Neural Correlates Underlying The Effect of Value on Memory Encoding
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Introduction

- Given capacity limits, it is necessary to prioritize encoding of to-be remembered information
- One way this can be tested is with value-directed memory paradigms
- These paradigms typically assign values or monetary rewards to stimuli. Participants try to remember higher value stimuli to maximize their score (e.g. CAR 3... HOUSE 9)
- Higher-valued stimuli are better remembered than lower valued stimuli
- In recognition memory, this effect of value is localized to recollection

The current study examines which recognition memory processes are affected by value-directed encoding and whether differences in EEG activity during the study phase can differentiate encoding processes for higher valued words.

Methods

Value-directed recognition memory task. 28 participants

**Study phase:** 40 nouns from the Toronto noun pool randomly assigned either a value (9, 7, 3, or 1), presented randomly

**Test phase:** 80 words, including all 40 from the study phase, self-paced responses of either “New,” “Know”, or “Remember”

Study and test phase 1 block, 5 blocks completed

Two ERP components at encoding associated with better recognition memory performance, but different encoding processes

**P300:** 450-650ms post-stimulus over parietal electrodes (PZ)
- Greater amplitude associated with increased attention and dopaminergic reward processing

**Frontal Slow Wave (FSW):** 1000-2000ms post-stimulus over frontal electrodes (FZ)
- Greater amplitude associated with more elaborative rehearsal strategies

Behavioral Results

- Higher-valued words remembered better than lower valued words (significant linear trend)
- This effect was only shown in “Remember” responses and not for “Know” responses
- Value affects only deeper episodic memory (recollection)

Sensitivity To Value

- How well a participant maximizes their score can be measured using the Selectivity Index
- Ranges from -1 (minimum possible score for number of words recognized) to 1 (maximum possible score for number of words recognized)
- Calculated separately for words given “Remember” responses and words given “Know” responses

**Selectivity Index = Subject’s score - chance score**

**Ideal score - chance score**

**Range:** -2 to 2

**Linear Contrast Amplitude:** 450-650ms

- The effect of value on the P300 ERP component (measured by linear contrast amplitude) correlates to the selectivity index
- This correlation is only seen for deeper “Remember” responses

P300

**Scalp Topography:**

- **Encoding ERP:**
- **Frontal Slow Wave**

Frontal Slow Wave

- Behavioral, higher-valued words were remembered better. This effect was localized to “Remember” responses. This suggests higher-valued words create deeper, episodic memories
- The P300 component demonstrated an effect of value, suggesting that value affects earlier attentional components (possibly dopamine driven)
- The FSW showed no effect of value, suggesting that value does not lead to increased elaborative rehearsal
- The effect of value on the P300 component correlated to how sensitive participants were to value, providing evidence that P300 component indexes value prioritization and selectivity

References