Analysis of Gaze on Comic Book Panel Structure

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Abstract

Comics have been shown to be able to tell a story by guiding the viewers gaze patterns through a sequence of images. However, not much research has been done on how comic techniques affect these patterns. We focused this study to investigate the effect that the structure of a comics panels have on the viewers reading patterns, specifically with the time spent reading the comic and the number of times the viewer fixates on a point. We use two versions of a short comic as a stimulus, one version with four long panels and another with sixteen smaller panels. We collected data using the GazePoint eye tracker, focusing on viewing time and number of fixations, and we collected subjective information about the viewers preferences using a questionnaire. We found that no significant effect between panel structure and viewing time or number of fixations, but those viewers slightly tended to prefer the format of four long panels.

Keywords: Eye tracking, Gazepoint GP3, Comic, Panel structure

1 Introduction

Comics have told complex, entertaining, and compelling stories by the use of pictures, dialogue, and visual narrative [McCloud 2011].The stories are told through a series of images, which requires the reader to move from one image to the next in sequence to proceed through the narrative [Meskin and Cook 2012]. Richard Wollheim argues that stories told through sequential images have been used even hundreds of years ago by barbarians to tell stories [Chilvers et al. 2009]. McCloud argues that even civilizations such as the ancient Egyptians have even used the style of sequential images which is the same style we use in modern day comics although the images may be different [McCloud 2011].

Artists have been shown to direct the flow of readers attention through comic book images and can successfully lead their readers gaze [Jain et al. 2012]. To do this, artists use a variety of tools to accomplish this feat. One of these tools is how the panels are formatted and arranged. Panels are created in a variety of shapes, sizes, and quantities to guide the reader through the story. Some comics may only use a few extended long panels for each page while others may use many small panels for the readers to follow. In a standard comic book, mixtures of sizes of panels are commonly used. With the variety of panel structures that vary in shape, size and quantity, the question of how these methods affect the readers gaze can arise. Would there be more consistency in the reader's gaze with few large panels when compared to multiple smaller ones? Do people tend to read wider panels over a longer period of time instead of thinner ones? Does color or even realistic art style versus cartoon affect any of these aspects? Many questions can be made on how these aspects and varying them can actually affect the readers experience.

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Panel size and panel content can be used to indicate the passage of time in a comic book narrative [Eaton 2012]. This research experiment is focused on observing the panel size aspect of this quote to see if the amount of time readers gaze upon a comic changes when using small panels compared to large panels. If an artist wants their viewers to gaze and study at a panel for a longer period of time, he or she could use one method of panel structure over another. A different artist who may want to progress the story quickly may possibly use an alternative panel structure. Eye tracking can help to analyze the gaze patterns of a reader, and through research, this information can potentially give insight to different strengths and weaknesses that certain techniques contain to be used by artists.

This is important for artists to understand since they have the role of creating a cohesive story combining text, images, flow and design. Creating a comic is a difficult task since there are many different methods, techniques, and styles to approach in creating it. Also, artists not only have to draw pictures, but they must also be able to communicate a detailed visual narrative to the readers with the various tools they have. Panel structures and arrangements serve as one of those tools which are why conducting this experiment could assist with learning more on the effect of varied panel structure.

We hypothesize that a comic with smaller panel structure will yield fewer fixations, and less time spent reading while producing a more consistent gaze because the readers will have a smaller area to look at in each panel. Panels with smaller space for the readers could possibly lead them to gaze upon panels for a shorter duration and continue moving on to the next piece of the story. On the other hand, the longer panels would be analyzed longer and would be analyzed multiple times. The larger panels have more space and presumably more material in them so the reader may be inclined to analyze every aspect instead of moving from one panel to the next. This may cause them to reexamine what they have seen and gaze longer at the larger panels.

2 Background

Our experiment involved the use of eye tracking technology to analyze how panel structures of a comic affects the amount of time users gaze while reading a comic. There has not been much previous work performed with eye tracking on reading comic books although there has been work done on single images. Scott McCloud, author of Understanding Comics, said the panel size and content can be used to indicate the passage of time in a comic book narrative [McCloud 2011]. This suggests that by having a larger panel size will cause readers to read a panel for a longer duration. However, Neil Cohn, author of The Visual Language of Comic, counteracts that statement by saying the reading time of comics is more conceptual than spatial, and that the content of the panel is more important to this reading than panel size [Cohn 2013]. Our research study is focusing on one aspect of Scott McClouds claim that panel size affects the amount of time viewers read content.

One preliminary exploration conducted on Japanese manga, actually recorded the eye movement to understand why readers paid attention to some images over others [Omori et al. 2004]. Through their study, they found that changing the speech bubbles could change reader's attention and gaze on the preceding panels. This study suggests the idea that by altering certain characteristics of a comic can change way readers behave. Discovering what aspects

can modify this behavior can be beneficial to artists so that they'll know which tools and styles to use for their intended purpose.

Jain et. al conducted an experiment that used eye tracking to analyze whether the arrangement of images has an impact on the users gaze [Jain et al. 2012]. They concluded that the users gaze was more consistent when viewing images in a narrative pattern rather than in a seemingly random pattern. Their experiment was conducted by comparing amateur photographs, comic book artwork, and photographs taken by robots [Jain et al. 2012]. Artists have been shown to successfully guide viewers gaze more consistently through comic pictures when compared to these alternative mediums [Jain et al. 2012]. This leads to the question of finding out how well are artists able to guide viewer gaze when using certain panel structures when compared to others. Conducting research on these methods can allow us to gain insight on the different strengths and weaknesses on various tools to help achieve an artist's goal.

3 Methodology

3.1 Subjects

Participants between the ages of 17 to 25 were recruited from the undergraduate population at Clemson University. Subjects were recruited through and word of mouth. No reimbursements were provided as a result of the study. The reason this study was geared towards college students is due to the convenience of having access to the GazePoint Eye-Tracker, the hardware used in our experiment, at Clemson University and the availability to students on campus. The researchers assisted each participant with the study. 22 students were brought in for the study with 16 males and 6 females who participated in the study.

3.2 Apparatus

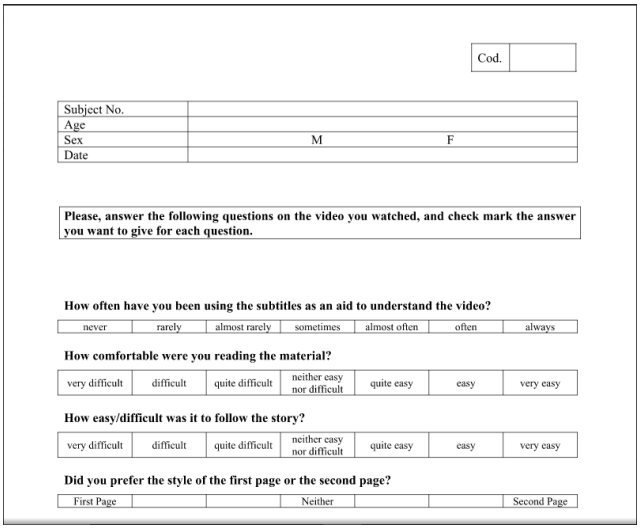
We collected users data using a Gazepoint GP3 eye tracker. This is a corneal and pupil reflection tracker and it has a degree of accuracy of half a degree visual angle and is about 50 pixels. The sample rating is about 60 Hz. This eye tracker is easy to use and requires no headgear and provides no distraction for the users. The Gazepoint tracker is able to track the gaze of both eyes, distance from the eyes to the screen, and it is able to tell when users blinks or has an eye closed without distracting the user while they read.

3.3 Experimental Design

The study was a between-subjects design and had two groups. Our independent variable was the panel structure consisting of having pages with either four panels or sixteen panels. Our dependent variable is the number of fixations and the amount of time viewed on each page. Both groups were given a four page comic with the same content, but varied panel structures for each group. For the first group, the first page had four wide panels, the second sixteen small panels. The third page had four panels and the fourth page had sixteen. The second group had a first page with sixteen panels, a second page with four panels, a third with sixteen, and a fourth with four panels.

3.4 Procedure

The participant first sat down in front of the desktop computer screen. The computer was already logged into a student account either by David Cherry or David Brickler. We explained to the user that their role in this eye tracking study was to read a four page comic at their own pace and that we would be collecting information on how they read comics. They were allowed to adjust the chair to a height that was comfortable before beginning calibration. Their eyes were calibrated to the Gaze Point Eye Tracker with assistance. After they were successfully calibrated, the study began. The user was presented with the first page of the comic, and then they were able to move towards the next page by using the space key. After the fourth page, participants were given some short questions to answer on the comic. The questions from the questionnaire are displayed in Figure 1.



Cod.

Subject No.	
Age	
Sex	M F
Date	

Please, answer the following questions on the video you watched, and check mark the answer you want to give for each question.

How often have you been using the subtitles as an aid to understand the video?

never	rarely	almost rarely	sometimes	almost often	often	always

How comfortable were you reading the material?

very difficult	difficult	quite difficult	neither easy nor difficult	quite easy	easy	very easy

How easy/difficult was it to follow the story?

very difficult	difficult	quite difficult	neither easy nor difficult	quite easy	easy	very easy

Did you prefer the style of the first page or the second page?

First Page			Neither			Second Page

Figure 1: *Post-Questionnaire used in the experiment.*

3.5 Stimulus

There were a total of eight comic pages used in this study with four pages per group. Each one of the four pages had a four-panel and sixteen-panel version displayed in Figure 2 and Figure 3. By varying these structures, we examined the differences between users gaze through the use of an eye tracker.

3.6 Data Collection

Data was collected through two different methods. First, objective data was collected with the Gazepoint Analysis program, logging information on each condition concerning the location, duration, and quantity of the users saccades (rapid eye movements) and their eye fixations. We also kept a record of how often users focused on specific areas of interest (AOIs). We used this data to perform a one way ANOVA statistical analysis to determine whether there were significant differences between the data of the four panel pages and the sixteen panel pages. In addition, we collected subjective data on the participants opinions by applying a 7-point Likert scale to the questions on their preference between panel structures. This data was averaged and the statistical analysis was performed to determine preference.

4 Results

Objective data about viewing times and fixations were analyzed through the use of one-way ANOVA tests. We set sixteen areas of interest (AOIs) on each page, and through the use of the GazePoint Analysis software, we were able to collect information on the average time users spent gazing at each AOI on every page. We also analyzed subjective data (in the form of the users preferences) using a one-sample t-test. An alpha level of 0.05 was used for all statistical tests.

Figure 2: *Four Panel Structure of Page 1.*

Figure 3: *Sixteen Panel Structure of Page 1.*

Using the GazePoint Analysis software, we collected data on the users gaze patterns. The average time taken for users to read through each page was calculated, and it was analyzed to compare the different panel structures (four panels and sixteen panels) to observe if significance was found. After the analysis, we did not find a significant effect for the first page ($p = 0.716$), second page ($p = 0.172$), third page ($p = 0.752$), or fourth page ($p = 0.563$).

In the same way, we also ran analyses to determine if panel structure had a significant effect on the number of fixations made in the viewing sessions for each page. As with viewing time, we did not find a significant effect for the first page ($p = 0.902$), second page ($p = 0.095$), third page ($p = 0.324$), or fourth page ($p = 0.980$).

In addition to the objective data that was gathered in this study, we tried to determine whether the participants tended to prefer the four-panel or the sixteen-panel structure for the comic. We placed the preferences on a seven-point Likert scale (four-panel = 1, sixteen-panel=7), and we ran a one-sample t-test in order to determine if the participants preferred one structure over the other. We found that there was a nearly significant tendency for viewers to prefer the four-panel structure (Mean = 2.9545, SD = 2.39995), $p = 0.054$.

5 Discussion

Statistical analysis shows that there is no significant difference in viewing time between the four-panel and the sixteen-panel pages. Although there were variances in viewing times, the large p-value in the analysis suggests that there is not even a close significant difference. Most of the variances came from within the sample; between the samples, the numbers are largely the same. An interesting finding is that users from the questionnaires showed a slight preference towards the four panel structure. This could possibly be because the panels were longer and not chopped up, unlike the sixteen-panel structure.

The low significance of the results could have occurred from various aspects of our experiment. One explanation is that it happened due to the comic being displayed with the same content, regardless of panel structure; it is common practice to adjust the text boxes and characters inside of the panel box and to have the content tailored towards each panel size. In our study, we simply separated panels by gaps of space between the original long panels to create four smaller panels. This could have potentially caused participants to view the comic the same way regardless of panel structure.

Another reason for this could be simply because the study only used a four-page comic. There is a possibility that a comic with more pages would be able to show a greater difference. More pages would give readers more content to read, and it might have given us more data to analyze to see if there really is significance in reading time, however, it may also be true that there isnt much of a difference. Further investigation is needed before we can suggest the idea that panel structure alone does not affect viewing time. A third possibility would be to have a single story that remains the same instead of two separate stories. Keeping consistent content could possibly have an effect. For future iterations we can make some of these adjustments and see if that affects the amount of time participants read panels.

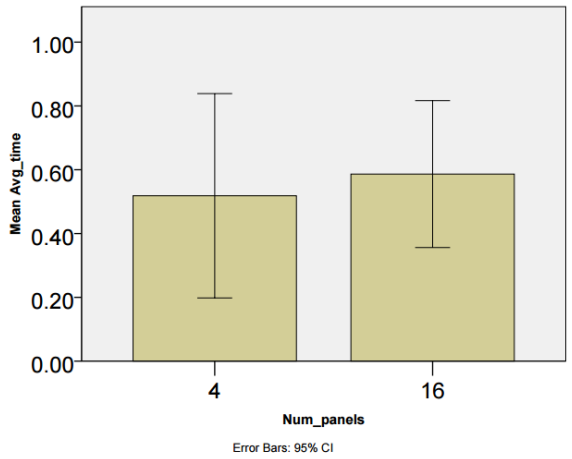


Figure 4: *Comparing viewing time of four- and sixteen-panel structure for Page 1 of the cat comic.*

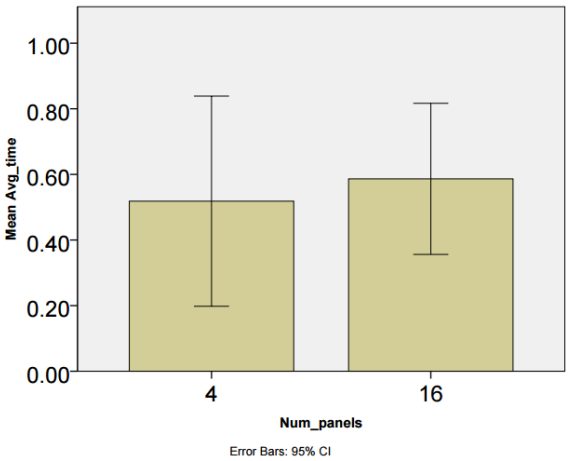


Figure 5: *Comparing viewing time of four- and sixteen-panel structure for Page 2 of the cat comic.*

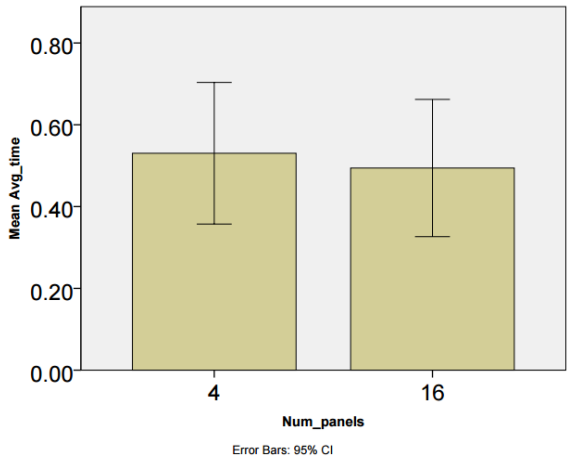


Figure 6: *Comparing viewing time of four- and sixteen-panel structure for Page 1 of the hero comic.*

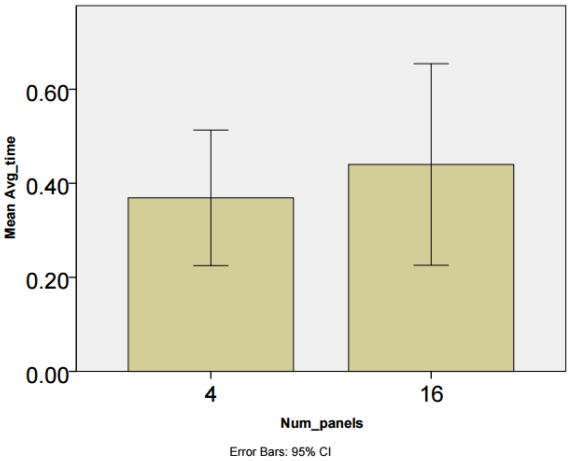


Figure 7: *Comparing viewing time of four- and sixteen-panel structure for Page 2 of the rhero comic.*

Additionally, we could focus on is the interaction between panel content and panel size. This means we could tailor the panel content towards the panel sizes, which coincides with what Scott McCloud said about both of these tools being able to affect the viewing time for the comic. Another experiment could be strictly varying the panel content instead of changing the panel sizes to see if it has a different effect. This would be in line with the idea Neil Cohn argues, which is that panel size doesnt affect viewing time much while panel content has a greater effect.

For future experiments, we can use a different stimulus format, such as panel content or page number, to test four panel structures against sixteen panel structure to support our results. If further studies support the data we received, then we can conclude that there is a difference in reading time and gaze when focusing solely on the panel structures

6 Conclusion

Comic books have been shown to be able to direct the viewers gaze through the use of imagery in sequence. This study was intended to explore the intricacies of how artists are able to direct the viewers gaze to make them focus on specific images or even details of an image. We focused mainly on panel structure and in determining the effects of comics with few panels of great size versus comics with many small panels, and we wanted to determine how this would affect the users viewing time, fixations, and personal preferences. We did not find any significant effect that panel structure has on a users viewing time or the total number of fixations per viewing session. There were a number of factors that could have contributed to the lack of significant findings, but we believe that the main reason for this is because the pictures were the same regardless of panel structure instead of having content adjusted to the individual panels.

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