



Strategies for Panel Sequence Segmentations in d-Comics

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Abstract. In contrast with reading a comic book where a reader needs to flip the physical pages, in d-Comics (digital comics) there are no physical pages and no page-flipping interaction. The screen sizes for displaying the comics, as well as the way a reader can interact with the content varies between different electronic devices. The author intended segmentation, used to be well embedded with physical pages, needs to be converted to fit different methods in d-Comics. In a previous experiment, we identified two types of panel sequence segmentations in d-Comics. This article describes a follow-up expert review to justify the detailed panel transition changes for the results collected. Nine categories (character, object, environment, symbol, text, frame, camera angle, drawing style and narrative time) were summarised for analysing the recognised changes for panel sequence segmentation. Besides a confirmation of the earlier results, the outcome of the expert review provided how the segmentations were identified. Based on these results, we argue there are three strategies to be considered by the author when creating panel sequence segmentation in d-Comics – narrative structure, visual space (including visual elements and spatial layout) and interaction.

Keywords: Digital comics · Panel sequence · Segmentation

1 Introduction

Comics as a storytelling medium is constructed by panel sequences [1, 2]. Due to the prevalence and accessibility of electronics devices, d-Comics (Digital Comics) provide a tremendous potential as a popular format for comics. However, many issues are still under discussion [3–5]. For example, whether sound and animation should be introduced in d-Comics? How to migrate panel sequences from printed comics and display them with different electronic devices? How to provide pleasant reading experience with d-Comics?

An obvious difference between printed comics and d-Comics is the physical carrier – whether a panel sequence is printed on physical pages or displayed on electronic screens. This also leads to a difference from the perspective of interaction – a reader flips the physical pages with the printed comics, while the interaction for continue reading d-Comics can be different with different electronic devices. For example, a panel

sequence displayed vertically on a smart phone screen that a reader can use a finger to tap and scroll the screen [6]. And many d-Comics are displayed with web browser on a desktop screen where a reader should interact with a cursor to read [7, 8]. Moreover, as virtual reality, augmented reality and mixed reality technology are becoming more accessible, d-Comics can be visualised in a virtual 3D space and a reader can walk through to read [9, 10].

The page-flipping interaction happens because a panel sequence has been segmented by physical pages. These segmentations can contain various storytelling intentions defined by the author such as curiosity, suspense, surprise, emphasis and storytelling pace (also known as “page-turner” and “cliffhanger”). However, the page structure doesn’t exist with d-Comics. Therefore, we started to explore whether there is a unit in d-Comics similar to the page?

In a previous study [11], we conducted an online experiment¹ to investigate how panel sequences are segmented in d-Comics. By analysing the collected data from 80 participants based on examples of 4 panel sequences, two types of segmentation of panels in d-Comics were identified and discussed (Fig. 1). A phasel (created by combining “phase” and “sequel”) in d-Comics is represented by one panel or multiple panels that belong to each other. The author cannot decompose these further into smaller phasels. A phasel describes a strong relation among a certain number of panels and a significant difference with other phasels, determined by the author’s storytelling intention. A fadel (created by combining “fade” and “sequel”) is represented by one panel that the author considers to be part of both the previous phasel and the next phasel. A fadel describes an overlapping transitional relation between two phasels, and it contains both the fading of the previous phasel and the starting of the next phasel determined by the author’s storytelling intention.

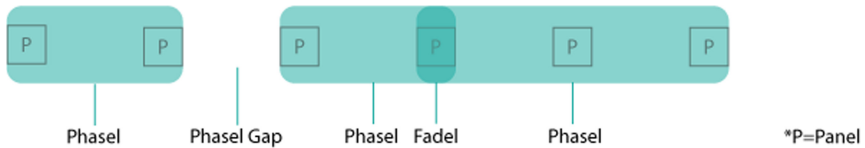


Fig. 1. Demonstration of phasel, fadel and phasel gap.

After identifying the units in d-Comics for panel grouping, the next question is: What affects the identification of the units? In another word, what influence the decision of segmentation? We adopts mainly from the panel transition types from McCloud [2, 12], combined several other panel transition categorisations through literature review [13–15] and answers in Experiment 1, came up with the following nine categories of changes between two panels: 1) Character (such as a human, a dog, a talking robot, with the difference in action, facial expression, appearance and amount of character); 2) Object (such as an apple, a clock, a sword, with the difference in appearance and movement); 3) Environment (such as a room, a forest, sea, with the different of location and weather); 4) Symbol (such as impact stars and motion lines); 5) Text (such as the

¹ We will address that experiment as Experiment 1 in this article.

character's dialogue, narration and sound effect); 6) Frame (such as different sizes and shape of a panel); 7) Camera angle (such as zooming in/out and looking up/down); 8) Drawing style (such as black and white, certain colour combination and abstract or concrete); 9) Narrative time (such as different direction and duration of narrative time). This article further investigates how readers could distinguish segmentations with the listed categories. Then to discuss how these categories could be considered as strategies, when authors want to adapt panel sequences for various electronic devices.

2 Design of the Expert Review

In previous research, a questionnaire was used to investigate what kind of changes have readers recognised when identifying certain panel segmentations. However, due to limitations such as the experiment time as well as the various backgrounds of the participants, it was not possible to allocate the changes for segmentation to unique panels. Therefore, we invited reviewers to provide their detailed understanding and reflection regarding the results received from Experiment 1.

2.1 Materials

Firstly, a card set which visualised and explained the potential nine categories for panel sequence segmentation was created to help improve the reviewers' understanding (Fig. 3). Secondly, a training session was created to introduce the reviewers to how the provided card set should be applied. Four other examples from SIR KEN ROBINSON: Full body education [16]—from Gavin Aung Than, the same author of the stories used in Experiment 1—were selected (shown in Fig. 2). The categories were listed with coloured check boxes, which matched the colours of the card set. The examples and checkboxes were printed on a long paper roll (to fit the horizontal linear panel layout). The size of the paper roll was 29.7×84 cm (two A3 papers connected with the longer edges). Thirdly, the four comic stories² from Experiment 1 were exported from the web and printed on a long paper roll. The print on the paper roll contained the linear panel layout, two introduction panels, the crop icons between panels, and under the panels the complete set of categories with the coloured checkboxes. The length of *The Lucky Ones* was 29.7×84 cm, *In Spite of Everything* was 29.7×126 cm, *Because It's There* was 29.7×252 cm, and *Ithaka* was 29.7×294 cm. The reviewer could indicate on the paper roll — using the checkboxes — the categories for every gap, especially for the identified segmentations. Finally, the result of the segmentation by the participants of Experiment 1 was printed and shown to the reviewers. The goal of this step was to trigger discussion of the reviewers about the segmentations created by the participants of Experiment 1.

² The four comics stories are from webcomics *Zen Pencils: The Lucky Ones* [18], *In Spite of Everything* [19], *Because It's There* [20] and *Ithaka* [21]. The panel numbers and gaps in-between are not included due to the page limit of this article, yet can be found in Appendix I in [22].

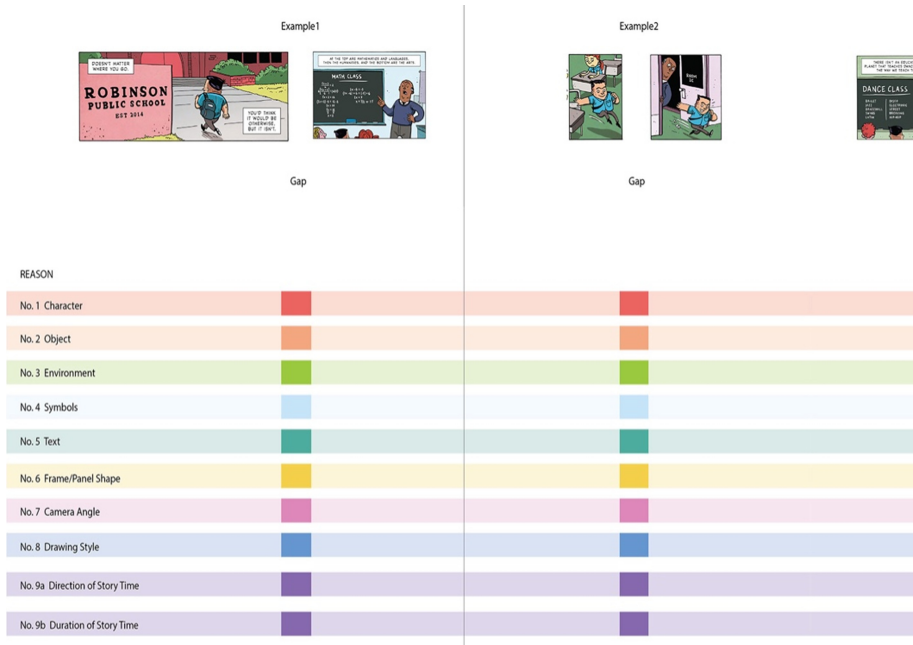


Fig. 2. The layout of the training examples.

2.2 Procedure

Three reviewers were invited, they were all PhD researchers in the field of Industrial Design. One female and two males, with an average age of 29.7. The cultural backgrounds of the reviewers were: one Asian, one European and one American. Each reviewer was invited to an office where the test was conducted. First, the goal of the experiment was introduced, and then the card set with the categories for segmentation was provided and introduced. After the reviewer had confirmed the understanding of the card set, the training session started.

In the training session, the full comic story was presented linearly on a touch-screen tablet (screen size 9.7 in., resolution 1024 × 768 pixels). Simultaneously, a long paper roll was placed on a table with the same linear story and the coloured checkboxes to mark the categories for segmentation. The reviewer could use the card set as a reference for the training task. As the investigator, the author of this article was involved in this session to confirm the reviewer’s opinions regarding the answers.

After the training session, the reviewer was provided, one by one, with each of the four comic stories which were also used in Experiment 1. Besides the interactive version on the tablet, a long paper roll was placed on the table for each story that could be used to fill in the categories for each segmentation (Fig. 3). After the reviewer had finished filling in the segmentation categories for each gap in each comic story, an interview was conducted. The investigator asked the reviewer their opinions about the segmentation data received from Experiment 1. Each reviewer answered the questions for all four comic stories. The conversation was audio-recorded during the whole interview.



Fig. 3. The settings of the expert review.

3 Results

The aim of this experiment was to investigate which specific elements in the panel sequences can influence the decision of segmentations. In this section, the data that resulted from the questionnaires and interviews from the reviewers will be analysed to find similarities among the reviewers. Two visualisation methods will be applied to inform the analysis. The intersection method will be used to visualise the categories that all the reviewers agreed. The union method will be used to visualise all the categories combined for each gap by all the reviewers, no matter if there was only one reviewer who considered it or all of them. The category and colours in the visualisations match with the colours used in the questionnaire. To provide a clear comparison between the different segmentations in each story, both the intersection and union visualisation will be discussed.

3.1 “The Lucky Ones”

The intersection visualisation based on all of the reviewers’ opinions can be found in Fig. 4. The change of character, text and camera angle are considered to be important categories for each gap by all reviewers. Excluding Gaps 1 and 10 (transition between introduction image and story content), the highest number of categories appears in Gap 5, while the lowest in Gap 3.

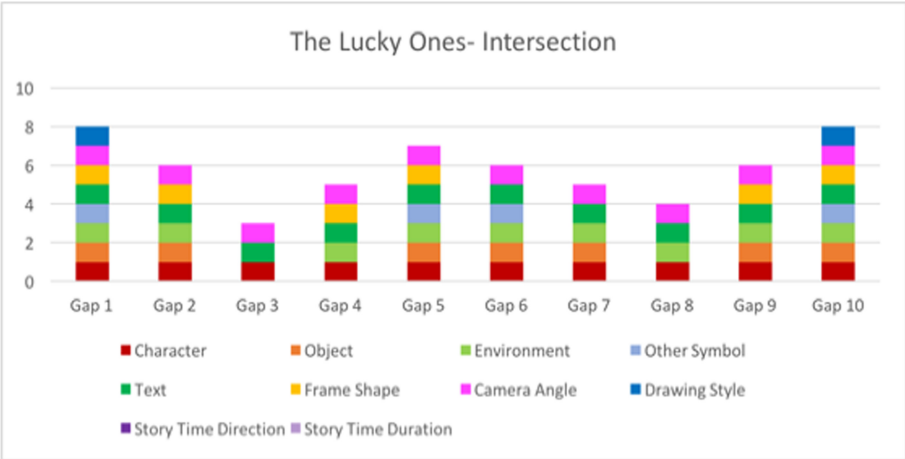


Fig. 4. Intersection of the categories for segmentation of The Lucky Ones.

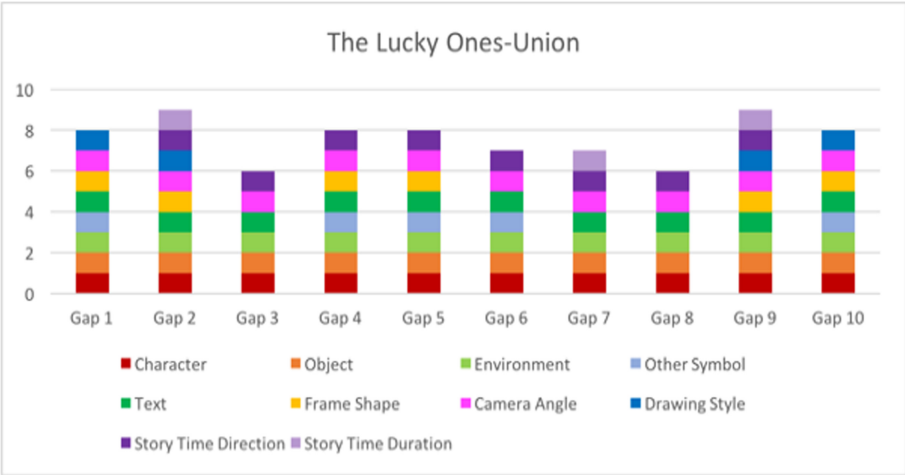


Fig. 5. Union of the categories for segmentation of The Lucky Ones.

The union of all the reviewers’ opinions combined is shown in Fig. 5. In this diagram, the differences between the gaps appear to be less obvious compared to Fig. 3. The major difference between the intersection and union is the consideration of narrative time. The reviewers explained that the narrative time is going backward in the panels. It is mainly because of the visual clues, such as the appearance of the characters becoming younger. In other words, the narrative is conveyed through the panels placed in space. The reviewers pointed out during the interview that they didn’t consider any segmentations because the time direction was constantly going backward. Additionally, according to the text in the panels, the story happens in the narrator’s mind, which meant that, although the memories of the narrator are moving backward in time (based on the images), the actual

story is moving forward (based on the narration text). According to the interview, all reviewers agreed that the panels in this story are hard to be segmented.

3.2 “In Spite of Everything”

The intersection of the reviewers’ opinions about the categories for segmentation can be seen in Fig. 6. After excluding Gap 1 and 19—because these are transitions between introduction image and story content—Gap 8 and 17 contain more categories related to segmentation than the rest of the gaps.

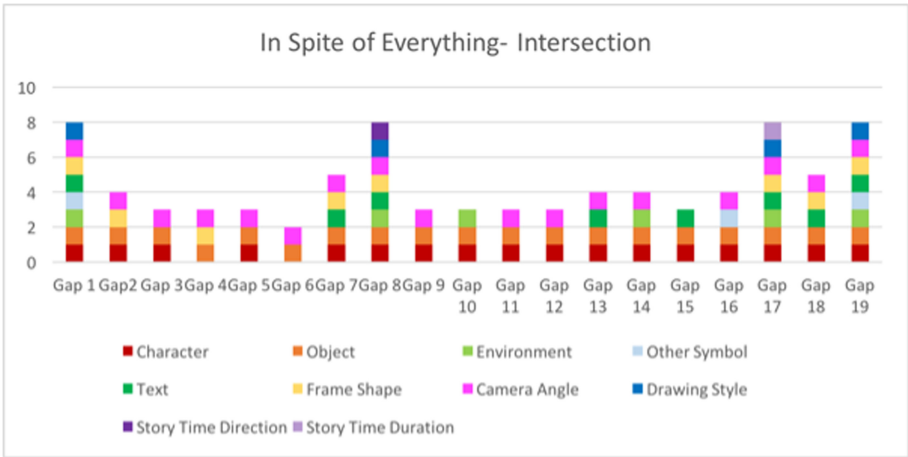


Fig. 6. Intersection of the categories for segmentation of In Spite of Everything.

The union of the reviewers’ opinions related to the categories for segmentation is visualised in Fig. 7. Comparable to Fig. 5, the higher number of categories for Gap 8 and 17 are still there. These results are consistent with the segmentations of the panel sequence created by the participants of Experiment 1. The reviewers confirmed that the story can be divided into three groups, with the segmentations at Gap 8 and Gap 17. The most important categories for this segmentation are caused by changes in narrative time and supported by the change of the character’s appearance and the change of colour.

3.3 “Because It’s There”

The intersection of the reviewers’ opinions about the categories for segmentation is described in Fig. 8. The differences between the gaps in this diagram are subtle. Excluding Gap 1 and 36 (transition between introduction image and story content), the highest number of categories appears in Gap 3, 12 and 14, while the lowest is in Gap 32.

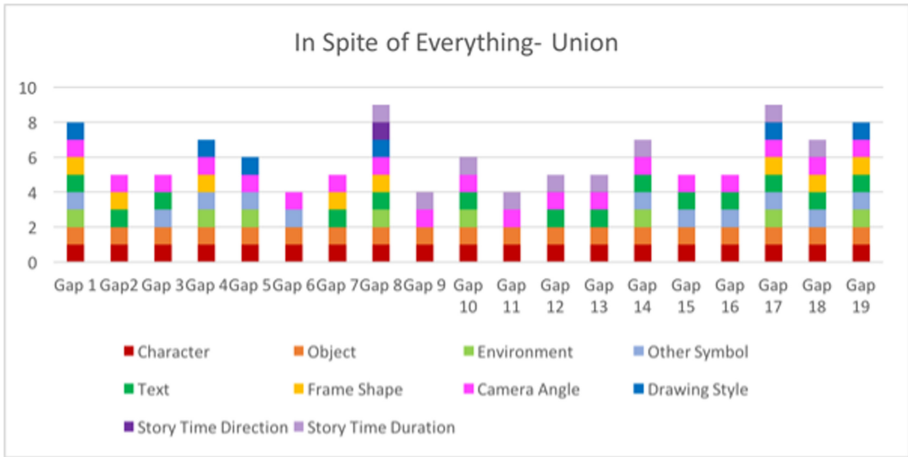


Fig. 7. Union of the categories for segmentation of In Spite of Everything.

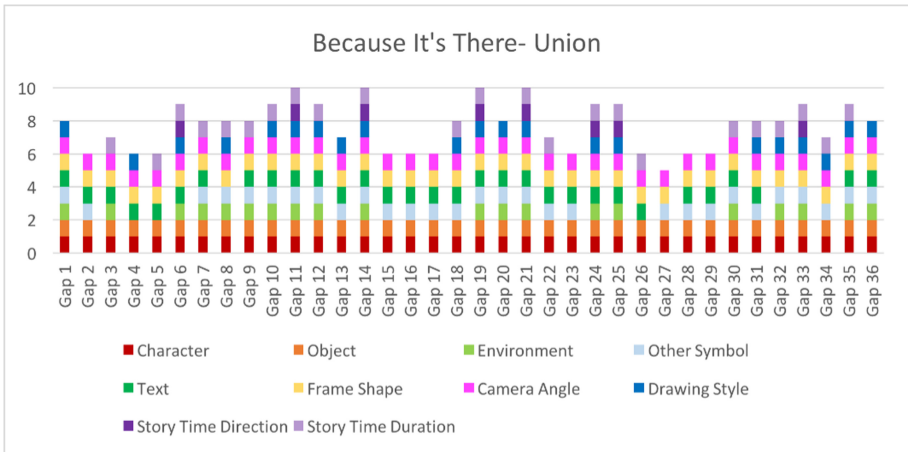


Fig. 8. Intersection of the categories for segmentation of Because It's There.

The union of the reviewers' opinions related to the categories for segmentation is illustrated in Fig. 9. By adding all the individual opinions of the reviewers, Gap 6, 10, 11, 12, 14, 19, 21, 24, 25, 33 and 35 become the gaps with most categories. Gap 3 is not part of this, and Gap 27 replaces Gap 32 to become the lowest one. In Experiment 1, the gaps 3, 7, 12, 14, 19, 21, 24, 25 were considered as important segmentations of the panel sequence. In this story—although less obvious than *The Lucky Ones*—the identified segmentations of the panel sequence from Experiment 1 can be matched with the categories of the reviewers in this review. During the interview, the reviewers confirmed that there were various categories related to the segmentations in this story. For example, Gap 3 is recognised mainly because of the narrative time duration change and environmental change, while Gap 19, 21, 24 and 25 are more related to the change of

characters. The findings related to Gap 6 and 11 are more surprising because the reviewers attributed a relatively high number of categories. However, the participants of Experiment 1 didn't consider these as clear segmentations. Upon discussion with the reviewers, it was suggested that the gap next to these special cases contains strong indications about the same category—the reader may perceive one panel for segmentation, but the segmentation could be identified at the two visual gaps related with this panel—the visual gap before this panel or after. One reviewer also described that these categories can “build up” the narrative.

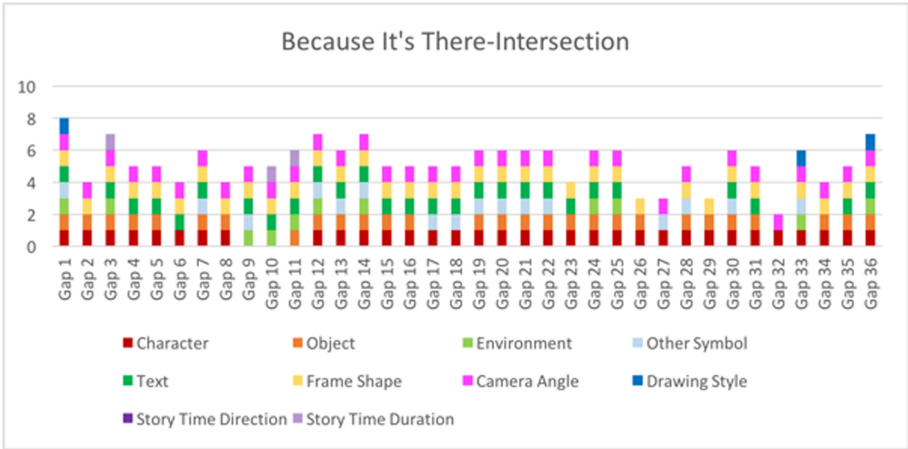


Fig. 9. Union of the categories for segmentation of Because It's There.

3.4 “Ithaka”

The intersection of the reviewers' opinions about the categories for segmentation is presented in Fig. 10. Besides Gap 1 and 60—which are the transitions between introduction image and story content—the highest number of categories for segmentation appear in Gap 6, 43 and 49. The lowest number can be found in Gap 17, 27 and 52.

The union of the reviewers' opinions related to the categories for segmentation is shown in Fig. 11. By adding all the individual opinions of the reviewers, Gap 11, 41, 43 and 54 became the gaps with most categories for segmentations (9 categories). Gap 6, 12, 30, 35, 37, 40, 42, 45, 46, 47, 49, and 59 have the second highest number of categories for segmentation (8 categories). The general pattern of intersection and union matches with the result from Experiment 1. All the gaps that were indicated as segmentations by at least 50% of the participants of previous experiment (Gap 8, 30, 37, 49) also have a high number of categories as suggested by the reviewers in the current experiment.

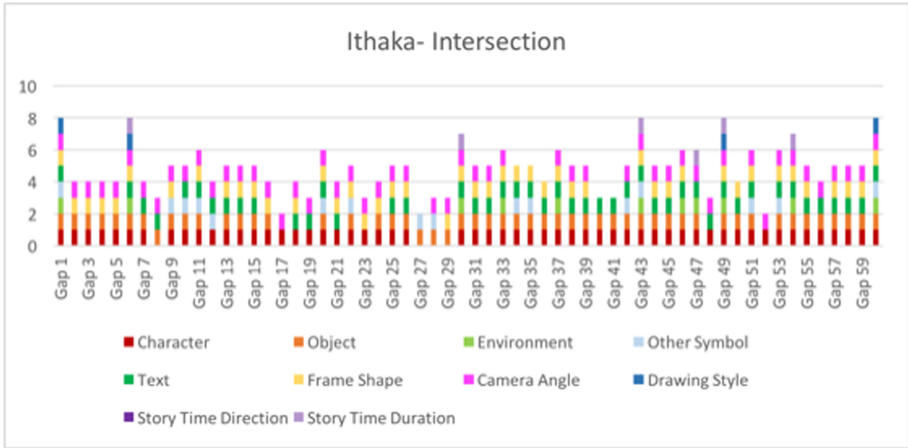


Fig. 10. Intersection of the categories for segmentation of Ithaka.

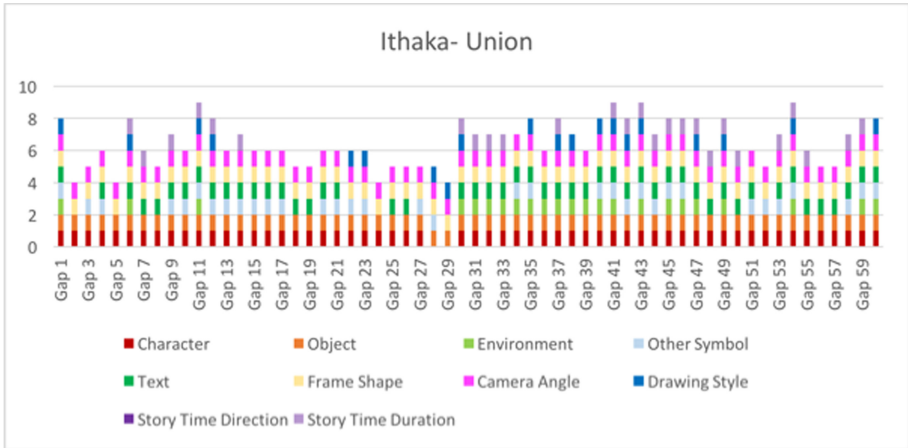


Fig. 11. Union of the categories for segmentation of Ithaka.

4 Discussion

All three reviewers confirmed that the panel segmentation patterns from Experiment 1 were valid and could be interpreted with the materials provided. The categories for panel sequence segmentation in d-Comics are complex. The influence of narrative timeline, narration texts, and other visual elements can be observed from the designed experiments. However, it remains difficult to compare the intensity of the categories for the segmentation. Due to various factors such as age, gender, cultural background, personal experience and evoked emotion by the story of the readers, the focus of identifying segmentation in d-Comics can be different.

4.1 Number vs Intensity

The current measurement of how a panel sequence can be segmented is based on the listed categories such as the narrative time, character and colour. By using the “intersection” and “union” method to describe the categories that the reviewers mentioned, the results matched in general the segmentations from Experiment 1, which is how majority (over fifty percent of the participants) perceive the segmentations. However, there are still exceptions. When reviewers were invited to explain the exceptions, the intensity was increased. This means that the perceived intensity of certain elements could overrule the influence of the number of elements.

However, it is not yet clear how the intensity of visual elements can exactly influence the segmentation. The results of both Experiments 1 and this expert review showed that the text elements and the other visual elements do not necessarily have to be synchronised in the panels. For example, in *The Lucky Ones* the texts flow forward through the panels. However, the images represent the narrative time going backward. Image and text may have a different influence on how a narrative is understood by the reader. In another word, although the elements that can be used to indicate segmentations can be identified, the hierarchical structure of these elements varies with the individual.

4.2 Relation Among Segmented Panel Groups

Another fact that could be observed from this expert review is the influence of the existing segmentations. For example, when the panels between two segmentations contain a longer narrative time, the reviewers tended not to make any new segmentations with a shorter narrative time, even if the panels with the shorter narrative time contained a comparable number of panel sequence segmentation categories. Although the panels are presented linearly, the comprehension of the story is accumulated in the mind (braiding in Groensteen’s [13] word), and there exist hierarchies in the segmentations. This observation matches Cohn’s [17] narrative structure with hierarchies in comics cognition.

5 Conclusion and Future Work

This article investigated the strategies of narrative structure (narrative time) and visual elements (character, object, environment, symbol, text, frame, camera angle and drawing style) for panel sequence segmentations in comics. The results of Experiment 1 and this expert review show that the strategies can be used to explain the perceived segmentations. However, individual readers have different understanding of, and preferences for, these strategies. For example, some readers were not that sensitive to changes in duration of the narrative time compared to others. Some of the readers focused more on how the characters change, some used the changes of the environment as a reference, and some were more influenced by the changes in colour tone. Even for the same reader, there was not necessarily a consistency among the influencing factors: a reader could create segmentations based on different strategies.

In printed comics, a segmentation in a panel sequence, aligns with the narrative structure, expressed through visual space, and is connect with the physical page. The

existence of the physical page is not only the segmentation of the panel sequence, but also influence the author's decision of layout of the panels in the page/spread, moreover, requires an interaction from the reader which is flipping the page. Since the physical page doesn't exist with d-Comics, we have explored using interaction and visual layout with different electronic devices for expressing segmentation [10]. We plan to include interaction with narrative structure and visual elements for the future study to further establish the strategies for panel sequence segmentation in d-Comics.

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