Evaluating Speedreading Methodology Using Eyetracking

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ABSTRACT
This paper evaluates the effectiveness of a speed reading technique. Using a Gazepoint GP3, novice participants were evaluated on time to completion and comprehension of a selection of passages from SAT practice tests released by the College Board. Participants were evaluated on time to complete a reading, and their comprehension and their scan path while reading was analyzed.

KEYWORDS
eyetracking, speed-reading, Saccades, Fixation Duration

1 INTRODUCTION
Speed reading is a technique that experts claim can vastly improve one’s time to complete a reading task without distracting from the reader’s comprehension of the passage.

Traditionally, speed readers employ various techniques to improve their scan path when reading text. It is important to distinguish the act of satisficing, where a reader will scan important portions of the text, but skim over sections with lower information density.

1.1 Background
Speed-reading techniques have long been used by readers to quickly skim over the details of a text and save reading time. Using these techniques, a reader’s reading speed increases but their relationship with increase in the level of comprehension is convoluted. Some studies suggest that if moderate comprehension is needed, speed-reading techniques can only help in reading a passage faster and there might not be any advantage of speed-reading on comprehension.

if higher comprehension skills are needed [2]. Here it is important to mention that reading fast without using any speed-reading techniques does not show any increase in comprehension even when easy comprehension is needed, so it is important to understand what these techniques are to better understand the effect of speed-reading on reading speed and comprehension.

Some previous work suggests that there is a less than significant difference in between the expert speed-readers and novice readers in regards with the comprehension scores if time pressure is not an independent variable[1]. But the techniques used in that work specifically relate to Park-Sasaki method of speed-reading and the experts using that technique had to go through a rigorous training for a couple of years to learn this method. The literature about simple speed-reading technique like guiding eyes to the words in the sentence and its effects on comprehension is not available suggesting a gap in research. It would be interesting to see if such a simple technique can show a difference in between the comprehension of a passage with and without using the guided speed-reading technique.

1.2 Hypotheses
In this experiment we hypothesize that guided speed-reading technique will increase the reading speed and reading comprehension of the participants.

2 METHOD
2.1 Participants
A total of N college students participated in this study (X females and X males; Mean age= ; SD = ). Participants were recruited through emails and general announcements in various classes at Clemson University. Participants with any self-reported visual impairments were excluded. As this experiment requires participants to demonstrate twelfth grade reading comprehension skills, they were excluded from the experiment if they were unable to meet this requirement. This study was approved by the university’s Institutional Review Board.

2.2 Stimulus
Participants read passages from the SAT Practice Tests, accessible online from the College Board. To gauge comprehension, participants were asked a random sample of questions from the exam.
2.3 Apparatus
Eye tracking metrics were collected by a Gazepoint GP3 eye tracker, which is an unobtrusive desk-mounted device that uses pupil/corneal reflection to track a person’s eye movements as they read passages from the reading section of SAT, provided by the College Board. Participants read passages on a 60mm diagonal monitor with a resolution of 1920x1080.

2.4 Experimental Design
The study was a quasi-experimental 2x1 within-subject design investigating the effect of guided speed-reading, where participants received a simple training on speed-reading technique before reading the passage versus control on reading speed and reading comprehension. Passage in every level: control and guided did not relate to one another and had different themes/stories. As these passages had different contents, they did not carry a risk to the internal validity of the experiment, and therefore the texts were not randomly assigned to the participants. All participants received same passages. Furthermore, the order of the levels was not counterbalanced as the sequence of deploying the levels was important for the study.

2.4.1 Considerations When Evaluating Comprehension. Per [2], measuring a participant’s comprehension of a passage can be challenging. For example, consider the common technique used when evaluating the interplay between comprehension and understanding. A participant will read a passage and have their time to completion calculated. From this, a reading speed in words per minute is calculated. Then, the participant is asked multiple-choice questions about the passage. Participants were then scored by the product of their reading speed in WPM and their percentage score on the comprehension questions. For example, a participant who speed-read an article at 3000 WPM and got a 50% score on comprehension would earn a score of 0.50 × 3000 = 1500. However, to consider the flaws in this metric, consider the person who “read” the passage at 10000 WPM but only scored a 25% score on the comprehension exam (no better than if they had guessed one of the 4 options). Their speed reading score would be 2500, significantly better than the first participant. But if their score on the comprehension exam was no better than random chance, did they read the article?

Studies resolve this problem in different ways. Some studies will ask participants more open-ended free-response questions, but these questions can be difficult to grade objectively. It is outside the authors’ expertise to develop and grade open-ended assessments of passages.

Other studies will determine comprehension as a binary. Participants who score high enough on the examination questions “understand” the passage. This method has significant drawbacks as well. Due to articles having different levels of comprehensibility, it can be difficult to assign a set threshold needed to understand the passage. Additionally, considerations about the effectiveness and discrimination index of questions come into play as well.

For this study, neither of these approaches can be used. It is not required for us to compare different participants in the study to determine our hypotheses. Instead, we will measure a participant’s change in comprehension score after introducing speed reading techniques.

For this technique to effectively discriminate changes in comprehension at increased reading speeds, other factors in the experiment must stay constant. Passages should have similar difficulties, and questions should stray away from analytical topics. To achieve this level of standardization, we selected a series of passages from the SAT. This corpus provides us with standardized passages and attached comprehension questions. Crucially, the College Board also releases statistics about high-school student performance on each question, allowing us to select readings for the different tasks with similar levels of difficulty.

2.5 Procedure
Each participant was greeted in the lab and asked to be seated in front of the desktop. They were then asked to fill out a pre-assessment questionnaire that collected general demographics data like gender, age, SAT score and information regarding any visual impairments that may skew the results of the experiment. The participants were then informed about the experiment and they were given an opportunity to ask any questions regarding the experiment. After that, the participants were asked for a verbal consent to participate in the study. Once the consent was verbally given, they were instructed to complete a short calibration and validation activity through Gaze Point Analysis using a five-point calibration grid. After calibration, participants were reminded to keep their head position as stable as possible without causing discomfort.

In the first level of the experiment which is the control level, participants were asked to read a passage with their normal reading speed. During this task, various measures such as number of fixations, fixation duration, saccade rate, pupil dilation, etc were collected using the eye-tracker. After reading the passage, the participants were asked a few questions related to that passage. This would help us assess how well they were able to comprehend the passage. Participants were then asked to complete the NASA-TLX survey. This survey would help us understand the perceived workload on the participants. In the second level, the participants were trained in a speed-reading technique before they were asked to read a passage. In the this level, the passage used had different theme/story than the one used in the first level. Comprehension questions were also asked in this experiment level and a NASA-TLX was collected after completing the passage. After the completion of all the tasks the participants were thanked and given the researcher’s contact information in case there were questions or concerns.

3 RESULTS

3.1 Discussion

3.2 Conclusion

3.3 Future Work

REFERENCES
