Different Patterns of Frontal and Temporal EEG Activity Associated with Explicit Memory

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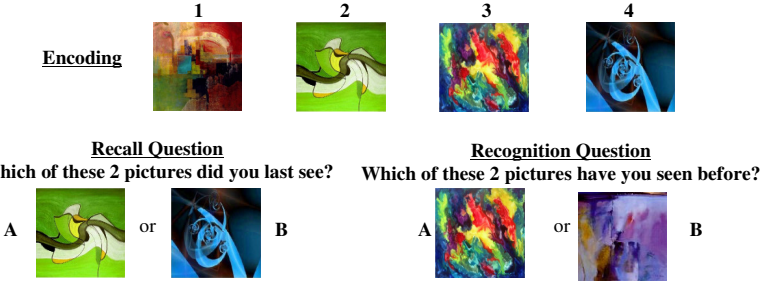
INTRODUCTION

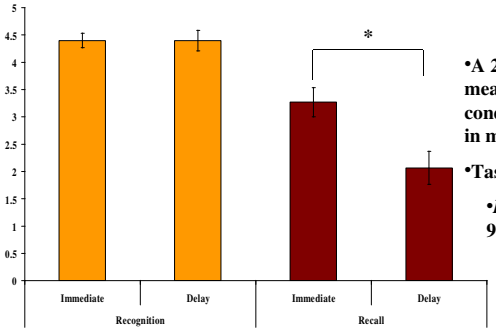
- **Traditionally, both recognition and recall processes are categorically described as examples of explicit memory function. However, there is evidence that these two processes are governed by distinct functional parameters, and potentially, separate neural substrates. Recognition memory is often considered a form of non-associative memory, requiring detection, identification and comparison of a previously-encountered stimulus with a novel one. Recall, however, is distinct from recognition, as it requires retrieval of information above and beyond novelty detection and without the benefit of concurrent perceptual support.**
- ***H_1: Therefore, we hypothesized that adults would have more errors on tasks assessing recall memory (i.e. recency judgments), rather than recognition memory.***
- **Evidence from the adult cognitive neuroscience literature also indicates a dissociation between the physiological expression of recognition and recall. Corsi, Leonard, & Milner (1991) found that adults with temporal lobe damage failed tests of recognition, but not recall, whereas adults with frontal lobe damage failed tests of recall, but not recognition. In the current study, baseline-to-task changes in continuous electrophysiology (EEG) were examined in relation to concurrent performance on a computerized task designed to independently examine both immediate and delayed recognition and recall performance.**
- ***H_2: We hypothesized that successful performance on the recognition tasks would be related to baseline-to-task changes in brain-electrical activity at temporal scalp locations, whereas successful performance on the recall tasks would be related to baseline-to-task changes in brain-electrical activity at frontal scalp sites.***

METHODS

While continuous EEG was collected, 15 adult females (ages 25-41) viewed a computerized slideshow of 40 abstract images (reproductions of museum work) displayed for 3 seconds each. images were both structurally rful, and they were ith verbal labels. t, 10 question slides (5 immediate recognition and 5 immediate recency judgments) were displayed periodically during the stimulus array. Approximately 30 minutes later, additional assessments of delayed recognition memory and delayed recency judgments were administered. Participants view a second slideshow consisting only of 10 question slides (5 delayed recognition, and 5 delayed recency judgments). Participants provided computerized responses for all questions, and response accuracy was recorded.



BEHAVIORAL RESULTS



* p<.01

- **A 2 (Task) x 2 (Delay) repeated measures MANOVA was conducted to assess differences in memory measures.**
- **Task x Delay Interaction:**
  - ***Hotelling's Trace:* F (1, 14) = 9.95, p<.01**

PHYSIOLOGICAL RESULTS

	Immediate Recognition	Delayed Recognition	Immediate Recall	Delayed Recall
Medial Frontal (F3/4)				
Lateral Frontal (F7/8)		r = .59, p<.05	r = -.53, p<.05	
Anterior Temporal (T3/4)			r = -.58, p<.05	
Posterior Temporal (T7/8)				

- **<u>Behaviorally</u>, a Task x Delay interaction was detected (F (1, 14) = 9.95, p<.01). Whereas performance on the immediate and delayed recognition tasks were equivalent, adults performed significantly worse on the delayed recall assessment than the immediate recall assessment.**
- **<u>Physiologically</u>, successful performance on the immediate recall task was related to baseline-to-task decreases in the 8-13Hz alpha band at lateral frontal (r (15)= -.53, p=.05) and anterior temporal (r (15) =-.58, p=.02) scalp locations. Thus, better immediate recall performance was related to cortical activation at these sites. Delayed recognition was related to baseline-to-task power increases in alpha power at lateral frontal locations (r (15)=.59, p=.02) . That is, better recognition performance was related to a different pattern of baseline-to-task activity, specifically, frontal deactivation. Neither immediate recognition nor delayed recall performance were related to task-related changes in brain-electrical activity.**

DISCUSSION

These data suggest that the processes of recognition and recall are behaviorally distinct in adulthood. Interference related to the delay was more detrimental for recall processes than recognition. While physiologically, the data do not show evidence for a regional dissociation between recognition and recall performance, unique patterns of cortical activation/deactivation were present for these two processes of explicit memory. Additional investigations will expand the sample and will also include a trial-by-trial analysis to explore individual differences in patterns of neural support of correct and incorrect responses in both the encoding and retrieval components of the tasks.

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