A wandering mind leads to attenuated cognitive processing when learning

Previous studies have shown that when a person’s mind wanders, sensory and cognitive processing, indexed by event-related potentials (ERPs), are diminished. Further, mind wandering has been shown to result in poorer learning and memory. However, few studies have looked at the neurocognitive consequences of mind wandering during learning.

**Prediction:** late cognitive processing should be attenuated when one’s mind goes offline, but there should be no/little difference in early sensory components, such as the P1, between mind wandering and on-task attentional states during study.

**Paradigm**

**Pretest:** word pairs are sorted into easy, RPL, and difficult conditions for each subject based on their responses & judgments of learning

**Study:** studying English-Spanish word pairs blocked by condition while brain waves were recorded

- **Attention state (on task or mind wandering) probed at the end of each randomly-timed block (15-90s)**
- Total of 24 study blocks & attentional probes
- Word pairs were displayed for 1000ms with a 500ms ISI

**Test:** subjects were tested on their learning of the studied word pairs

**Analyses**

Only events (word pairs) presented 12s before an attention probe during study were examined. Integrated area (amplitude) at electrode sites and time windows of interest were statistically compared between on task and mind wandering states.

**Results**

<table>
<thead>
<tr>
<th>Electrode</th>
<th>On Task vs. Mind Wandering:</th>
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<tbody>
<tr>
<td>P1 (75-105ms):</td>
<td>$F(1,28) = 0.67, p = .42$</td>
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<tr>
<td>P2 (180-230ms):</td>
<td>$F(1,28) = 0.91, p = .35$</td>
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<tr>
<td>Slow Wave (275-725ms):</td>
<td>$F(1,28) = 4.56, p = .042^*$</td>
</tr>
</tbody>
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**Electrooculography (EOGs):**

- **VEOG:** $F(1,28) = 6.11, p = .020^*$
- **HEOG:** $F(1,28) = 1.34, p = .26$

**Mind wandering vs. Baseline (0):**

- Slow Wave (275-725ms): $F(1,28) = 1.44, p = .24$

**Summary**

- Mind wandering is associated with an attenuated late slow wave at posterior sites, which could index reduced learning-related cognitive processing
- Vertical eye movements were shallower during mind wandering episodes than when on task
- Processing when mind wandering was not different from a baseline of 0

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