

Aging, Emotional Memory, and the Hippocampus



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OBJECTIVE

Many studies have suggested that memory is enhanced for emotionally arousing compared to neutral material. Emotional memory has not been evaluated in mild cognitive impairment (MCI), a disorder involving reduced memory in the context of intact general cognitive abilities and activities of daily living. MCI is associated with decreased hippocampal volume and may be a preclinical state of Alzheimer's disease. However, accurate classification of "MCI" versus "normal" for research purposes can be problematic.

We used a rate of forgetting paradigm, sensitive to mesial temporal lobe dysfunction in humans, to evaluate the rate of information loss for emotional versus neutral pictures.

Specific Aims.

- To examine the rate of forgetting (ROF) for emotional and neutral pictures for MCI patients versus controls.
 - Self-reported arousal ratings were gathered to determine whether there were group differences in arousal at encoding.
- To examine the ROF data using a continuous indicator of memory status rather than group classifications.
- To examine the relationship between hippocampal volume (regardless of group classification) and picture recognition memory.

PARTICIPANTS

	Control Group	MCI group	p-value
Age	77.92 (7.11)	73.08 (11.29)	ns
Male/Female	8/5	8/3	
Education	16.23 (3.14)	15.50 (2.39)	ns
WASI 2-scale estimated IQ	120.20 (12.20)	110.22 (9.90)	ns
MMSE	29.23 (1.17)	28.25 (1.49)	ns
GDS-15 total score	2.31 (2.56)	3.67 (2.67)	ns
HLVT-R total recall z-score	0.75 (0.97)	-1.81 (0.70)	0.005*
HVLT-R delayed recall z-score	-0.30 (0.98)	-2.23 (0.69)	<0.001*
HVLT-R % retention z-score	-0.066 (0.89)	-1.64 (1.51)	0.006*

METHODS

Neuropsychological Testing

Classification of MCI was based on a consensus conference that took into account function in daily activities, intellectual estimates, and performance on neuropsychological measures, including the Hopkins Verbal Learning Test Revised (HVLT-R).

Emotional Memory Task

Presentation of 120 target pictures
(International Affective Picture Set; Lang et al., 2001)
 40 low, 40 medium, 40 high arousal

Participant rates picture
 Arousal (1-9)
 Valence (1-9)

10 minute memory test

1 hour memory test

2 week memory test

3 month memory test

Example Pictures



Recognition Memory tests:

-Each included a *unique* set of 30 of the original target pictures interspersed with 30 distracter pictures matched for content, valence, and arousal.

-DV: percentage of correctly discriminated words for the low, medium, and high arousal categories.

Hippocampal volume acquisition:

- A subset of 11 participants underwent MRI scanning (7 MCI and 4 controls)
- Images were obtained on a Siemens 3T Allegra scanner
- Volume of the hippocampus was traced in the program "Measure" by a trained and blinded rater

RESULTS

SA 1: ROF for emotional and neutral pictures for MCI patients compared to controls.

Results 1:

•**Arousal ratings:** The MCI and control groups did not differ in their *ratings* of low, medium, and high arousal pictures.

•**ROF:** The groups did not differ in their recognition scores [$F(1,20) = 0.271, p = 0.608$] and there was no group X arousal interaction [$F(3,60) = 2.387, p = 0.078$].

*This project was supported by the Evelyn & William McKnight Brain Institute.

SA 2: To examine the ROF data using a continuous indicator of memory status (HVLT % Retention z-score) .

	Low	Medium	High
10 min.	0.362*	0.324**	0.261**
1 hour	-0.036	0.07	0.033
2 weeks	-0.019	-0.034	0.403*
3 months	-0.041	0.027	0.03

Regression coefficients (R²) for individual regression equations with memory status as the predictor of recognition memory performance for the low, medium, and high arousal conditions.

SA 3: To examine the relationship between hippocampal volume & recognition memory.

	Low Arousal	Medium Arousal	High Arousal
10 min.	0.55	0.695*	0.714*
1 hour	0.14	0.755*	0.744*
2 weeks	0.478	0.263	0.587
3 months	0.054	0.694*	0.582

Correlations between hippocampal volume and recognition memory performance for each arousal condition at each testing session

*Indicates significance at the $p < 0.05$ level.

**Indicates significance at the $p < 0.01$ level.

CONCLUSIONS

- Neither group showed enhanced recognition performance for emotionally arousing pictures.
- Upon removal of the between-groups classification, memory status was significantly associated with 2-week recognition memory performance for high arousing pictures.
- Hippocampal volume was positively correlated with recognition memory performance for high but not low arousal stimuli.
- Individuals with better memory status benefit more from emotional arousal than those with poorer memory status.

Future Directions:

- A recall rather than recognition paradigm may have better elicited differences between the groups.
- Emotional memory in MCI should also be studied using personally relevant emotional information.