Forgetting Memories: How Meaning Influences Memory Decline in the Hippocampus

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Abstract

Cognitive neuroscience research suggests that forgetting may depend on which brain areas are supporting a memory, and whether the memory is for meaningful or less meaningful content. The hippocampus is known to represent more vivid recollections of the past, and hippocampal memories appear to decay at the same rate regardless of meaning. In contrast, the medial temporal lobe represents more intuitive feelings of familiarity, and is better at retaining memories for meaningful experiences over time. We sought to test the impact of interference on hippocampal and non-hippocampal memories. We had participants study and recognize a list of random words in a continuous recognition task, providing us with ratings of which words were recollectable (i.e., likely being remembered hippocampally) and which were not. Subjects then viewed an interference list of words that was either semantically related or unrelated to the studied words. In a final phase, we assessed whether memory for the original items had declined due to the interference items. While the related interference items generalcelerated forgetting, they had a much bigger impact on previously recollected words (i.e., hippocampally-dependent memories). Our study demonstrates that when it comes to forgetting, hippocampal memories may have some sensitivity to meaning.

Introduction

- Memories can be broadly divided into 2 classes: re-experienced memories and familiar memories
  - Re-experienced memories are when you can mentally reconstruct a past image or event in your mind's eye, essentially reliving the memory
  - Familiar memories are when you have an impression that a past event occurred but are not able to visualize it
  - In our study participants could also select a "neither" option (N) rather than either of the above two memory types - this was mainly used for words subjects were seeing for the first time in a list, and therefore had no memory of
- Memory strength can be rated on a 1-6 scale
  - 1 - 3 correspond to a new memory - with 1 being the most confident a memory is new
  - 4 - 6 correspond to an old memory - with 6 being the most confident a memory is old
- In our study, words appeared one by one on a computer screen, with subjects rating each word for the type of memory they associated with the word (R, F or N) and for memory strength (1-6 scale)
  - If subjects remembered a word as appearing earlier in the list, they would rate the word as an old memory (4-6), whereas a word they had never seen before would be rated as a new memory (1-3)
- After rating a series of words, subjects viewed another list of words and spoke each word aloud
  - In the "related" condition, words from this phase were semantically related to words from the first phase
  - In the "unrelated" or control condition, words from this phase were not related to words from the first phase
- In a final phase, subjects viewed words from the first phase alongside a semantically related word and were asked to choose which word was from the original list

Hypothesis

- We hypothesized that under the related condition...
  - Re-experienced words would be more easily recalled in the testing condition
  - Familiar words would have more difficulty being recalled in the testing condition
- Re-experienced memories be more easily recalled after viewing related words because these words should bring to mind clear recollections of the words they refer to
- Familiar memories should be more difficult to recall after viewing related words because you may hesitate to recognize the word, wondering if it only feels familiar because you have seen the related word, leading you to believe you have a false memory of the original word

Methods

1st Phase: Study

2nd Phase: Interference

3rd Phase: Test

All participants were randomly sorted...
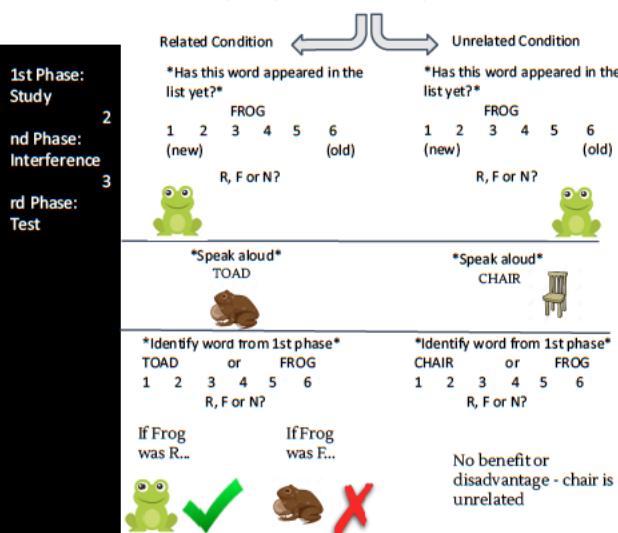
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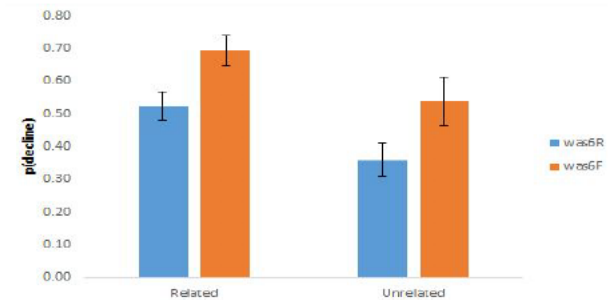
- Memories were more likely to decline under the related condition for both familiar and re-experienced memories
- Familiar items were more likely to decline than re-experienced items under **both** conditions (related and unrelated)

Conclusions

- Having subjects view semantically related words did not help subjects recall an original list at all: in fact, it increased the probability of memory decline regardless of the type of memory
  - Using synonyms or words with related meaning is unlikely to help people remember an idea, and may even hinder their ability to recall their original thought
- More research is needed to investigate how semantics affect memories of the hippocampus and medial temporal lobe

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