**Assessment of working memory load on temporal expectation processes during visual discrimination**

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**Introduction**

- Knowledge of when a target will appear improves response time
- Older adults do not benefit from these cues, potentially due to limited resources
- To address this, we assessed whether a concurrent working memory load alters a cue-based benefit on discrimination ability in young adults

**Background**

- Three types of cues: S (short delay), N (neutral), L (long delay)

*Previous results demonstrate:*  

- Younger adults discriminated targets faster following a cued short delay
- Older adults exhibited no cue-based benefit, and was marked by neural declines in the posterior contingent negative variation (CNV) and alpha band (8-12 Hz) activity prior to target
- Could this reflect limited available resources in older adults to use cued information?

**Methods**

- 23 Young adults (aged 18-35 years)
- 64 electrode Biosemi EEG (1024 Hz sample rate)
- 3-way ANOVA: Cue (Short, Neutral, Long), Delay (Short, Long, Load 0, 3, 6)
- EEG analysis focused on CNV and alpha band (8-12 Hz) activity prior to target as indices of temporal attention that decline in aging
- EEG analysis also focused on beta band (12-30 Hz) activity prior to target as an index of working memory load
- Alpha and beta band activity identified in lateral posterior electrodes (P7/8, P3/4, P07/8, O1/2), CNV identified in central posterior electrodes (POZ, OZ, IZ, O1/2)
- Alpha and beta band ANOVAs incorporated Hemisphere (Left, Right) as factor

**Results: CNV / Alpha Activity**

- Contingent negative variation (CNV):  
  - Delay main effect (F(1,22) = 16.00, p < 0.01)  
  - Cue x Delay interaction (F(1,22) = 0.89, p > 0.05)
- Alpha band (8-12 Hz) Activity:  
  - Cue main effect (F(1,22) = 12.06, p < 0.01)
- No main effects or interactions with Load, indicating these neural measures are modulated by temporal attention, but not affected by a concurrent working memory load

**Results: Performance**

- Targets were discriminated faster following a predictive short delay, replicating previous results
- Detection performance improved with a working memory load

**Results: Beta Activity**

- Beta activity was modulated by temporal attention and increased with working memory load
- Participants who did not modulate beta activity based on cued information did not exhibit cue-based performance gains
- Cue-based beta modulation decreased with working memory load, similar to older adults with no load

**Conclusions**

- Discrimination performance improved with a concurrent working memory load, presumably increased task engagement
- Beta band (12-30 Hz) activity prior to target increased with increasing working memory load and was modulated by cues (predictive < neutral) indicating that preparation for discrimination involves suppressing working memory representations
- Decreased beta modulation was associated with declines in performance
- A high working memory load resulted in less beta modulation and was comparable to older adults without a concurrent working memory load, suggesting age-related declines in expectation processes may stem from limited cognitive resources

**References**


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