relationship labels, and when users select a checkbox label, the edge for the corresponding relationship is emphasized. The system can show relationships between multiple comics on the same screen and simultaneously apply the emphasizing function to all of them (see Fig. 2). In this figure, the relationships are visualized for two comics when the "Would Like To Know" label has been selected. Using this function, users can compare the comics' relationships and understand the similarities and dissimilarities of the comics' contents. This function lets users easily understand where the selected relationship appears between comic characters, even for complex relationship

⁵ <https://rpubs.com/auroratsai/440718>.

⁶ <https://visjs.org/>.

diagrams, and promotes user understanding of the correlation diagram. Relationship emphasis helps users to discover the links between selected characters. Users can find specific relationships using these two features, such as calm and passionate characters being best friends.

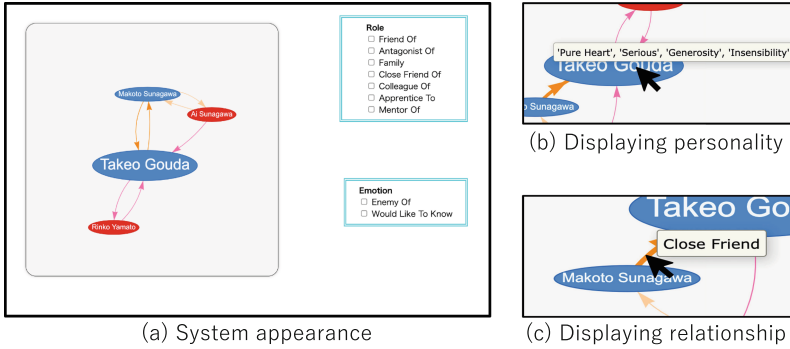


Fig. 1. System appearance

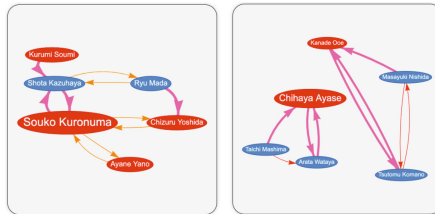


Fig. 2. Emphasizing the edges of the designated relationship

4 Experimental Validation

We tested whether the proposed visualization system enables people to understand relationships, including comic character personalities, easily. Eleven participants were involved in the experiment. The automatic placement of comic characters sometimes resulted in the main characters being placed at the edge of the screen. As the main characters are essential story elements, we manually positioned these nodes at the center of the screen.

First, we taught the participants how to operate the system. Next, we presented them with correlation diagrams for four works and they answered five questions. As the correlation diagram presented, we used the following four

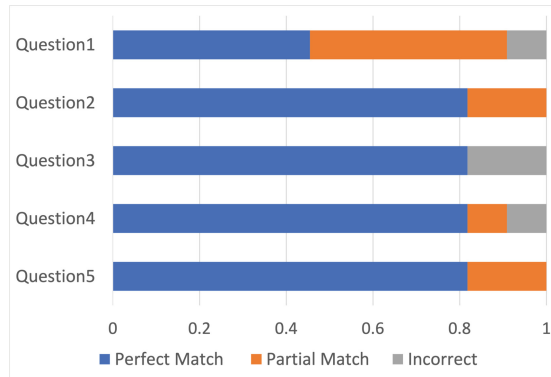


Fig. 3. Results from experimental questions: Love Triangle, Same Gender Love, One Woman Is Favored By Many Men, Irritable Character And Positive Character are Rivals, Have Hostility To The Main Character

works, “Nisekoi” (by Naoshi Furumi, Shueisha Inc.), “Touch” (by Mitsuru Adachi, Shogakukan Inc.), “What Did You Eat Yesterday?” (by Fumi Yoshinaga, Kodansha LTD.), and “Card Capture Sakura” (by CLAMP, Kodansha LTD.). Since some users may have prior knowledge of these works that could affect their answers, we presented the diagrams without naming the work to remove this factor. We asked the users to select all works with the relationships such as “love triangle”, “same gender love”, “one woman is favored by many men”, “irritable character and positive character are rivals,” and “have hostility to the main character” from the four options. We recorded how they used this system and checked whether the operations they performed to select an item matched the asked relationship before answering the question and whether they confirmed the node and edge contents before answering the question. We also conducted an open-ended questionnaire regarding the usability and visibility of the system.

Figure 3 shows the result of the questions. Each question may have multiple answers. A perfect match means the participant selected all relationships correctly, and a partial match means they selected some relationships correctly. The remaining option indicates incorrect answers. We found that 74.5%, 18.2%, and 7.3% of the results were perfect matches, partial matches, and incorrect, respectively.

We confirmed two operating tendencies from user observation. First, those whose answers were perfect matches checked the edge and node contents after emphasizing the edge. Second, those whose answers were partial matches only checked the contents of node and edge. We received feedback from the open-ended questionnaire that, “It is easy to check the relationship because each of the selected edges is emphasized.” The operation tendency showed that users emphasized the edge to search for the requested relationship and checked the contents of both the node and edge. The percentage of perfect and partial matches combined was as high as 92.7%. Therefore, the results show that using the correlation

diagram to check comic character relationships and personalities helped the participants to find specific relationships. We also received a negative feedback that “It is hard to check the edge because the edge crowd some of the nodes, and it was hard to find the comic character personalities.”

5 Discussion

The experimental results indicate that our interaction system, presenting character personalities and emphasizing relationships in correlation diagram, is effective to find specific relationship even if there are complex relationships. However, the open-ended questionnaire pointed out a problem with the system. When one character has many relationships, it becomes difficult for the user to see nodes and edges simultaneously. In such a case, we can solve that by displaying edges dynamically in chronological order or by volumes, thereby reducing the number of edges and making it easier to understand the content. As the character personality information does not have the emphasizing function used for relationships, it is difficult for them to compare or find similar personalities. In order to emphasize the personality, the system should give visual clue to the nodes, such as the color of presenting the principal personality trait for each character.

6 Conclusion

In this study, we built an interactive visualization system that users can use to discover the personality and relationships of comic characters. We verified the system utility for the experiment. The results confirmed the utility of displaying the contents of character personalities and relationships by emphasizing visualizations. On the other hand, checking content was difficult for crowded edges, and that personality information requires a visual effect similar to that for edges. Our future work will improve the information display for character personalities and characters with multiple relationships.

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