**SSBA830 Team Project**

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## **Introduction**

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### Research Question

Our objective of this experiment is to study the effect of memory on survey participants who type in information, viz-a-viz those who copy and paste information. In this experiment, we study the effect of copying and pasting (treatment group) versus typing (control group) on memory.

### Background

Many experiments have tested the effects of typing vs handwriting on memory and comprehension. Smoker, Murphy, and Rockwell (2009) showed that participants had better recognition and recall of words when asked to write them verse typing them. Many of these studies postulate that the improved performance in memory is due to increased semantic processing from handwriting. Mueller and Oppenheimer (2014) demonstrated that students who took notes by hand performed better on conceptual questions than students who took notes on a laptop. The authors noted that laptop note takers were more likely to copy notes word-for-word, indicating that they were not processing and truly understanding the information as well as longhand note takers.

Given this background research, we expect that copy-pasting would result in even less semantic processing than typing, and that our participants asked to copy-paste information would have worse memory than the typing participants.

## **Hypothesis**

Our main hypothesis is that users who copy and paste information are less likely than users who type information to remember what they have learned. In our experiment, we set up a survey to test whether an individual when presented with a block of text is able to retain information. There are two different conditions that the survey takers are exposed to:

* The first is the “Copy & Paste” (C&P) condition, where the survey participants can copy and paste the answer to the questions based on the block of text that they need to read.
* The second is the “Typing” (T) condition, where the text is presented as a picture so the only viable option that the participants have is to type in the information that is asked of them. The “Experimental Design” section provides more details about the survey design and execution.

We expect that if a participant copy-pastes a long block of text, they are less likely to remember the information than if they typed it. On the other hand, if a participant is forced to type,we expect that they would spend more time processing the information which would lead to better memory.

## **Experimental Design**

### Qualtrics workflow

When participants started the survey, they were directed to a default question block that collected basic information: age, gender, country of origin, native English speaker, student or not. Afterwards, Qualtrics randomized who would be in the C&P (treatment) group and who would be in the T (control) group. Both groups were shown two excerpts: a paragraph regarding emoji usage and a conversation including emojis. Having read each excerpt, the survey taker answered four questions each: one was for transcribing a piece of the text they just read, and the other three were distraction questions, which were also on emojis. The difference between the C&P and T group was that the C&P group’s excerpts were highlightable for copy and pasting, whereas the T group’s excerpts were screenshots.

Having completed the 2 reading and transcribing activities, all survey takers were shown the same multiple choice comprehension where they were asked questions specific to the information they had transcribed earlier. At the end of the entire survey, two questions were asked regarding difficulty and whether or not they copy/pasted or typed. The last question specifically helped in measuring how many complied to C&P, since we expect that not all participants who had the option to C&P would actually do so.

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### Initial Findings from Pilot

### The purpose of a pilot survey is to test the correctness of the instructions, examine if the results are varied, and identify potential issues. The pilot survey was sent to 10 of our batchmates and we received 10 valid responses within 48 hours. 6 of the 10 pilot survey takers were assigned to the control (T) group and 4 of them were assigned to the treatment (C&P) group. In this pilot stage, the T group answered the four questions with an average accuracy of 91.7%, while the C&P group had an accuracy rate of 68.8%. As we hypothesized, the C&P group appeared to have a lower accuracy rate than the T group. Since we observed varied results from the T and C&P groups and our pilot survey takers indicated that the instructions were clear, we proceeded to distribute the same survey on a larger scale without making any changes.

## **Experimental Results**

### Survey Participants

For experiment participants we gathered survey responses from 3 main sources, our MSBA classmates, Reddit forums, and Facebook groups. Our criteria for choosing these three channels were based on size, convenience, experiment stage, and diversity. We aimed for a control (T) vs treatment (C&P) split of 50%, however we achieved a split of 59.6% control to 40.4%treatment due to a compliance rate of 93.2% in the treatment group and uneven simple randomization**.** In total, 140 survey respondents fully completed the survey. The survey demographic breakdown is as follows:

* English first language - Yes (56.6%), No (44.4%)
* Gender - Men (35.2%), Women (59.2%), Non-Binary (3.5%), Perfer not to say (1.4%), Other (0.7%)
* Student - Yes (65.5%), No (34.5%)

## Randomization Check

To perform a randomization check, we performed t.tests on four controlled variables: age, gender, english as first language, and if the participant was a student or not. The t.tests compared these variables between both the treatment and control groups and found no statistical significance, indicating that our groups were well-balanced.

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### Results

For our intention to treat effect (ITT), that is the treatment effect on those who were placed in the treatment group (C&P), we have concluded that the treatment group scored 19.08% less than the participants who were placed in the control (T) group. For our Complier Average Causal Effects (CACE) we have concluded that participants who copy pasted the information scored 20.5% less than the participants who were forced to type.

## **Limitations and Potential Errors**

**1. Randomization -** We elected to perform simple randomization since we did not know ahead of time who would take and finish our survey. One issue we faced was that Qualtrics was vague about how it randomly assigned participants. There was an option to “evenly present elements”, which we chose not to use since it was unclear if that would violate rules for experimental randomization (assigning every other participant to treatment). As a result we ended up with an uneven split of participants in our treatment (59) and control groups (81). However, since we had such a large treatment effect, our experiment still had very strong statistical power (99.18%). If we had an even split (70/70) and the same treatment effect, statistical power would only slightly increase to 99.29%.

**2.** **Possible Spillovers -** Since we randomized at the individual level, there is a chance that participants in the treatment and control groups interacted with one another before the survey was taken. This was somewhat mitigated by the distraction emoji questions that obscured the true motivation of the survey. We could have further mitigated this risk by performing block randomization, but this would have come at the expense of potentially having dissimilar participants in the treatment and control groups.

**3. Missing Covariates -** We collected various demographic information from participants to use as covariates in our analysis, but one variable we neglected to collect was whether the survey was completed on a phone/laptop/tablet. The result might have been different depending on the device used, so this was a missed opportunity to more precisely measure the factors that affected memory.

## **Conclusion**

As paper becomes a thing of the past for notetaking and transcribing the switch to digital mediums becomes more and more prominent. After setting up a randomized control trial using surveys to test whether a participant was less likely to remember information that they had copy pasted rather than typed in, we found that, among the compliers who copy and pasted had an accuracy score of 20.5% less We used demographic variables such as age, gender, nationality, and whether the participants native language was English or not in order to ensure randomization. We find that participants who have typed in information are more likely to remember said info compared with those who copy pasted it.

## References

*1. Smoker TJ, Murphy CE, Rockwell AK. Comparing Memory for Handwriting versus Typing. Proceedings of the Human Factors and Ergonomics Society Annual Meeting. 2009;53(22):1744-1747. doi:*[*10.1177/154193120905302218*](https://doi.org/10.1177/154193120905302218)

*2. Mueller PA, Oppenheimer DM. The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking. Psychological Science. 2014;25(6):1159-1168. doi:*[*10.1177/0956797614524581*](https://doi.org/10.1177/0956797614524581)