

The Effects of Reading Medium and Writing Perspective on Memory Recall

Graham P. Wright

Georgia Institute of Technology

Abstract

In this 2 x 2 between subjects design, experimenters tested the effects of reading medium (paper or computer screen) and writing perspective (first-person or third-person) on memory recall (performance on a reading comprehension test). Participants in this experiment included 40 Georgia Tech students who were enrolled in the class “Research Methods.” Experimenters prepared a fabricated story about the rescue of a missing cat and wrote two versions, one as a narrative (first-person) and another as an objective recount of the event (third-person).

Participants had three minutes to read the appropriate version of the story, one minute to play the game 2048 as a distraction, and as much time as they wanted to take a 11 question reading comprehension test over the story. Participants were tested in pairs, randomly assigned to writing perspective, and assigned to reading medium based on the order they participated in the experiment. Hypotheses predicted that the first-person narrative perspective would produce higher reading comprehension than the third-person objective perspective, paper reading material would produce higher reading comprehension than computer reading material, and that the first-person narrative perspective would interact with the paper reading medium to produce superior reading comprehension. Results showed no significant main effects or interaction effects. Since data was gathered from only college students at Georgia Tech who had previously been exposed to psychological research, generalizability of results should be taken with caution.

Reading Medium and Writing Perspective on Memory

As the world moves towards the digital age, more people are exposed to computers every day. The Internet has become an excellent place to read and glean new information, causing it to become one of the main attractions of the computer. As such, it is important to understand if this new medium, the computer screen, is just as effective as a physical medium such as paper. Internet users have also started to get their news from online news sources which employ different styles of reporting. This could include interviews, objective reporting, and other methods. It would be useful for news sources and readers to know what method of reporting is most effective in communicating information that the reader will remember. Previous experiments have investigated the effects of reading medium on reading comprehension (Wise, Bolls, Myers, & Sternadori, 2009) (Margolin, S. J., Driscoll, C., Toland, M. J., & Kegler, J., 2013) and study time management (Ackerman & Goldsmith, 2011).

In an experiment by Wise, Bolls, Myers, and Sternadori (2009), experimenters looked at the effects of writing style (narrative vs inverted pyramid), video intensity (high vs. low), and story (one of four stories) on heart rate and recognition memory (a multiple choice test with four questions for each story). Each of the four stories had a narrative version and an inverted pyramid version. Participants were given four stories of varying writing styles, each with an accompanying video clip of either high or low intensity, and were later tested on the details of the stories. Experimenters also measured the heart rate of each of the participants. The results suggested an interaction effect between writing style and time; video clips that followed after participants read an inverted pyramid style text story slowed heart rate much faster than video clips that followed the narrative stories. The narrative stories also led to a higher accuracy of recognized details than inverted pyramid stories. The heart rate deceleration was explained by

the allocation of more cognitive resources even though this did not improve accuracy of story recognition. According to the experimenters, the narrative stories evoked more mental images, leading to a higher recognition rate.

The next experiment (Margolin, S. J., Driscoll, C., Toland, M. J., & Kegler, J., 2013) tested the effects of type of text (expository vs. narrative) and media presentation (paper vs. computer vs. Kindle) on reading comprehension (measured by percentage correct on a reading comprehension test). The type of text was a within-subjects independent variable, and the media presentation was a between-subjects independent variable. Participants read 10 passages (half narrative and half expository) on the assigned condition's reading medium and answered five or six comprehension questions as each passage was completed. Results showed no main effects or interaction effects among the variables. Experimenters concluded that, while it may be distracting to become accustomed to a new reading medium, the required cognitive resources must be minimal, leading to the lack of main effects.

An experiment by Ackerman and Goldsmith (2011) actually consisted of two smaller experiments. The first experiment tested the effects of learning medium (computer screen vs. paper) on test performance (test over various passages read) in a time regulated setting. Participants read a series of six texts either on paper or a computer screen based on the condition, completed a prediction of performance test, and a 10 question multiple choice test over each text as it was read. Participants were allotted seven minutes to read each text and five minutes to take each test. Results found no significant difference of test performance between learning mediums. This led experimenters to conduct a second experiment that involves self-regulated allotment of time.

The second experiment was identical to the first one, except this time participants were allotted 90 minutes to work through all texts, prediction of performance tests, and the multiple choice tests (self-regulated learning). Experimenters found a main effect of study media; performance on the tests was higher in the paper medium than in the screen medium. There was also a significant interaction effect; the condition with a paper medium and self-regulated learning performed significantly better on the tests than conditions with the screen medium and the two levels of regulated learning. One possible explanation for these results is that the test medium (paper for the paper learning medium and computer for the computer learning medium) may have influenced the recall of details from the participants, skewing results.

Ackerman and Goldsmith's experiment (2011) looked at the effects of reading medium on test performance, something we would like to incorporate into our experiment. Their experiment tested the participants on different mediums; the paper medium participants took the test on paper, while the computer medium participants took the test on the computer. We would like to keep the test medium constant across conditions. We would also like to have a reasonable amount of questions to test memory recall as opposed to having only four questions (Wise, Bolls, Myers, & Sternadori, 2009). We can be most efficient if we have a universal test that both types of stories, first-person and third-person, can answer. The experiment by Margolin, Driscoll, Toland, and Kegler (2013) most closely resembles the experiment that we want to replicate; it used various literature pieces gathered from a college library and prewritten tests to measure the effects of reading medium and writing style on higher level reading comprehension. We would like to replicate this study but instead of higher level reading comprehension, we would like to test the recall of simple story details.

After a consideration of previous research, we constructed a 2 (reading medium: paper vs. computer screen) x 2 (writing perspective: first-person vs. third-person) between subjects design that measures memory recall as its dependent variable. Participants first read either a first-person or third-person version of a fabricated story on either paper or on a computer screen. Participants then play the game 2048 as a distraction and take a reading comprehension test on the reading material. The number of correct answers on the reading comprehension test for each condition will be recorded and analyzed. Our study predicts that the paper medium and the first-person narrative writing style will lead to the highest reading comprehension scores. We also believe that these two conditions will interact to produce superior test scores.

Method

Participants

This experiment took place on the campus of Georgia Institute of Technology in the J.S. Coon building over the course of two days. Participants were comprised of 40 Georgia Tech students who were enrolled in the class “Research Methods.” Each trial tested two participants at a time due to time constraints.

Research and Design

The purpose of this experiment was to investigate the effects of reading medium and writing perspective on memory recall. Reading medium and writing perspective were both between subjects independent variables. This experiment, then, was a 2 (reading medium: paper vs. computer screen) x 2 (writing perspective: first-person vs. third-person) between subjects design. We operationalized memory recall, the dependent variable, to be the number of correctly answered questions on a reading comprehension test that covered the material in the provided story.

Materials and Procedure

Materials. Before experimentation, four documents were prepared. The first document included the prompt to be read to all participants before experimentation (Appendix A). The second and third documents included the fabricated story, written from both the first-person narrative perspective (Appendix B) and the third-person objective perspective (Appendix C). Both versions of the fabricated story contained the same testable details so that a single test could be administered to all participants regardless of the writing style. The final document consisted of the online reading comprehension test (Appendix D), a ten question four answer multiple choice test. This experiment required two laptops, one for each participant in the pair being tested. A desk provided space for the laptops to sit and two chairs provided a place for the participants to sit. A room with a door was preferred in order to limit any outside distractions. Experimenters used a random number generator to randomly assign participants in each pair to the writing perspective condition. A time keeping device was required for measuring time intervals throughout the experiment. One paper copy of the first-person fabricated story and one paper copy of the third-person fabricated story were needed.

Preparation. The experimenters placed the two laptops in a room. The laptops were preloaded with the digital version of the fabricated story, the online game 2048, and the reading comprehension test. The conditions were numbered: paper story and first-person was given a 1, paper story and third-person was given a 2, computer screen story and first-person was given a 3, and computer screen story and third-person was given a 4. The paper copies and digital copies of the story were labeled at the top with the appropriate number (for example, Experiment Number: *number here*). Participants were chosen for the experiment in a convenience sample with two participants being tested at a time. The reading medium for the pair of participants alternated

each trial; the first time the pair experienced the paper reading medium, the second time the new pair experienced the computer screen reading medium, etc. By a random number generator, one participant was assigned to the first-person condition and the other participant to the third-person condition. The participants were told what their experimenter number was in order to correctly respond on the test. If the trial was a paper reading medium condition, then experimenters hid the digital story from view on the laptop and placed the correct paper copy of the story on the desk in front of the laptop. If the trial was a computer screen reading medium condition, the experimenter opened the digital story on the laptop.

Pilot Study. In order to ensure that our test was reasonable and valid, we performed a pilot study on five participants. We made sure that at least one participant participated in each of the four conditions of the experiment. These participants followed the same procedure as the actual experiment, but we instead tested the participants one at a time as opposed to in pairs. We concluded that our test and story versions were suitable for a larger participant pool.

Procedure. Once a pair of participants had volunteered for our study, one experimenter led the pair of participants into the experimental room and closed the door behind them. The participants in the pair were read the experimental prompt (Appendix A). Following this, each participant in the pair was allowed three minutes to read his or her version of the fabricated story (Appendix B or C). They were then allowed one minute to play the distraction game, 2048. Finally, they were told to take the online reading comprehension test (Appendix D). They were allowed to leave whenever they were finished.

Results

Hypothesis and Purpose

The purpose of this experiment was to investigate the effects of reading medium and writing perspective on memory recall. We hypothesized that a first-person narrative story would lead to higher reading comprehension scores and a paper medium would lead to higher reading comprehension scores. We also hypothesized that a first-person narrative story and paper reading medium would produce superior reading comprehension scores to a third-person objective story and computer screen reading medium. We conducted an analysis of variance on the data.

Reading Medium and Memory Recall

There was not a significant main effect of reading medium on memory recall, $F_{(1, 36)} = .042$, $p > .05$. Our data did not suggest that reading medium has a significant effect on memory recall. This was contrary to our hypothesis that the paper reading medium would lead to higher reading comprehension scores.

Writing Perspective and Memory Recall

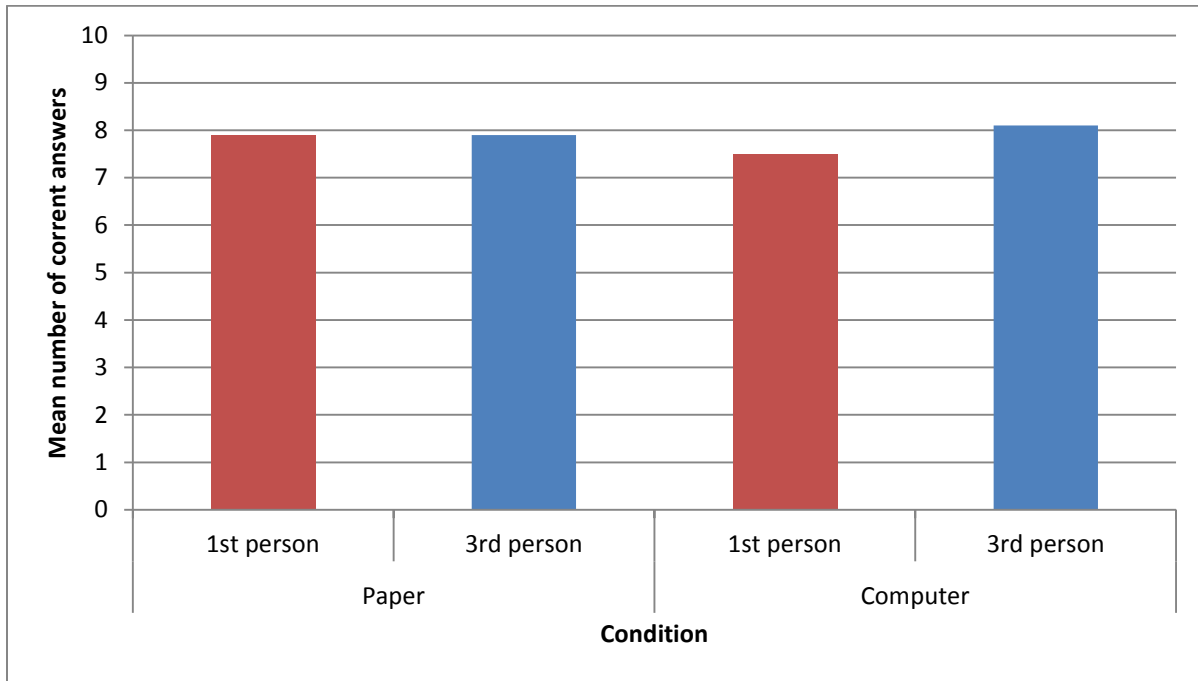
There was not a significant main effect of writing perspective on memory recall, $F_{(1, 36)} = .380$, $p > .05$. Our data did not suggest that writing perspective has a significant effect on memory recall. This result disagreed with our hypothesis that a first-person writing perspective would lead to higher reading comprehension scores.

Interaction Effect on Memory Recall

There was not a marginally significant interaction effect of reading medium and writing perspective on memory recall, $F_{(1, 36)} = .380$, $p > .05$. Our data did not suggest that reading medium and writing perspective interacted in a significant way to affect memory recall. This

result disagreed with our hypothesis that a first-person paper medium would lead to superior reading comprehension scores due to an interaction effect.

Figure of Results



Graph 1. Mean Number of Correct Answers on Reading Comprehension Test by Condition

Discussion

The data we gathered showed no significant effect of reading medium on memory recall. Participants who read the story on paper performed at almost an identical level to participants who read the story on a computer. This conclusion agrees with the findings of Margolin, Driscoll, Toland, and Kegler (2013) and Ackerman and Goldsmith (2011), suggesting that perhaps reading medium does not significantly alter memory recall. However, both our and their experiments limited the sample to college students. The possible problem with this is that college students come into contact with computers on a daily basis and are much more aware of emerging technologies than other age groups. It would be worthwhile to expand our sample to other age groups to determine whether or not this effect of reading medium varies with age. It is

possible that, with minimal confidence in or preference for computers, people do worse on recall or comprehension tests as a self-fulfilling prophecy. This could be the case for older participants, but investigating the effects of reading medium in children could be valuable as schools begin introducing electronics into the learning environment. Expanding to more age groups would certainly require more resources but may produce useful data in answering these questions.

Our data also suggested no significant effect of writing perspective on memory recall. The two different writing perspectives, first-person and third-person, produced nearly identical results in terms of memory recall. This contrasts previous research that a narrative writing style produces higher recall accuracy than a third-person objective writing style (Wise, Bolls, Myers, & Sternadori, 2009). This previous research included accompanying video clips with the news stories, so it is possible that these clips led to this effect. If there truly is no effect of writing perspective, then the identical results between the writing styles shows us that our efforts to equate the first-person and third-person versions of the story were successful. If there actually is an effect, one possible confound lies in the fact that the first-person narrative story version contained more extraneous details than the third-person objective story version. Since participants knew they were being tested on the reading material, it is possible that these participants tried to remember more details which ended up interfering with the recall of details in the test.

One error in our experiment concerned equating the two versions of the story. For question 9 of our test, “How did the main character find the name of the owner of the cat?” the answer (by voicemail) was found in the first-person narrative story version but not in the third-person objective story version. This resulted in a very low mean score for that question, so we did not incorporate this question into our data. Our test scores also experienced a ceiling effect;

the mean number of questions answered correctly for all conditions hovered around 8 (Graph 1) out of 10 (11 minus the thrown out question). There were multiple participants who scored perfect on the test, and this ceiling effect may have limited their performance. If we were to replicate this experiment, we would like to construct a longer story and possibly a larger test as a result in order to invoke a larger variance in scores in hopes of exposing a main effect if one is present. A larger sample size gathered from random sampling would also be good idea so that our sample is less homogeneous.

Due to the small sample size and homogeneous participants, these results should be generalized with caution, especially since past research has produced varied results on the subject. The experiment definitely provides a framework for a simple and efficient manner of testing reading medium and writing style for experimented under time and resources constraints. As people glean more of their daily information from computers, the effectiveness of reading medium and writing style in affecting memory recall becomes more relevant. Being able to transition to an exclusively electronic world requires careful research and understanding of the advantages and disadvantages of employing these types of variables in news, learning, and leisure. This will require many more experiments on a larger scale in order to fully understand the underlying mechanisms of these effects.

References

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Appendix A

Experimental Prompt

Today you will participate in a reading comprehension experiment. You are to read an article we provide only one time through and you will have a time limit of 3 minutes maximum. Once you finish reading there will be a 1 minute period where you are to play a game called 2048. In this game you are given a 4x4 block containing tiles which have numbers on them. you use the arrow keys to move all of the tiles in one direction. when two tiles of the same number collide they merge into a single block whose number is the sum of its two parents. The object is to get a sum of 2048. After this distraction period you will take an 11 question test on the passage you read. Once you complete the test let one of us know. The experiment should not take more than 5 minutes and you are free to leave at any time. If you consent you may begin.

Appendix B

First-Person Narrative Story

Amy Sisk saved Fluffs the cat from the top of a tree last Tuesday afternoon! Amy recalls, "I was walking down 6th street last Tuesday and suddenly heard a meow off in the distance. I

looked around frantically trying to figure out where this distinctive sound was coming from. Low and behold, I saw an orange cat in the shaggy oak tree just several yards in front of me. In order to save the cat, I ran to my neighbor, Charlie Washington's, garage and asked him if I could borrow his ladder. Charlie said, "Sure!" but also said he could not assist me in saving the cat because he had a soufflé in the oven. I took the ladder to the tree where the cat was stuck. I was able to climb the ladder and gently carry the cat down the ladder and back to my house. Once at the house, I looked at the cat's tag and found both the cat's name, "Fluff" and the owner's phone number. I called the owner but only got his voicemail. From the voicemail I discovered that the owner's name was Richard Norris. I left my name and address for Richard in hopes that he would come pick up his cat. About an hour later, Richard knocked at my door and retrieved Fluff." Thanks, Amy, for your noble civil efforts!

Appendix C

Third-Person Objective Story

Last Tuesday at 5 pm, a Savannah local saved the cat Fluffs, who was stuck up a tree. Amy Sisk was going for a walk down 6th street when she heard the meow of a cat in trouble. She looked up into a shaggy oak tree and noticed an orange cat in need of help, stuck high up in a shaggy oak tree. Thinking quickly, Amy went over to her neighbor Charlie Washington's house to see if he could help her to rescue the cat. Charlie had a soufflé in the oven and could not leave, but offered the use of his ten-foot ladder. Amy took the ladder from his garage and returned to the tree to save the cat. After retrieving the cat from the tree, Amy returned home with the cat and called the number on his collar. An hour later, owner Richard Norris picked up his cat and Fluffs was returned to the comfort of his home.

Appendix D**Reading Comprehension Test**

1. What type of tree was the cat stuck in?
 - A. White oak tree
 - B. Shaggy oak tree
 - C. Pine tree
 - D. Dogwood tree

2. What street was the main character's walking down when she heard the cat in the tree?
 - A. Pine Street
 - B. 6th Street
 - C. Norris Street
 - D. Ferst Street

3. What was the name of the cat?
 - A. Fluffs
 - B. Puffles
 - C. Snuffles
 - D. Toofkins

4. What was the full name of the owner of the cat?
 - A. Gene Smith
 - B. Gram Jones
 - C. Richard Norris
 - D. Hayden Brown

5. How long was the ladder?
 - A. 8ft
 - B. 6ft
 - C. 12ft
 - D. 10ft

6. How did the main character find the name of the cat and the phone number of the owner?
 - A. Phone book
 - B. Facebook
 - C. Cat's tag
 - D. From the neighbor

7. What is the main character's last name who saved the cat?

- A. Smith
- B. Brown
- C. Long
- D. Sisk

8. How did the main character first notice the cat in the tree?

- A. Saw the cat
- B. Heard the cat
- C. Smelled the cat
- D. Walked by the cat

9. What was the last name of the neighbor?

- A. Lincoln
- B. Washington
- C. Taft
- D. Reagan

* The following question was thrown out due to an error in equating story details *

10. How long did the main character wait before the owner came to pick up the cat?

- A. One day
- B. 3 hours
- C. 1 hour
- D. 15 minutes

11. How did the main character find the name of the owner of the cat?

- A. Voicemail
- B. Phone book
- C. Cell phone contact list
- D. Google

12. What was your experiment number?

- A. 1
- B. 2
- C. 3
- D. 4