Available online at:
https://cc.arcabc.ca/islandora/object/cc%3Apsycjournal

J Camosun Psyc Res. (2020). Vol. 2, pp. 37-44.
Submitted Summer 2019; accepted September 2019.

The effects of semantic clustering on memorization ability.

Author: Vladimir Doricic*

Supervising Instructor: Grace Chan, Psyc 110 ("Experimental Psychology")

Department of Psychology, Camosun College, 3100 Foul Bay Road, Victoria, BC, Canada V8P 5J2

*Corresponding author email: vdoricic@gmail.com

ABSTRACT

This experiment examined the effects semantic clustering has on memory, and whether it improves memorization ability. Ten adult participants were tested on their ability to memorize two different lists of 25 words. One of the lists was unsorted and the words had no similarities to each other. The other list, sorted by category, was semantically clustered. Each participant was given one minute to memorize the list, and then another minute to recall and write down as many words from the list as they could remember. This process was repeated for the second list. One half of the participants received the unsorted list first; the other half received the sorted list first. It was hypothesized that more words would be recalled from the clustered list rather than the unsorted list. The results of the experiment confirmed the hypothesis. Each participant in this experiment recalled more words from the sorted list rather than the unsorted list, and the results were statistically significant. The results are discussed in terms of their applications and importance as a proper technique for improving memorization ability. Recommendations for future research are also discussed.

1. Introduction

Memory plays a critical role in life. Long-term memory is especially important, as those memories are typically held indefinitely (McLeod, 2010). There are two different types of long- term memory, both of which are crucial. Implicit memory, which is often referred to as unconscious memory, is important for tasks that do not require much thought. Examples of this are things like walking or riding a bike, tasks which do not require conscious thought. (Zimmermann, 2014). Explicit memory, on the other hand, is often referred to as conscious memory. It is important as conscious memory guides our everyday thoughts. Examples of this are things like memories of experiences, thoughts, feelings, or information. Explicit memory can be broken down into two different types: episodic memory and semantic memory. Episodic memory refers to memories of experiences. Semantic memory refers to knowledge that was learned or acquired. Semantic memory is also more durable than episodic memory (Seladi- Schulman, 2018). Both types of memory are crucial for the day-to-day functioning of a human being.

Semantic clustering is the process of grouping similar objects, words, or things together, such that the objects in one cluster are more like each other than objects in another cluster. There are many ways in

which you could cluster objects including, but not limited to, objects with similar spellings, objects with similar sounds, objects that relate to each other, or objects belonging to the same category ("What is Clustering?", 2019). With regards to memory, when trying to memorize and subsequently recall sets of information, semantic clustering would organize that information in such a way that similar information would be grouped together in order to assist recall (Manning & Kahana, 2012). There have been studies done that have found that semantic clustering has aided in memorization ability.

In one such study, researchers examined the link between semantic clustering and memory among younger and older adults, and the difference in their respective memorization abilities (Kuhlmann & Touron, 2016). Two experiments were done, one with an "individual words" format, and the other with a "whole list" format. The "individual words" format involved the participants being given each word individually for a short period of time. The "whole list" format involved each participant getting the entire list of words for a longer period. In both formats, groups of younger and older adults were tested. In each individual experiment, participants were instructed to memorize the words and attempt to recall them afterwards. For each format, there were two tests. For the first test, participants were uninstructed on any sort of memorization technique. For the second test, participants were instructed to use semantic clustering. Across all four experiments, amongst both younger and older adults, the number of words recalled increased with the use of semantic clustering. This effect was much higher using the whole list format rather than the individual words format. Additionally, across all four tests, younger participants outperformed the older participants. Finally, there was a greater increase in memorization performance when using the whole list format as opposed to the individual words format when participants were instructed to use semantic clustering.

In another study, researchers examined the age-related decline in memorization ability and the extent of its effect on recall and encoding processes (Cadar, Usher, & Davelaar, 2018). In this experiment, researchers examined the effect aging had on recall by manipulating the word lists, giving them unrelated words as well as semantically similar words. The experiment found that, regardless of the list, there was a noticeable decline from the younger participants to the older participants. Moreover, both younger and older participants had more success recalling the related words as opposed to the unrelated words. Finally, the difference between recalling unrelated and related words was more significant among the younger adults than it was among the older ones. The younger adults outperformed the older adults on both word lists, but the difference in performance was much higher for the related words. The research concluded that age affects both the retrieval as well as the encoding aspects of memory, and semantic clustering ability does decline with age.

The current experiment examines the ability for semantic clustering to improve memorization. In the current study, participants were given two lists of 25 words, one that was disorganized and had no semantic clustering, and another in which the words were sorted by category and semantically clustered. One half of the participants were given the unsorted list first; the other half received the sorted list first. Based on prior research into semantic clustering, it was predicted that

memorization and recall would be better with the semantically clustered list.

2. Methods

2.1 Participants

Ten individuals participated in the current study. Participants were recruited from friends and family living in Victoria, British Columbia. Participants were asked to participate, and all volunteered. All participants were tested under the same conditions, isolated and without distractions. Their ages ranged from 18 to 66 years, with a median age of 22.5. There were 7 males and 3 females. One half of the participants received the unsorted list before the sorted list, and the other half was given the sorted list first. The first five participants received the unsorted list first, the final five received the sorted list first.

2.2 Materials

The materials used in this study consisted of a one-page informed consent form, a laptop, a stopwatch, a pen and a piece of paper. The informed consent form was printed on an 8.5 x 11 inch white paper in 12-point Times New Roman font. The form included a brief overview of the study, as well as an outline of the rights of the participant (see Appendix A for a copy of the informed consent form used in this experiment). The laptop was used to display the two lists of words used in the experiment (see Appendix B for the word lists). Each list consisted of 25 words. The stopwatch was used as a timer to precisely measure the one minute allowed each participant to memorize each list provided, as well as one minute for writing down what they recalled of each list. The pen and piece of paper were used by the participants to write down the words recalled for the experiment. The paper was an 8.5 x 11 inch lined piece of paper.

2.3 Procedure

To begin, the researcher first asked each participant if they would be interested in participating in an experiment. The researcher then requested that each participant read and sign the consent form, which explained their rights. Once each participant signed the consent form, the researcher outlined the experiment. The researcher explained to the participants that they would need to memorize two different lists of 25 words each. After each presentation of a word list, participants were required to write down as many words as they could recall on the piece of paper provided to them. Following the participants' agreement to take part in the experiment, the researcher asked if they had any questions.

Once the participants were informed about the experiment, they were placed in front of a computer, with a piece of lined paper and a pen in front of them. The procedure for the two different experimental groups was identical, apart from which list was given first. To begin, each participant was shown a list of 25 words and was given one minute to memorize them. Once the minute was up, the list was taken away and the participant had one minute to write down as many words as they could remember. The researcher then took the paper and replaced it with a new one. Next, the participant was shown the other list of 25 words and given one minute to memorize it. Following the expiry of that minute, the list was taken away and the participant was given one minute to write down as many words as they could recall. Following the end of that minute, the list was taken away, the results were tallied, and the participant was

Table 1. Means (and Standard Deviations) of words recalled from the Unsorted and Sorted lists of words.

Descriptive Statistics	Unsorted List	Sorted List
Mean	9.7	16.5
Standard Deviation	3.70	3.80
N	10	10

Table 2. Inferential statistics from the experiment.

$t = 3.85$	$df = 18$	$p = 0.001173$

debriefed. The debriefing included an explanation of the difference between the two lists, the purpose of the experiment, and the research hypothesis. They were then asked if they had any further questions and were thanked for their participation.

3. Results

The level of significance set in this experiment was .05. The average number of words recalled for the unsorted list was 9.7 (*SD* = 3.70). The average number of words recalled for the sorted list was 16.5 (*SD* = 3.80). See Table 1 and Figure 1 for a summary of the descriptive statistics. See Table 2 for a summary of the inferential statistics. These data were analyzed using a *t*-test and the results were statistically significant, $t(18) = 3.85$, $p = 0.001173$, suggesting that participants were able to recall more words using sorted lists rather than unsorted lists, which is to say that semantic clustering improves memorization ability.

4. Discussion

The hypothesis being examined in the current experiment was that using semantic clustering should improve memorization ability. The hypothesis was supported in that the sorted list of words proved to be easier to memorize than the unsorted list.

The results are consistent with previous studies that demonstrate semantic clustering improves memorization ability, especially so when using a whole list (e.g., Kulhmann & Touron, 2016). The results are also consistent with the research that showed that, even though semantic clustering ability declines with age, it improves memory (Cadar, Usher, & Davelaar, 2018).

Finally, the research is consistent in that using similar categories is one of the acceptable ways to test semantic clustering's ability to improve memorization (Manning & Kahana, 2012).

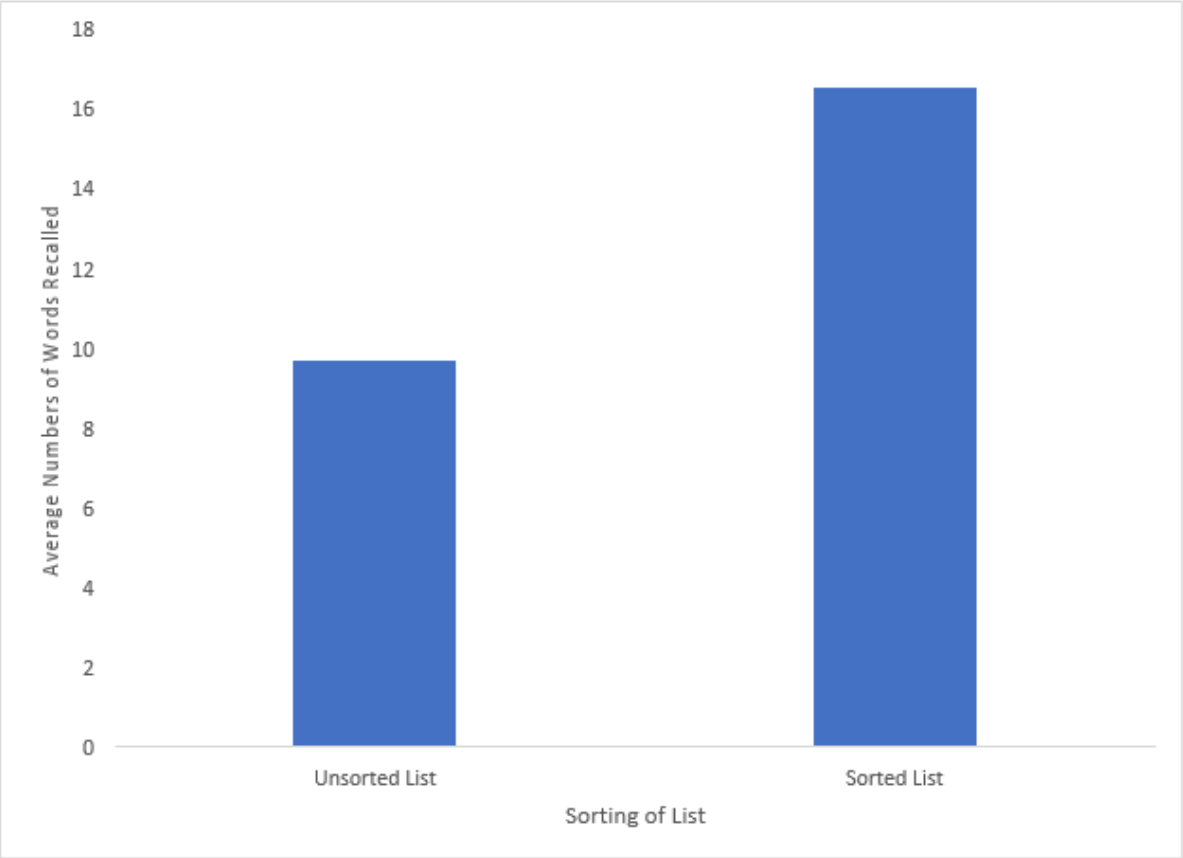

Figure 1. The average number of words recalled (out of 25) from the Unsorted List and the Sorted List.

These results are important for applications in enhancing memory and memorization. The fact that semantic clustering had a positive impact on memory should be of use to practically anyone. Memory and memorization are vital parts of everyday life, so any trick that improves memorization ability should be of use to many people. Whether it's a student studying for a test, or someone remembering critical information for their job, anything that helps improve memorization ability is important, and semantic clustering has proven to be a great tool to meet that objective.

The present study was basic in nature, so future research is likely required. Due to a small sample size of only 10 people, the results could be further confirmed, or perhaps disproved, by using a larger sample size. Furthermore, given the type of semantic clustering used, where words were ordered by category, participants may have been guessing words that belonged to a category, rather than actually remembering them. Should there be future research conducted, perhaps there would be a way to discourage participants from guessing in order to get a more accurate result; adding a

penalty for an incorrect guess could solve this potential pattern.

Expanding this research to test the differences between ages, genders, education levels, etc. may also be beneficial, as further research may provide insight on how semantic clustering affects different types of people. It may be beneficial to see who benefits the most. Additionally, the research done by Manning & Kahana (2012) showed that using multiple different types of clustering was the best way to study semantic clustering. Perhaps using multiple different types of similarities between words, as opposed to just sorting words by category, would yield different results. Further research into that area could be beneficial.

References

Cherry, K. (2019, June 29). A simple DIY short-term memory experiment. Retrieved from https://www.verywellmind.com/a-short-term-memory-experiment-2795664

Dorina Cadar, Marius Usher, & Eddy J. Davelaar. (2018). Age-related deficits in memory encoding and retrieval in word list free recall. *Brain Sciences*, (12), 211. doi: 10.3390/brainsci8120211

Kuhlmann, B. G., & Touron, D. R. (2016). Aging and memory improvement through semantic clustering: The role of list-presentation format. *Psychology and Aging*, *31*(7), 771-785. doi: 10.1037/pag0000117

Manning, J. R., Kahana, M. J. (2012). Interpreting semantic clustering effects in free recall. *Memory*, *20*(5), 511-517. doi: 10.1080/09658211.2012.683010

McLeod, S. (2010, December 14). Long-term memory. Retrieved from https://www.simplypsychology.org/long-term-memory.html

Seladi-Schulman, J. (2018, February 20). Explicit memory: overview, comparisons, and how to improve it. Retrieved from https://www.healthline.com/health/explicit-memory

(2019) What is clustering? - definition from Techopedia. Retrieved from https://www.techopedia.com/definition/17/clustering-databases

Zimmermann, K. A. (2014, February 13). Implicit memory: definition and examples. Retrieved from https://www.livescience.com/43353-implicit-memory.html

Appendix A

Informed consent form used in the experiment

A Study on the Psychology of Semantic Clustering and Memorization Ability

This study is investigating memorization strategies and their effects on memorization ability. Before taking part in this study, please read the consent form below. If you understand the statements and freely consent to participate, please provide a signature and date at the bottom of the page.

Consent Form

This study is designed to understand how effective semantic clustering is for improving memorization ability. This study is being conducted by Vladimir Doricic, a student of psychology at Camosun College for the partial fulfillment of the requirements for Psychology 110, Experimental Psychology. The study has been approved by the Instructor of the course, Grace Chan.

Participation in the study typically takes approximately 5 minutes and is strictly anonymous.

All responses will be kept completely confidential, and in no case will responses from individual participants be identified. Rather, all data will be pooled and then analyzed.

Participation in this study is voluntary, and participants may withdraw from the study at any time.

Participants begin by getting a list of 25 words which they will have 1 minute to memorize, and then will have 1 minute to write down as many words as they can remember. Afterwards, participants will be getting a second list of 25 words, which they will also get 1 minute to memorize, and finally they will have 1 minute to try and write down as many words as they can remember.

If participants have further questions about this study or their rights, they may contact the principal instructor(s), Vladimir Doricic (vlad-d@hotmail.com) or the course instructor, Grace Chan at 250-370-3217 (ChanG@camosun.ca).

If you are 18 years of age or older, understand the statements above, and freely consent to participate in the study, please sign below.

Appendix B

Word lists used in the experiment

Unsorted List

Nine	Swap	Cell	Ring	Lust
Plugs	Lamp	Apple	Table	Sway
Army	Bank	Fire	Hold	Worm
Clock	Horse	Color	Baby	Sword
Desk	Hole	Find	Bird	Rock

Sorted List

Horse	Cat	Dog	Fish	Bird
Orange	Yellow	Blue	Green	Black
Table	Chair	Desk	Bookcase	Bed
Teacher	School	Student	Homework	Class
Apple	Banana	Kiwi	Grape	Mango