Forgetting of contextually related episodic memories induced by retrieval and recognition

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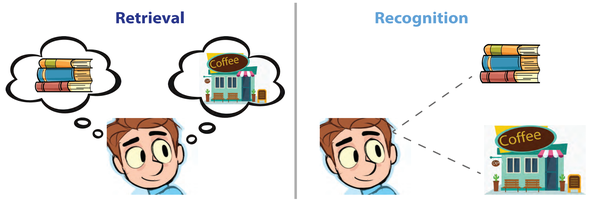
1. INTRODUCTION

Background

Context refers to all the peripheral information that characterizes an episodic memory, placing it in space and time. Context acts as an important binding agent of our memories.

MEMORY RETRIEVAL.

Recent memory models highlight the importance of contextual information for remembering episodic events. During recall, this information is used as a "spotlight" to drive memory search, which takes into account how close in time we form memories and the distinct contextual features we associate those memories with (Polyn et al., 2009; Sederberg et al., 2008).

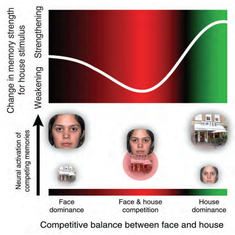


COMPETITION-DEPENDENT FORGETTING.

1. Accessing memories is a competitive process process that is dependent upon the context cues available to us.

2. Context cues may influence different reactivations of memories, leading to memory competition.

3. Homeostatic regulations have explained competition-dependent forgetting (Norman et al., 2007), whereby moderately active memories become vulnerable and may get weakened (Detre et al., 2013; Lewis-Peacock & Norman, 2014).



Retrieval and recognition are two processes that can make competing memories susceptible to forgetting (Anderson et al., 1994, 2000; Maxcey et al., 2014).

QUESTION: How does the temporal distance between items in a shared encoding context influence forgetting during memory retrieval?

Hypothesis

- We expect that changes in temporal distances between the presentation of items sharing a context will bias the competitive dynamics between those items at the time of memory retrieval.
- Specifically, items encoded closer together in time will be more likely to compete with each other during cued retrieval and later be forgotten.
- We also hypothesize that combining multiple forms of memory retrieval can have a stronger effect on forgetting.

2. METHODS

I. Encoding
Object triplets are presented serially, separated by short (1.5 s) or medium (6 s) gaps, on a unique background image.

II. Retrieval practice
For ~ 2/3 of triplets, one target object is cued for retrieval using the background image and a specific cue.

III. Memory test
Recognition confidence memory test is given for all objects seen during encoding plus novel foils.

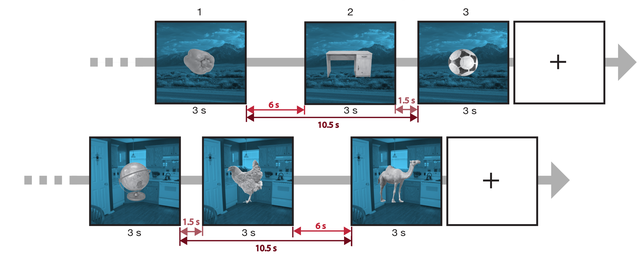
Encoding

ENCODING TRIALS

Participants are presented with a series of objects (3 s each), arranged into triplets on top of a unique background image. They are instructed to **create associations** between consecutive objects and the background, while performing a **subcategory judgement** (natural/manmade) for each object. There are 48 triplets, with 144 unique objects.

Encoding trials consist of objects presented consecutively with two contextual features:

1. **background scene**
2. temporal context - the temporal distance between the presentation of two objects can be either **short (1.5 s)** or **medium (6 s)** within a triplet. This scenario allows for 3 relative encoding distances - **short (1.5 s)**, **medium (6 s)**, and **long (10.5 s)**.



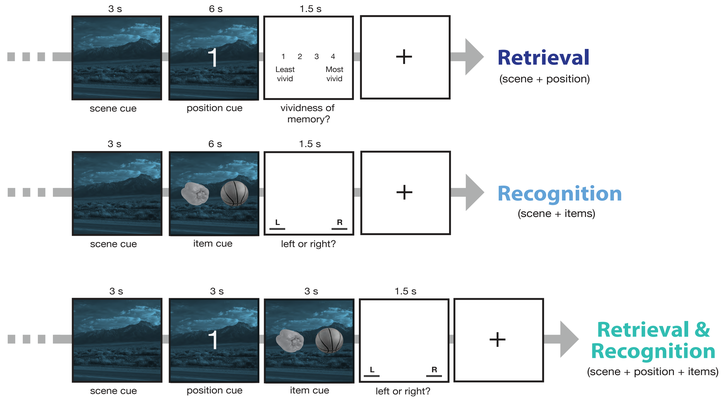
Retrieval practice

Context-based cued retrieval trials

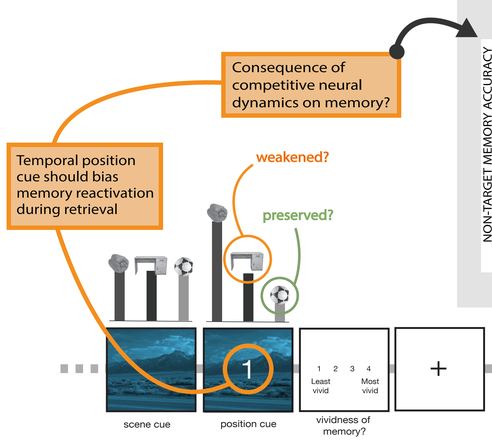
During the scene cue, participants are first to think of all three objects associated with the background image from encoding. They are then to think of the object indicated by either a context or item cue, or both. Finally, they make a specific judgment on the probe object.

36 unique trials (1 per triplet)
1 target object per trial
2 non-targets objects per trial
3 repeated retrieval practice trials per triplet

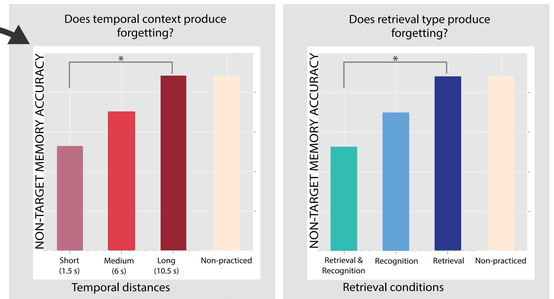
Retrieval conditions (b-s)



3. RESULTS



Hypothesized results

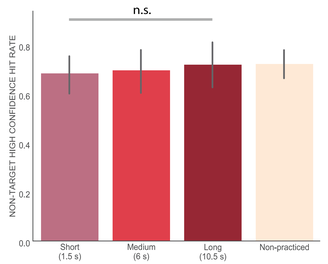


RP- Non-target objects from all practice trials

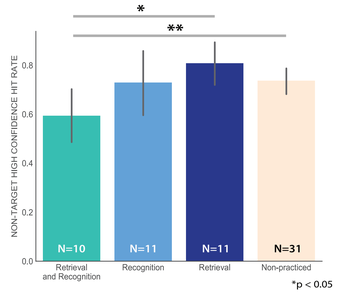
NRP Objects from triplets that were not involved in practice trials

Behavioral results (N=32)

By temporal distance:



By retrieval practice condition:



*p < 0.05
**p = 0.01

Memory accuracy for non-target objects was calculated as high-confidence hit rates for RP- objects (i.e., highest recognition confidence for an object that was old).

Thus, memory accuracy was only influenced by the type of retrieval. Interestingly, combining both retrieval and recognition led to worse memory for RP- objects.

Although no significant difference was found for memory accuracy by temporal distance, RP- high-confidence hit rates worsened as the temporal distance decreased ("long" to "short"). Thus, this finding is suggestive of the expected trend for competition-dependent forgetting, as memory accuracy for RP- objects was lower than that of NRP objects.

4. CONCLUSIONS

- In conclusion, retrieval practice and recognition practice were used to bias competition between memories encoded at different times during memory search.
- There is evidence for competition-dependent forgetting (N = 32). Competing memories that were encoded closer in time were remembered less well.
- Interestingly, combining both forms of retrieval practice (context-based cued retrieval and cued recognition) resulted in greatest forgetting of competing memories.
- This work motivates a future fMRI study that would seek to evaluate the neural mechanisms underlying these competition-dependent forgetting effects.

References

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