Delineating the impact of mind wandering on event-based prospective memories with varying error-related consequences

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Introduction

Detecting prospective memory (PM) cues initiates PM recall

- Failing to detect the cue and recall the PM is called a PM error
- PM errors and consequences can vary in perceived value (buying milk vs paying bills)
- Value-based attention theories predict better PM cue detection for high-value cues#

Visual processing is diminished during mind wandering (MW)

- Shift in processing external task to internally-generated, task-unrelated information[2]
- Reduced MW-related P1 (visual) and P3 (cognitive) ERP component amplitudes[3,4]
- Speeded responses and impaired ability to identify target stimuli during MW[3,4]
- MW-related perceptual decoupling may decrease detection of PM cues, impairing PM

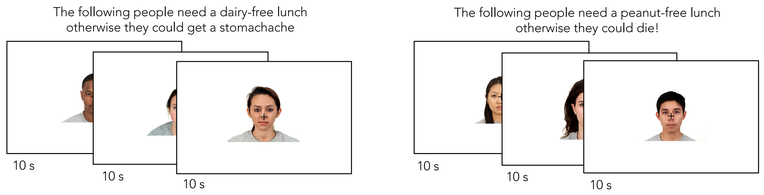
How does the perceived value of a PM affect cue detection?
Does MW impair cue detection differently for high-valued cues?

Methods

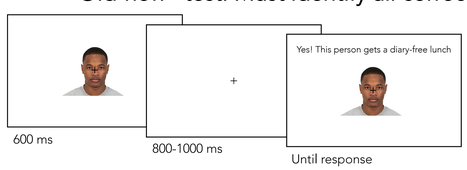
Task: Deliver standard lunches, adjust when necessary

PM Encoding

Study 6 faces for 10 s each: 3 moderate PM cues + 3 severe PM cues



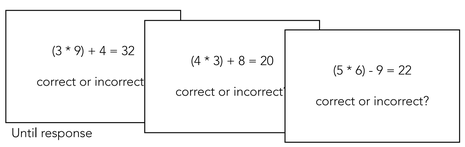
"Old-new" test: Must identify all correct x8 to ensure faces are encoded



- "New" faces here also appeared in the primary task as **learned standard controls** who should receive a standard lunch
- Faces that were not included here but appeared in the primary task were **not learned standard controls**

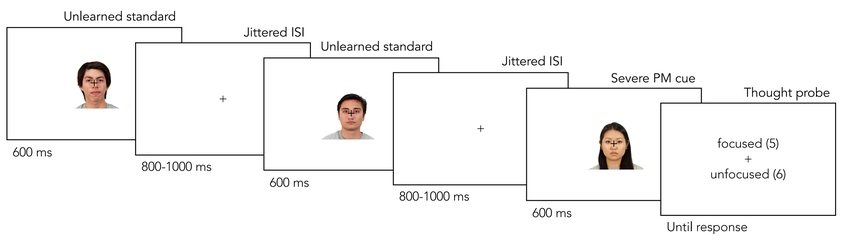
Math Task

30 s distractor task to disrupt working-memory and target memory stores



Primary Task

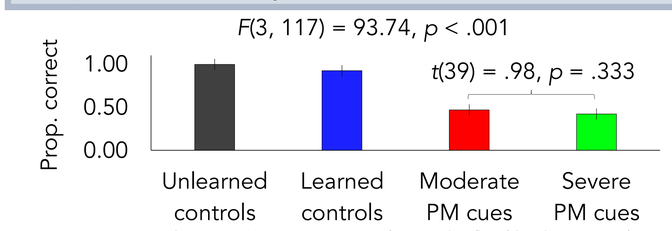
Target detection task with PM cues + thought probes to report attentional focus



- PM Moderate: 5% of total trials
- PM Severe: 5% of total trials
- Learned controls: 10% of total trials
- Not learned controls: 80% of total trials
- Thought probes for half of PM trials
- EEG collected with 64-channel montage
- Participants with at least 12 observations of MW included in MW-related analyses (N = 27)

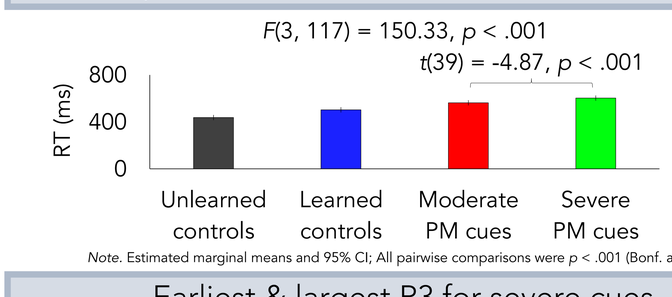
Results: Value on PM (N = 40)

Response accuracy similar for severe & moderate cues



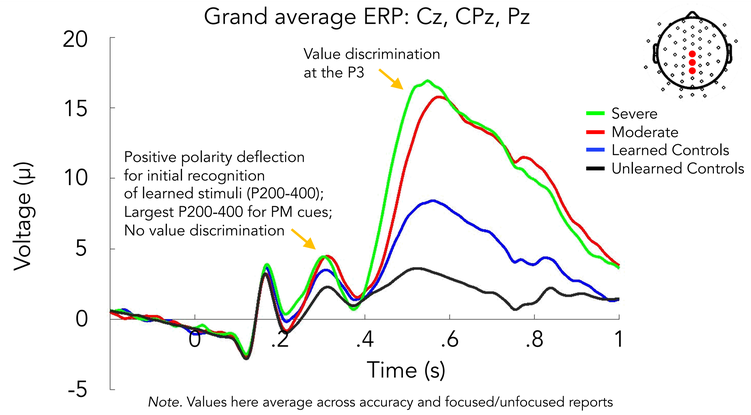
Note. Estimated marginal means and 95% CI; Errors made for controls reflect false alarms; errors for PM cues reflect misses

Response times (RT) slowest for severe cues



Note. Estimated marginal means and 95% CI; All pairwise comparisons were $p < .001$ (Bonf. adjusted)

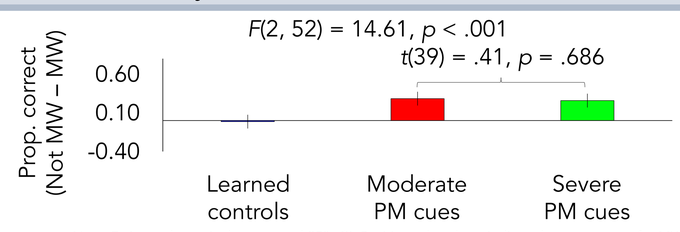
Earliest & largest P3 for severe cues



Note. Values here average across accuracy and focused/unfocused reports

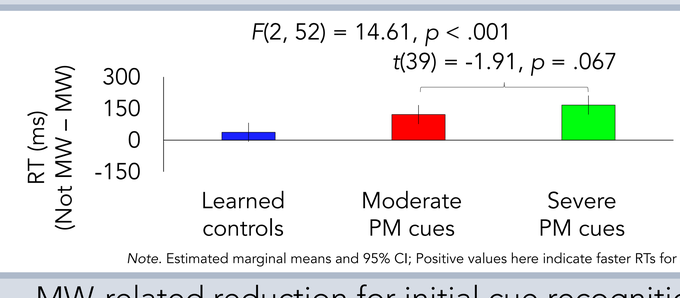
Results: MW on PM (N = 27)

Worse accuracy for MW; similar for severe & moderate



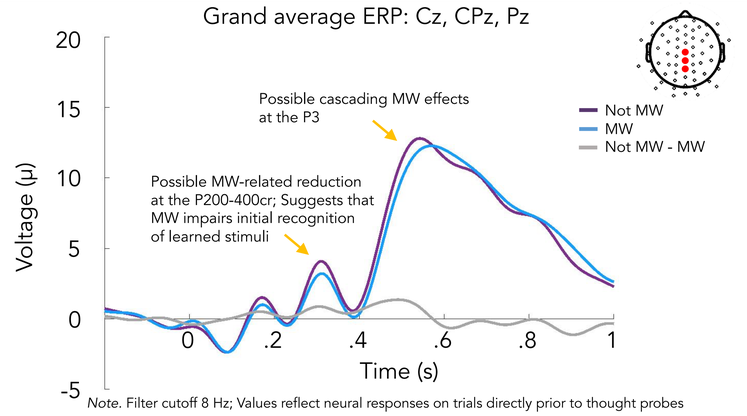
Note. Estimated marginal means and 95% CI; Positive values here indicate lower accuracy for MW

Faster RT for MW; similar for severe & moderate



Note. Estimated marginal means and 95% CI; Positive values here indicate faster RTs for MW)

MW-related reduction for initial cue recognition



Note. Filter cutoff 8 Hz; Values reflect neural responses on trials directly prior to thought probes

Discussion

Value-based neural processing advantage for severe PM cues did not translate to better performance

- The P3 was earlier and larger for severe cues than moderate cues, learned controls, and unlearned controls respectively; first value-based discrimination
- Severe cues, however, were linked to the slowest RTs, and response accuracies were similar for severe and moderate cues; no performance advantages
- Early-latency P200-400 was linked to the initial recognition of a learned stimulus: larger for severe and moderate cues than controls

MW-based PM deficits may have originated as early as initial recognition of learned stimulus

- Self-reported MW was associated with PM cue misses; similar MW-based deficits observed for severe and moderate cues
- MW was also linked to faster RTs, an effect that was not significantly different for severe and moderate cues
- Future analyses will assess whether this MW-related impairment is linked to insufficient initial detection of PM cues (attenuated P200-400) as well as possible cascading effects at the P3 across severe and moderate PM cues

References: [1] Young L., et al., (2007). *Proc Natl Acad Sci, 104,* 8235-8240. [2] Smallwood, J., & Schooler, J. W. (2006). *Psychol Bull,* 132, 946-958. [3] Kam, J., et al., (2011). *J. Cogn. Neurosci., 23,* 460-470. [4] Baird, M., et al., (2014). *J. Cogn. Nuerosci., 26,* 2596-2607.

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