Neural reactivation of mnemonic interference during associative memory and effect of aging

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Highlights

- Older adults' associative memory is more susceptible to proactive interference compared to younger adults.
- Higher level of proactive interference is associated with more neural reactivation of encoding during retrieval. This pattern was observed from both younger and older adults.

Introduction

In our everyday life, we have to encode and retrieve a variety of information which have overlapping features and it can cause confusion between memories. Sometimes, previous memories inhibit the formation of new memory (proactive interference), especially when there are shared features between old and new information. To understand the interaction between old and new memory, we have to enlarge our knowledge on the memory reactivation, which is one of the most important process involved in updating, strengthening or weakening of episodic memory.

Previous studies have shown that reactivation of previous memories can occur when there are shared features between the existing and a novel episode (McClelland et al., 1995; Norman and O'Reilly, 2003). However, it remains unknown how the reactivation of old memories during the encoding of a new memory can influence later retention of the new memory.

Therefore, the purpose of the present study was to investigate the reactivation of encoded memory during the retrieval under different levels of proactive interference. In addition, we are interested in the effect of aging on this pattern of reactivation. We conducted representational similarity analysis on EEG data to measure the pattern similarity between encoding and retrieval which allows us to estimate the neural reactivation.

Objectives

- Investigate the memory reactivation of encoding during retrieval under proactive interference.
- Study that the pattern of reactivation under interference is differ by age group.
- Examine the effect of proactive interference on associative memory in older and younger adults.

Materials & Methods

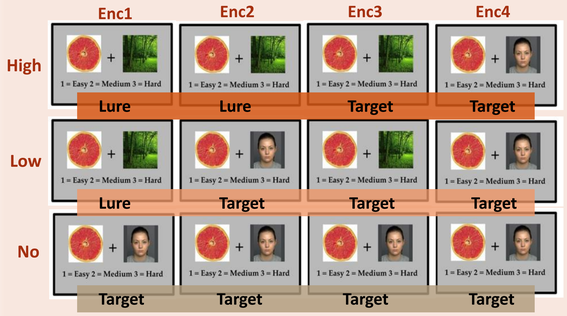
1. Participants

Measure	Young (n = 24)	Old (n = 25)
Age	24.17(4.32)	69.12(4.65)
Sex (F/M)	16/8	12/13
Education	16.52(1.87)	16.96(1.72)

- For the EEG analysis, we included only 19 younger adults and 23 older adults based on the quality of EEG data.

2. Associative memory task

- There were 4 encoding blocks that objects were paired repeatedly with either faces or scenes. Depending on the interference condition (high, low or no), the associates for the object can be changed across the blocks.

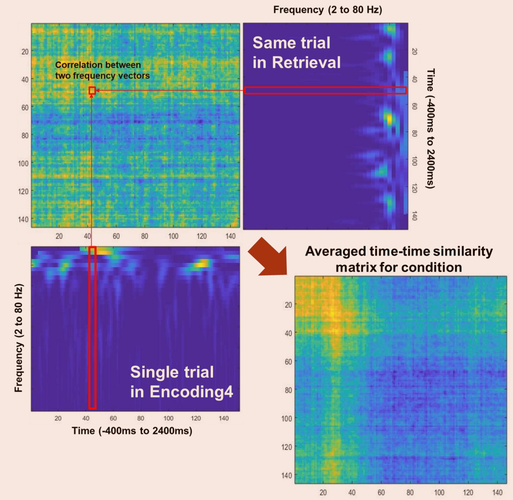


- In the retrieval block, participants made a decision whether a face or scene was the most recently paired with the object (Target).
- The level of interference was manipulated by increasing the number of presentations for the other, least recent, face or scene (Lure).
- Each encoding and retrieval block included 216 trials (72 for each condition).
- EEG was recorded over the encoding and retrieval blocks

3. EEG recording & time-frequency analysis

- EEG data were collected from 128 Ag-AgCl electrodes using an ActiveTwo amplifier system.
- Each epoch was transformed into a time-frequency dimension using Morlet wavelet with 5 cycles in 2 Hz intervals from 2 to 80 Hz.

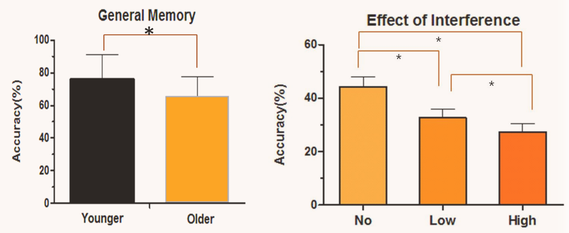
4. Representative similarity analysis (RSA)



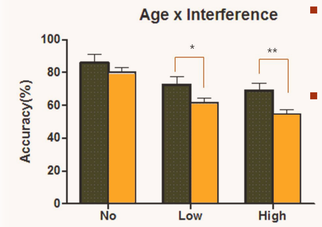
- We calculated the representative similarity between encoding and retrieval to estimate the neural reactivation of encoding during retrieval.
- Time x Time similarity matrix from 8 spatial clusters were generated for every single trials.
- The frequency vector from every time point of encoding trial was correlated with that of retrieval trial.
- Then, averaged similarity matrix were made for each interference condition (High, Low and No).

Results

1. Behavioral results

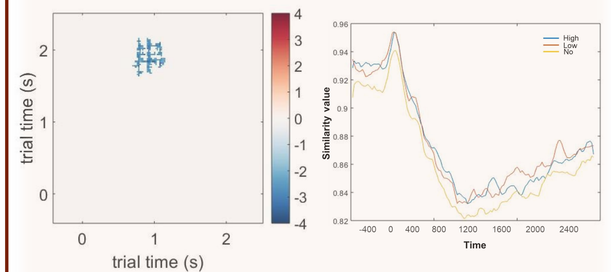


- Effect of age on the subsequent associative memory performance was statistically significant. Younger adults showed better associative memory than older adults.
- In addition, the effect of interference conditions was significant. As the level of proactive interference is higher, the memory performance was lower.



- The interaction between age and interference level was marginally significant.
- The difference between age groups was larger for the high-interference condition compared to no-interference condition.

2. RSA results



- From RSA, we found a significant cluster, which showed that the relationship between similarity and the level of interference is positive (no < low < high).
- This pattern was observed across the age group.
- When there was a interference from previous memory, that memory is more reactivated when people try to retrieve it

Conclusions

We found that older adults are more vulnerable to the proactive interference when they try to remember associations between stimuli. In addition, there was a linear positive relationship between interference level and the neural similarity. This implies that our brain reactivates encoding more during the retrieval of interrupted information compared to uninterrupted information.

References

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