Cogs 119 Project Final Report: False Recall

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Introduction

The Big Question

Our remarkable but imperfect human memory shapes how we recall and understand the world. Memory is not an accurate record of what happened; it can be easily manipulated, reconstructed, or even fabricated, leading to false memories—remembering something differently from what happened or something that never happened. Yet, why do people confidently falsely recall or recognize events or details? How is it possible to firmly believe in something that may be objectively wrong? Understanding false memory is important because it doubts the accuracy and reliability of human memory, highlighting that people can confidently recall memories that never appeared under controlled conditions. As in the case of eyewitness evidence, for instance, false memories can cause harm to other people and even sometimes to themselves. This research question is interesting as it examines the factors influencing false recall and looks into explaining how the brain can confidently and actively recall memories of events that never occurred.

Past Literature

The phenomenon of false memory has received much attention and concern in psychology. Loftus (1996) showed that therapeutic practices could result in false memories of traumatic events, where excavating repressed memories involves interfering with therapeutic techniques and guided visualization. The first experimental investigation of false memory was conducted by Bartlett (1932), highlighting his distinguishing between reproductive and reconstructive memory. According to Bartlett's (1932) reconstructive theory, he emphasized that memories are influenced by an individual's knowledge and beliefs as well as cultural and social

factors. Therefore, memories are not stored as exact reproductions of past experiences, but are reconstructed and altered upon retrieval. The relationship between memory distortion and semantic association provided a framework for further studies. For example, Deese (1959) first discovered that lists of words with a high degree of association resulted in high levels of false recall. Roediger and McDermott (1995) later replicated Deese's (1959) observation using six lists that had previously produced the highest level of false recall. Their findings showed that participants often falsely recalled or recognized a non-presented word closely associated with the studied lists. In Experiment 1, false recall rates were 40% in the 12-word lists, and in Experiment 2, 55% in the 15-word lists. (Roediger and McDermott 1995). Later studies, like Underwood (1965), showed that the higher the frequency of early priming of implicit responses, the higher the chances of developing false recognition. Building on these findings, Arndt and Reder (2003) further discovered that unique font presentations led to lower levels of false recognition, in which unique font item associations resulted in the lowest false recognition rates, while themed fonts resulted in the highest.

Specific Question and Core Logic Behind

The specific research question of our experiment is: How do semantic association words affect the formation and confidence in false memories? Our study will explore this phenomenon by replicating Experiment 1 of Roediger and McDermott (1995), where participants were given several studied lists that were semantically associated with each other, but included non-presenting words with different levels of association (critical, weakly related, unrelated lures) to test for false recognition. We hypothesize that participants will falsely recall and confidently recognize non-presented words strongly associated with the studied lists.

Specifically, among the non-studied words, we hypothesize that recognition rates will be highest for critical words, followed by weakly related words, and lowest for unrelated words. The core logic behind this study is the concept of memory illusion and the spreading activation theory, which suggested that learned words activate mental pathways that bring related but unlearned words into the brain and create false memories through semantic networks. This process draws attention to the systematic nature of memory mistakes and their dependence on associative networks by showing how the brain organizes information focusing on coherence over accuracy. In general, this study aimed to examine how semantic associations contribute to memory illusions and false recall.

Method

Improvements

The first draft of our experiment included only one test block (1 list). To improve the study and align it more closely with Roediger and McDermott's (1995) method, additional test blocks were added, resulting in a total of six lists. This change aimed to make the results more reliable and consistent by increasing the variety of stimuli participants encountered. We also decided to remove the recall test that was part of Roediger and McDermott's (1995) original design to shorten the experiment’s overall duration and to focus more on the recognition test to test for false recall. New items were added to the recognition test to measure how confident participants felt about weakly related and unrelated words. This enabled better evaluation of memory distortion and false recognition across different word types.

Subject

The study involved 37 University of California San Diego participants who were enrolled in *Cogs 119: Programming for Experimental Research*, a course focused on programming and replicating experiments. Data collection took place during a regular lecture session.

Materials

The materials consisted of the first six-word lists from the appendix of Roediger and McDermott (1995). Each list contained words semantically related to a critical lure, a word strongly associated with the list but deliberately excluded to test for false recall. For instance, the critical lure "anger" list included words like *mad, fear, hate, age, temper, fury, ire, wrath, happy, fight, hatred,* and *mean,* but the word "anger" itself was excluded. These six lists, along with their critical lures, were used as originally designed in Roediger and McDermott's methodology.

To control for potential order effects, the order of the words in each list and the lists themselves were presented in randomized order. The recognition test included 42 words presented in randomized order: 12 studied (randomly selected 2 per list) and 30 non-studied words. The 30 non-studied words included: 6 critical lures, 12 unrelated lures to any of the studied words, and 12 weakly related lures (2 per list). The unrelated and weakly related words were carefully picked to minimize the association with the critical lures.

Procedure

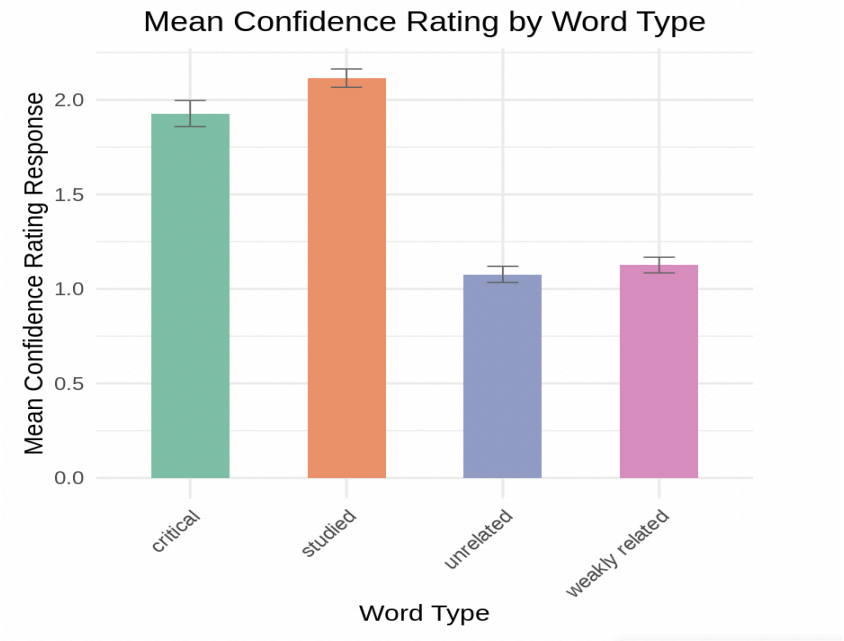
During the lecture, participants were presented with six lists of 12 words, and they were shown and heard one list at a time. Each list contained words semantically related to a non-present critical word. After studying all six lists, participants completed a 42-word recognition test at their own pace, rating their confidence levels regarding whether each word

was "old" (previously presented) or "new" (not presented). For each word, participants rated their confidence using a four-option Likert scale: "Definitely New," "Probably New," "Probably Old," and "Definitely Old" (numerically indexed from 0-3 for analysis).

Results

Figure 1

Mean Confidence Ratings (out of 3) by Word Type (critical, studied, unrelated, and weakly related)



Note: Confidence ratings were collected using a four-point Likert scale, indexed numerically from 0 to 3: 0 = "Definitely New," 1 = "Probably New," 2 = "Probably Old," and 3 = "Definitely Old."

Participants' confidence ratings and false recall rates for critical, studied, weakly related, and unrelated words were analyzed to explore the phenomenon of false memory. Table 1 and Figure 1 highlight key differences across these word types. Studied words had the highest mean

confidence rating of 2.11, SE = 0.0485, reflecting participants' strong confidence in recognizing these words as "old." Interestingly, semantically associated critical lures, despite not being presented, had a mean confidence rating of 1.93, SD = 1.03, nearly equal to that of studied words. This finding indicates that participants were almost as confident in falsely identifying critical lures as they were identifying studied words.

Table 1

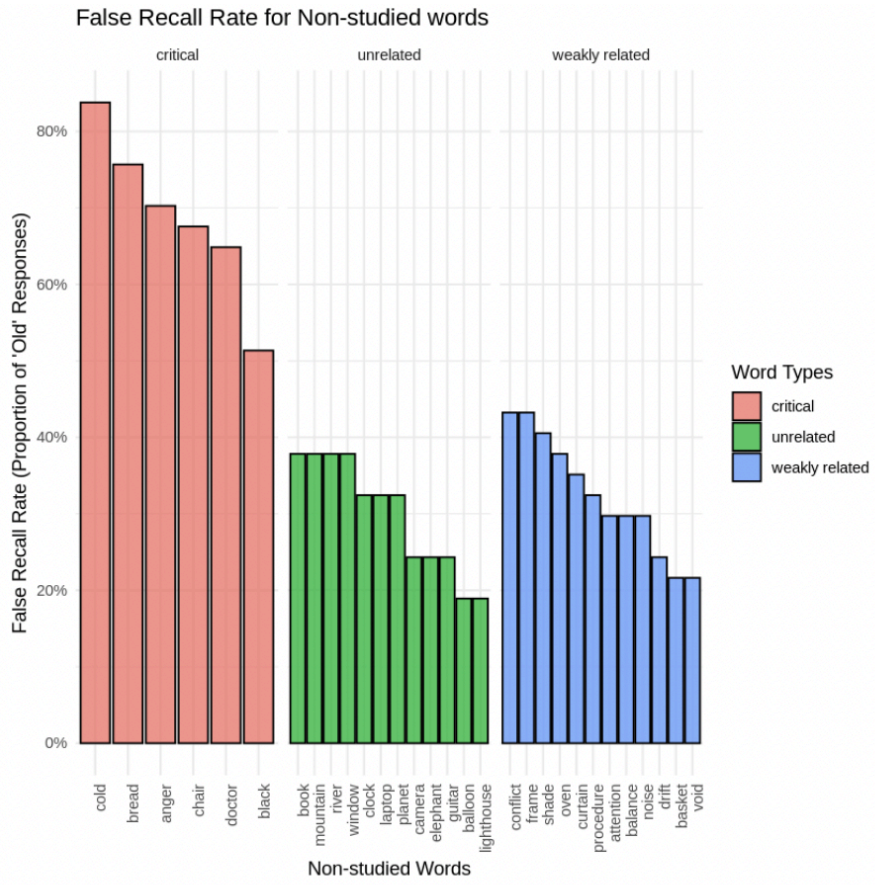
Mean Confidence Ratings, Standard Deviations, and Standard Errors by Word Types

	word_types	mean_response	sd_response	n	se_response
	<chr>	<dbl>	<dbl>	<int>	<dbl>
1	critical	1.93	1.03	222	0.0689
2	studied	2.11	1.02	444	0.0485
3	unrelated	1.08	0.903	444	0.0429
4	weakly related	1.13	0.877	444	0.0416

In contrast, the mean confidence rating for weakly related words (mean = 1.13, SE = 0.0416 and unrelated words (mean = 1.08, SE = 0.0429) received much lower confidence ratings. These words, having limited or no semantic association with the studied lists, were less likely to be falsely recognized, and participants demonstrated lower confidence when making errors. The mean confidence rating for weakly related words was slightly higher than for unrelated words. The consistency of these findings is supported by the more minor standard errors for weakly related and unrelated words, as shown in Figure 1 and detailed in Table 1. The slightly larger standard error for critical lures shows more variation in participants' confidence ratings for these words. This is clearly shown by the error bars in Figure 1, which match the standard errors reported in Table 1.

Figure 2

False Recall Rate for Non-Studied Words by Word Type



To determine the false recall rate for non-studied words, participants' responses were categorized based on whether they rated the words as "old" (either "probably old" or "definitely old"). As depicted in Figure 2, critical words showed the highest false recall rate, followed by weakly related words and unrelated words. Table 2 shows that the average false recall rates were 68.92% for critical words, 32.43% for weakly related words, and 29.95% for unrelated words. These findings suggest that words with strong semantic associations to the studied lists were more likely to be incorrectly recalled with confidence compared to words with weaker or no

associations. Additionally, a t-test confirmed a significant difference in confidence ratings between critical and unrelated words, $t(664) = 10.958$, $p < 2.2e{-}16$, with critical words receiving significantly higher ratings. The mean confidence rating for critical words (mean = 1.928) was substantially higher than unrelated (mean = 1.077), illustrating the impact of semantic associations on false recall and the confidence participants placed in those errors.

Table 2

Average False Recall Rates by Word Types (participants rate the words as "old")

word_types	false_recall_rate_avg
<chr>	<dbl>
critical	68.91892
unrelated	29.95495
weakly related	32.43243

Discussion

Summary of Main Outcome

The experiment showed that semantic associations play a major role in creating false memories, consistent with what Roediger and McDermott (1995) found. Participants demonstrated high false recall rates for critical words that were not presented; however, were semantically related to the study lists, reflecting confidence in their false identifications. The results indicated that the mean confidence rating for critical words (mean = 1.93) was nearly as high as that for studied words (mean = 2.11). In comparison, unrelated words (mean = 1.08) and

weakly related words (mean = 1.13) had much lower false recall rates and confidence ratings. Among non-studied word types, critical words had the highest average false recall rate.

These findings aligned with our hypothesis that participants would falsely recall and confidently recognize non-presented words that were closely associated with the studied items. As predicted, recognition rates were highest for critical words, followed by weakly related words, and lowest for unrelated words. This supported that semantic connections have a strong impact on false recall. The results also back this up, with critical words being falsely recognized 68.92% of the time, much higher than weakly related words at 32.43% and unrelated words at 29.95%. This pattern corresponds with the spreading activation theory, which suggests that encountering semantically related words activates associative networks in the brain, increasing the likelihood of falsely recalling related but unstudied words.

Interpretation and Implications

Memory isn't perfect, and everyone sometimes recalls things inaccurately. As Bartlett (1932) pointed out, memory is a reconstructive process influenced by connections between related information. This study shows that memory mistakes are not random, yet happen because of how the brain organizes and connects ideas. For example, participants often confidently but incorrectly remembered critical words, showing how the brain merges related concepts into cohesive but false memories. These findings also reveal how false information spreads. When individuals are exposed to false information that appears related, their memory can store and recall the information as true, which in turn increases the likelihood of remembering the false information as trustworthy. This has implications for the field of law, especially in the

examination of the credibility of eyewitness testimony. Eyewitnesses are crucial to court cases, but this research shows how normal brain functions can lead to confident yet incorrect memories. These false memories can strongly influence jury decisions and increase the chances of wrongful convictions. This then invites reconsidering how eyewitness evidence is gathered, assessed, and used in the courts. In therapy, recognizing memory's reconstructive nature is essential to avoid unintentionally creating false memories during clinical interventions, as Loftus (1996) showed, methods such as guided visualization can unintentionally produce false memories of trauma, which can have negative consequences.

Limitations and Future Directions

One of the limitations of our study is that the participant pool could be more diversified. All participants were students from UC San Diego. This limits the generalization of the findings to a broader population with diverse ages and cultural backgrounds. Another limitation is the decision to exclude the recall test to shorten the duration of the experiment. The participants in Roediger and McDermott's (1995) original experiment design wrote down the remembered words after each list, starting with the most recent and then in any order. Eliminating this aspect may have affected how information was encoded and retrieved in this experiment, potentially influencing the results.

In further research, we intend to extend the study by examining conditions under which false memories would be reduced. For example, would informing participants about the presence of lures eliminate or reduce false memories? The investigation of factors such as explicit warnings or training to spot lures may have practical applications in therapy and law. This

extension aims to explore further mechanisms of false memory formation and methods of improving memory recall and recognition accuracy in different contexts.

Reflection on Learning

The process of implementing the experiment provided me with many insights into the complexity of memory study and the challenges of experimental design. One of the key takeaways was that participants often gave high confidence "old" ratings to semantically related but not presented words, which showed the vulnerability of the brain to memory distortions. The difference between participants' confidence ratings and actual recall accuracy underlined the reconstructive and imperfect nature of memory; subjective certainty often does not equate to reality. This experiment further emphasized careful selections from the unrelated and weakly related categories of non-presented words, and randomized lists that can balance all such design confounding variables that always may affect the overall outcome validity. Furthermore, researching false memory studies deepened my understanding of how cognitive theories, like spreading activation, can be applied as testable hypotheses. Overall, throughout this experiment, I learned the importance of designing memory studies with precision. This process helped me understand how careful planning and attention to detail are crucial for exploring the complexities of human cognition.

References

Arndt, J., and Reder, L.M. (2003). The effect of distinctive visual information on false recognition. J. Mem. Lang. 48, 1–15.

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology.* Cambridge, England: Cambridge University Press.

Deese, J. (1959). On the prediction of occurrence of particular verbal intrusions in immediate recall. *Journal of Experimental Psychology, 58,* 17-22.

Loftus, E. F. (1996). Memory distortion and false memory creation. *Journal of the American Academy of Psychiatry and the Law Online*, *24*(3), 281-295.

Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. Journal of Experimental Psychology: Learning, Memory, and Cognition, 21(4), 803–814.

Underwood, B. J. (1965). False recognition produced by implicit verbal responses. *Journal of Experimental Psychology, 70,* 122-129.