

Investigating the Correlation between the Self-Reference Effect and Memory Capacity in the  
Working Memory and Long Term Memory

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Memory encoding is something that influences how people remember information and what information is transferred from working memory to long-term memory. Craik and Tulving's theory of levels of processing hypothesizes that information is better remembered in LTM tasks the deeper the processing level is (Craik, F. I. M., & Tulving, E., 1975). They argued that this is because this yields more elaborate and meaningful encoding which leads to better memory retention and retrieval. The most effective processing is semantic processing, which is when words are remembered based on their meaning, previous knowledge, and experience. Cognitive psychologists have theorized that the mind has organizational structures called schemas that serve to organize and store our experiences in our memory. These schemas are constructed from prior experiences and one of the most important schemas is the notion of the self (*The Self Reference Effect*). The self is a multidimensional concept that encompasses the abstract representation of one's perception of oneself. In terms of memory, the self-schema allows us to organize new information and encode it in this already-existing structure.

Another memory recall effect is the word length effect which theorizes that shorter words are more easily recalled in working memory tasks because of the articulatory rehearsal process and phonological store. These two components illustrate that the capacity of short-term memory is less about how many items are presented (Miller's theory of working memory capacity  $7 \pm 2$  items) (Miller, 1956), and more about the time it takes to process and retain the items in the working memory. The phonological storage capacity of the working memory is about two seconds long. Within these two seconds, more short words can be rehearsed than long words, and for this, the word length effect is shown (Baddeley, Thomson & Buchanan, 1975). This study aims to see if a correlation exists between the word length effect and the self-reference effect in

both working memory and a long-term memory recall task. This is important for understanding the divisions between working memory and long-term memory and identifying whether a self-reference cue is helpful in a working memory task.

Previous literature has investigated the difference between phonological and semantic cues on memory recall in both immediate and delayed memory tasks. One study investigating this found that recall was better in the semantic synonym judgment cue in comparison with the phonological rhyme cue in both the working memory and long-term memory recall task (Pham, T., & Archibald, L. M. D., 2022). This supported the hypothesis that semantic memory encoding or deeper levels of processing are better for memory recall than phonological memory encoding methods regardless of the time between studying and testing.

A second study (Rose, 2010) specifically aimed to replicate Tulving and Craik's levels of processing task in a working memory task while also examining whether Craik and Lockhart's transfer-appropriate-processing framework would help to explain some of the recall differences between the working memory span task and the long term memory task (Craik & Lockhart, 1972). The researcher also tested whether the length of word lists, which influences the load on the phonological loop, would affect recall in both immediate and delayed recall tasks. Another aspect that the researcher investigated was if a difference existed in recall ability if encoding and testing were in similar or different conditions. The processing framework theorizes that memory is better in recall tasks when the task matches the level of processing that occurred during encoding (Rose, 2010). This means that while memory is generally better for semantically encoded information if the information is phonologically encoded and the prompt for retrieval is also phonological, memory should be better for that information due to the encoding prompt matching the retrieval prompt. The researchers found that in immediate recall, the shorter lists of

words were remembered almost with 100% accuracy but the longer lists had much lower accuracy. However, for the delayed recall task, the items from the shorter list were remembered with much less accuracy in comparison with the percentage of words recalled from the long list. This evidence suggests that there is a substantial benefit of deeper levels of processing for long-term memory recall tasks, but this effect is not present in immediate recall tasks. The results indicated that levels of processing during initial encoding did not affect performance in the working memory task. However, there is evidence that suggests that retrieval from long-term memory is involved in the performance of working memory tasks.

Another study by Loaiza and Camos (2018) investigated how semantic representations are affected by cue types as well as different maintenance strategies. This includes rehearsal and refreshing, which are both used in working memory tasks to maintain information in the working memory with a recall task in mind. Refreshing is different from rehearsing in that it involves focusing on the information and connecting it to existing long-term memories. Loaiza and Camos predicted that the phonological and semantic cues would yield different results in the different maintenance strategies whereas refreshing would yield higher accuracy in the verbal working memory (Loaiza & Camos, 2018). The results of these experiments support a covert retrieval model where items in the working memory are maintained during complex span tasks due to their retrieval cues made from connecting the words to long-term memory schemas that already exist (Loaiza & Camos, 2018).

Based on all of this literature, this study will examine whether the self-reference effect is present in working memory as well as long-term memory and whether this effect is correlated with word length. We predict that words that are processed at a deeper, self-referenced level will be better recalled than words that are phonetically coded. Additionally, self-referenced words

will be better recalled than non-self-referenced words, particularly in short-term and long-term memory recall tasks. The word length effect will primarily manifest in short-term recall tasks, but we predict that an effect will be present as well in a delayed recall task. Previous investigations have indicated that phonological cues are less effective than semantic cues, especially for long-term memory tasks. As for working memory capacity, shorter words are more easily recalled in immediate recall tasks, however, this effect does not usually translate into delayed recall tasks. Additionally, memory recall in long-term memory tasks tends to be higher when memory encoding instructions involve self-referencing the material than when they do not. For this reason, we expect to see an effect of self-reference in both delayed and immediate recall tasks.

This experiment will look at recall accuracy for two different levels of processing: semantic processing in the form of self-referenced cues in comparison with phonological cues. It will also measure how recall is affected by the length of the words provided in the lists that are either self-referenced or phonologically encoded. This is a 2x2 within-subjects design where the dependent variable is the number of words recalled in the immediate recall task as well as the delayed recall task. Participants will be from a pool of college students studying psychology, ages 19-25. Participants will be given will read a set of instructions that explains that the study is interested in memory recall and that they will be shown multiple lists of words that they will be asked to recall. Once the participant agrees to participate in the experiment, demographic questions will be presented. Then, the participants will then receive one of four lists and should read the words aloud as they appear on the screen. Each word will appear for 1.5 seconds and participants will be asked for two of the lists to “answer whether this word describes you” and for the other two lists to “answer whether this word is written in capital letters”. After each list is

presented, participants will be asked to type out as many of the words as they could remember from the previous list. In the end, participants will be given a surprise recall task in which they are to write as many words as they can recall from all four of the lists.

The data from this experiment will be analyzed using two 2 way repeated measures ANOVAs. The first will look at short-term recall analysis, where the dependent variable will be the number of words correctly recalled in each of the conditions (short self, long self, short non-self, and long nonself). To test for an interaction between the length of words and whether they were self-referenced or not, we will run a 2 way repeated ANOVA test. If an interaction effect is present, Tukey's posthoc test will be used in order to find the effect size.

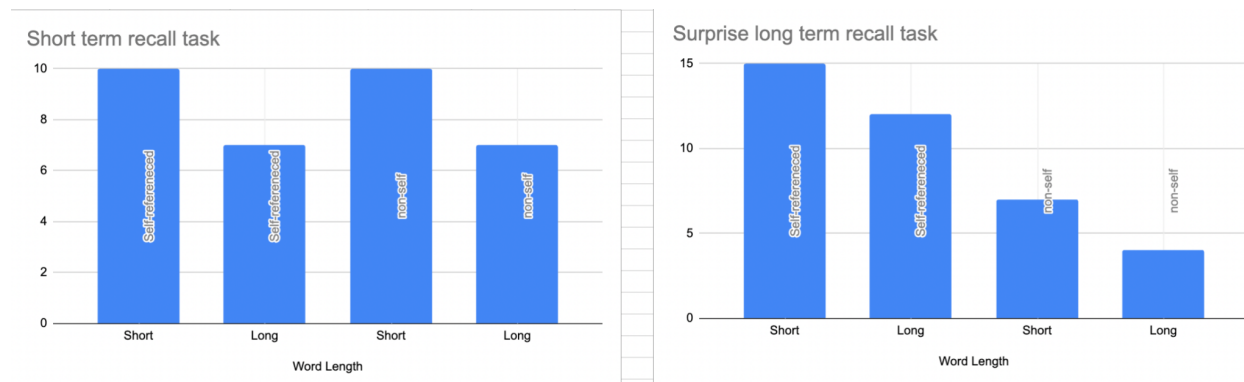
For the long-term recall analysis, the dependent variable will be the number of words recalled that were short vs. long and the number of recalled words that were self-referenced vs not self-referenced. For this, we will run a 2 way repeated ANOVA test once again. If there is an interaction effect, we will run Tukey's posthoc test to find the effect size.

## Appendices

Table of words presented

Short Self Referenced	Long Self Referenced	Short Phonological Cue	Long Phonological Cue
odd	irritable	kind	APATHETIC
dull	sophisticated	COOL	personable
strange	educated	brave	OBEDIENT
young	honorable	SMART	enthusiastic
shy	adaptable	tall	environmental
strong	superficial	rich	THERAPEUTIC
fast	emotional	TOUGH	remarkable

Predictions for the data:



Consent Form: “In this study, you will be asked to view and recall several lists of words. If you decide not to participate, your refusal will involve no penalty and no loss of benefits to which you are otherwise entitled. Participation in this study is voluntary, and you may withdraw your consent to participate at any time without penalty. You may skip any questions you do not wish to answer. This study is anonymous. Do not put your name or other identifying information on any information you provide.”

Debrief Form: “As a course requirement for a course on Research Methods in Cognitive Psychology (Psychology 117L), our research group is interested in studying how semantic

processing, particularly the self reference effect, affects verbal working memory, and whether we can still see phonological capacity limits in short term memory, such as the word length effect, when semantic processing is at play. Thus, in the study we have participants recall words each time seven words are presented as instructed, but they also complete a surprise recall task after all 28 words have been presented to see if the self-reference effect can still be seen, as it has been shown to occur in long term memory with this paradigm. If you have any questions regarding the study, please ask the experimenter or contact Dr. Mary Hegarty at [hegarty@psych.ucsb.edu](mailto:hegarty@psych.ucsb.edu) or 893-3750. If for any reason you do not wish to have your responses used in our data analysis, please let the experimenter know. Then, we will return your work back to you and we will not include your responses in our analysis. Thank you very much for your participation”



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