

How does stress affect working memory consolidation?

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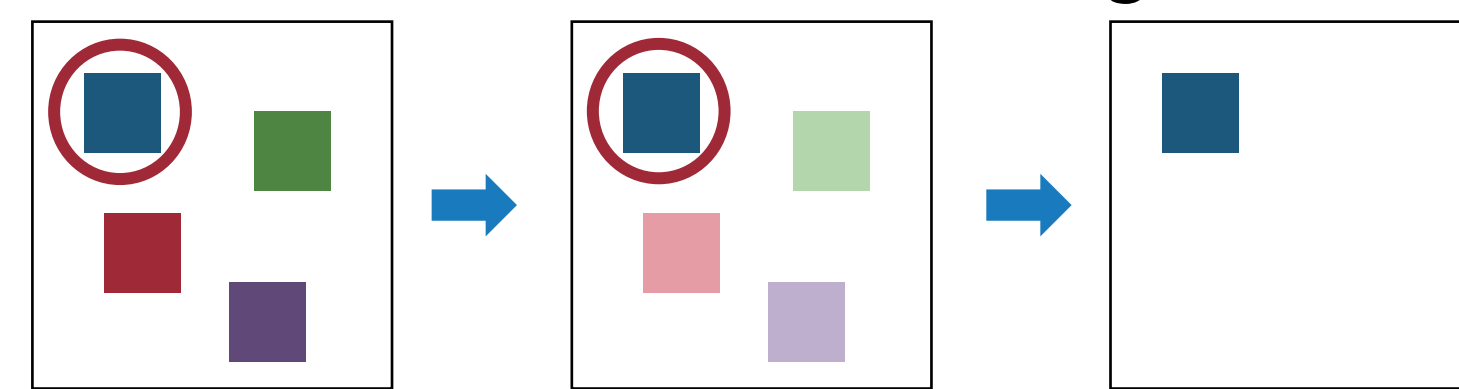
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Stress has mixed effects on working memory performance.

Previous research suggests that stress may improve (Lai et al., 2014), impair (Schoofs et al., 2008), or have no effect (Pulopulos et al., 2015) on working memory performance, and the impacts on specific processes like working memory consolidation have not been investigated.

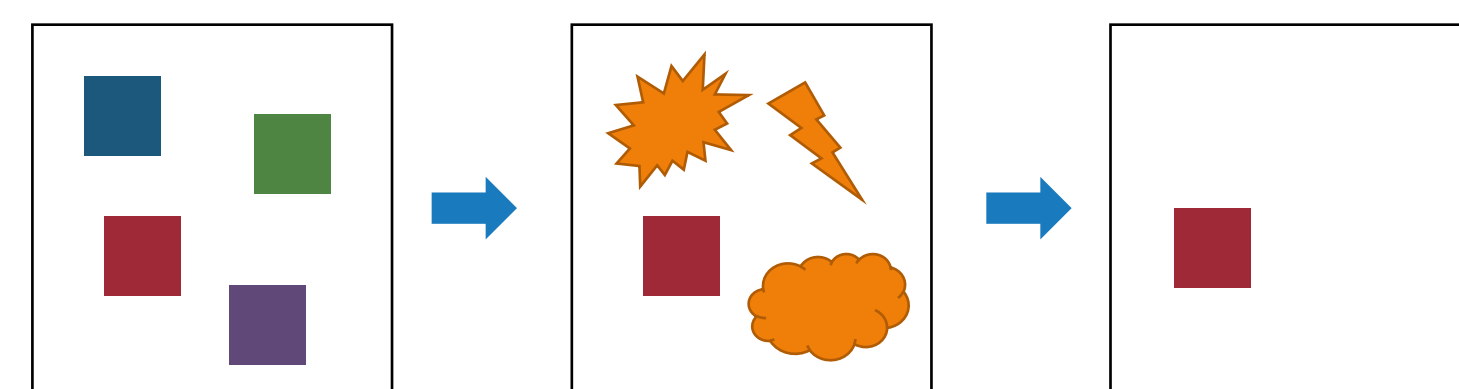
Two theories to explain stress effects

Attentional Narrowing



- Stress groups ↓ working memory error, even at shortest delays
- Central item ↓ working memory error, peripheral items ↑ working memory error
 - Stronger effect in stress groups
- Stress groups ↓ secondary task response time

Resource Allocation



- Stress groups ↑ working memory error, even at longest delays
- No difference between central item and peripheral items across stress groups
- Stress groups ↑ secondary task response time, even at longest delays

Recall error is weakly affected by item type, but not stress or consolidation time.

Stress & Item Type and Recall Error

- No main effects of stress ($BF_{10} = .09$) or item type ($BF_{10} = .55$)
- No interaction effect ($BF_{10} = .01$)

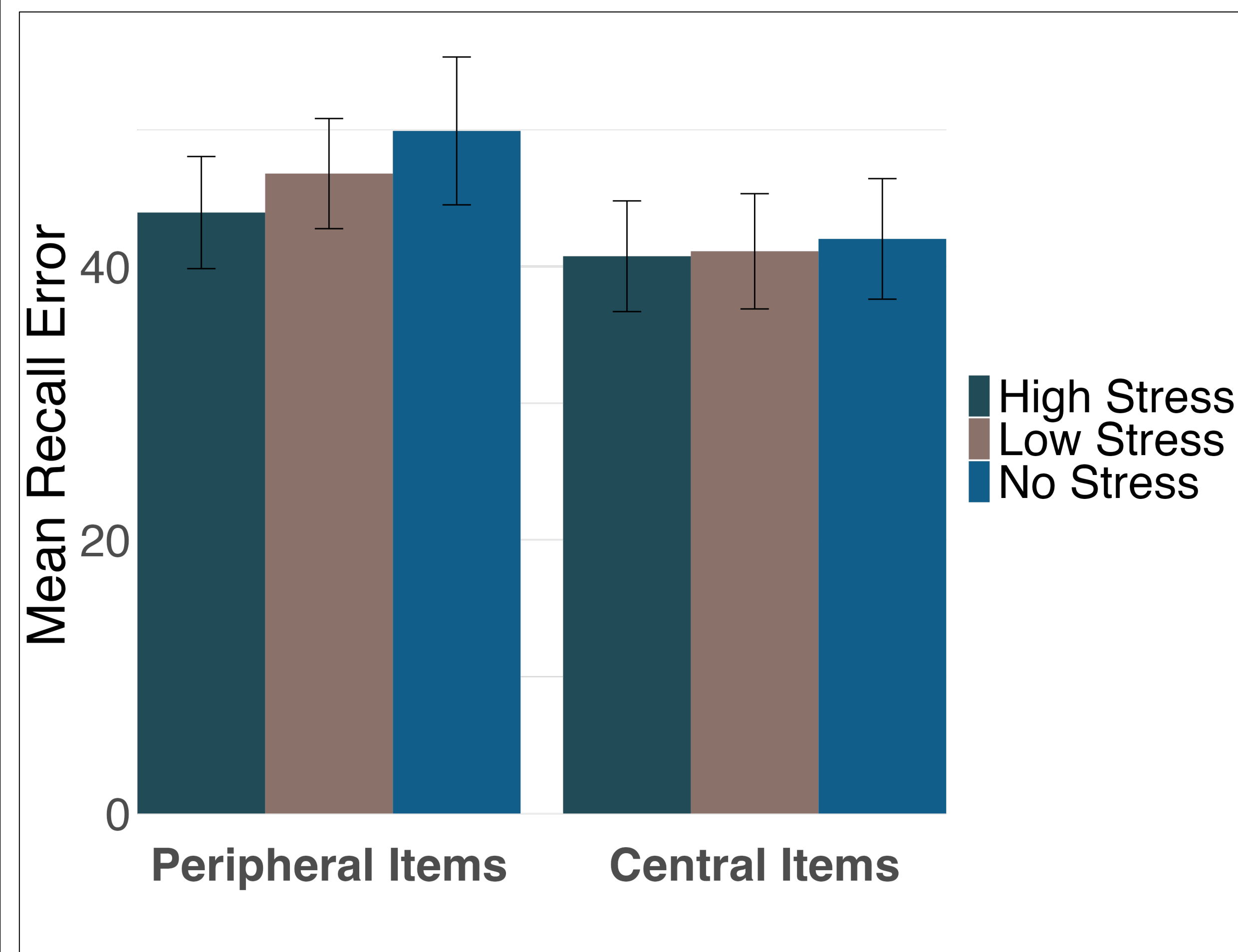


Figure 2. Stress and item type effect on working memory recall error. Error bars represent standard error.

Stress & Delay and Recall Error

- No main effects of stress ($BF_{10} = .09$) or delay ($BF_{10} = .02$)
- No interaction effect ($BF_{10} = 1.6 \times 10^{-5}$)

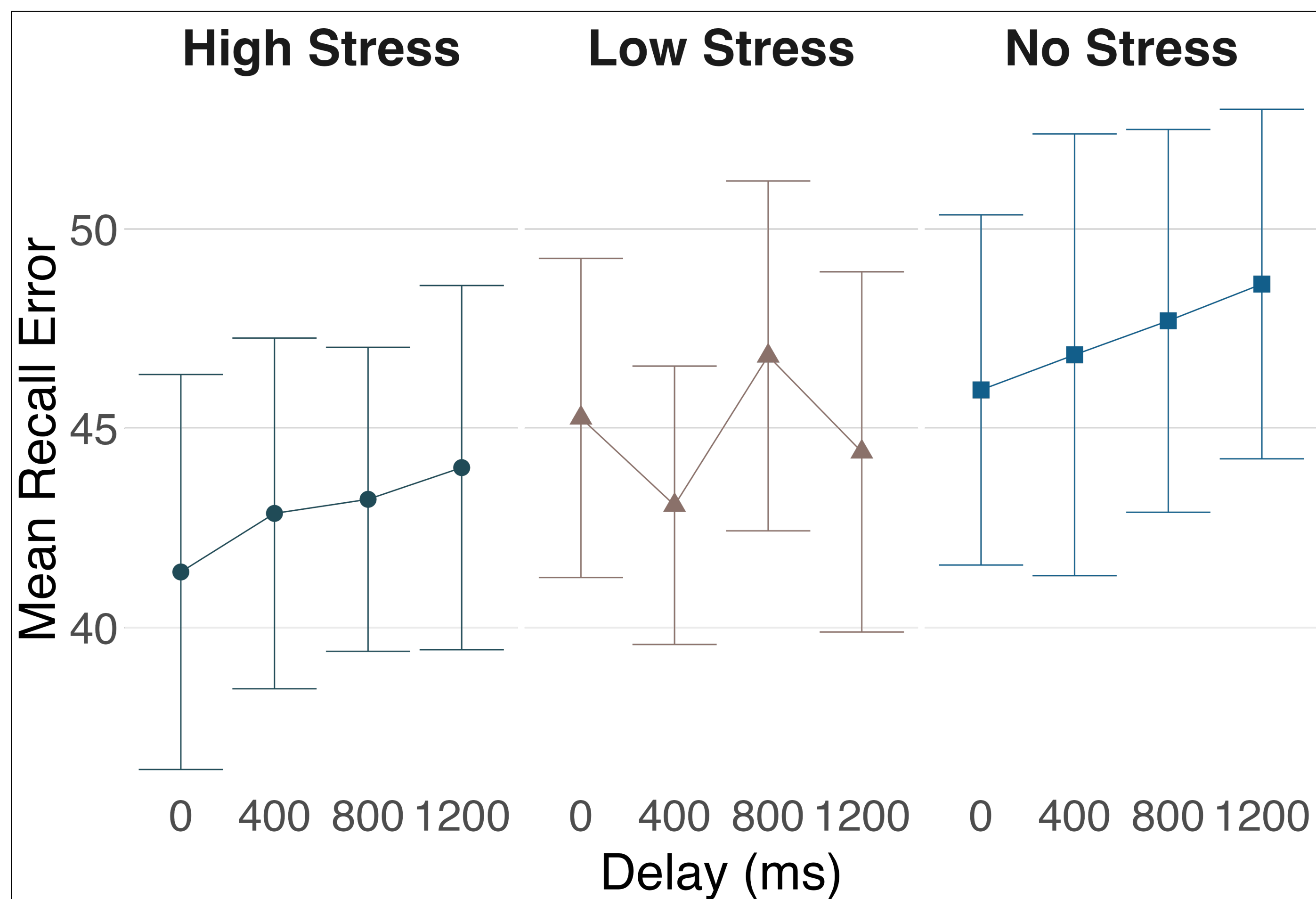


Figure 3. Stress effect on working memory recall error across different delay conditions. Error bars represent standard error.

Current (Ongoing) Study Methods

Participants $N = 39$ (13 per stress condition)

Procedure

- Stress/Non-Stress Task before Working Memory task
- 3 item visual array of colored objects (400 ms)
 - ↳ 1 item cued to prioritize
- Parity Judgment task (3 items, 3600 ms total)
- 4 delays (time before/after secondary task):
 - ↳ 0/1200, 400/800, 800/400, 1200/0 ms
- Continuous recall for each item

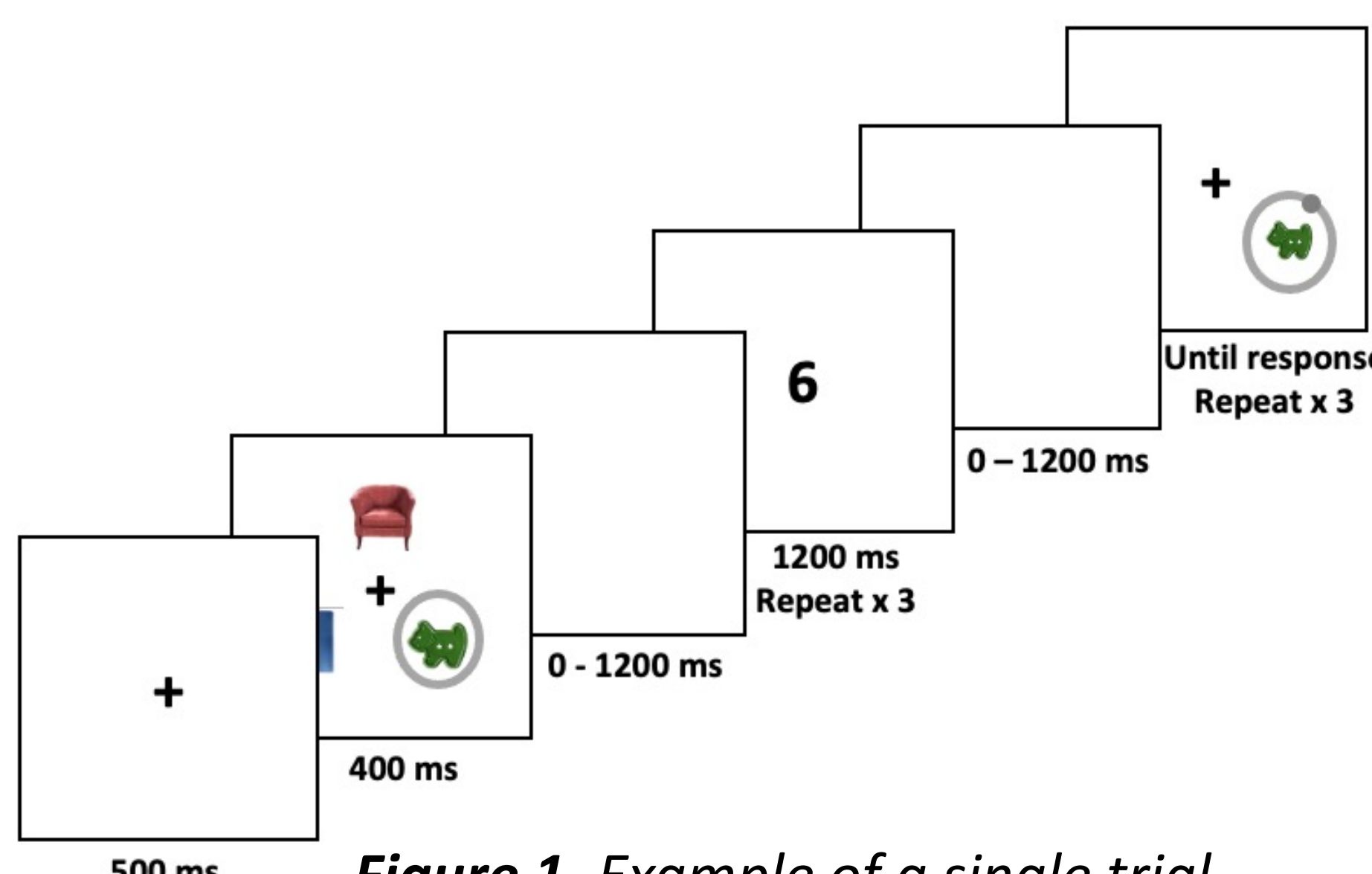


Figure 1. Example of a single trial

Secondary task response times decrease with increased consolidation time and stress may speed up working memory consolidation.

Stress & Delay and Secondary Task Response Time

- Main effect of stress ($BF_{10} = 3.9$)
- Strong main effect of delay ($BF_{10} = 3029$)
- No interaction effect ($BF_{10} = .01$)

Stress and Secondary Task Response Failure

- High Stress: 6.6%
 - Low Stress: 8.3%
 - No Stress: 7.8%
- $BF_{10} = .14$

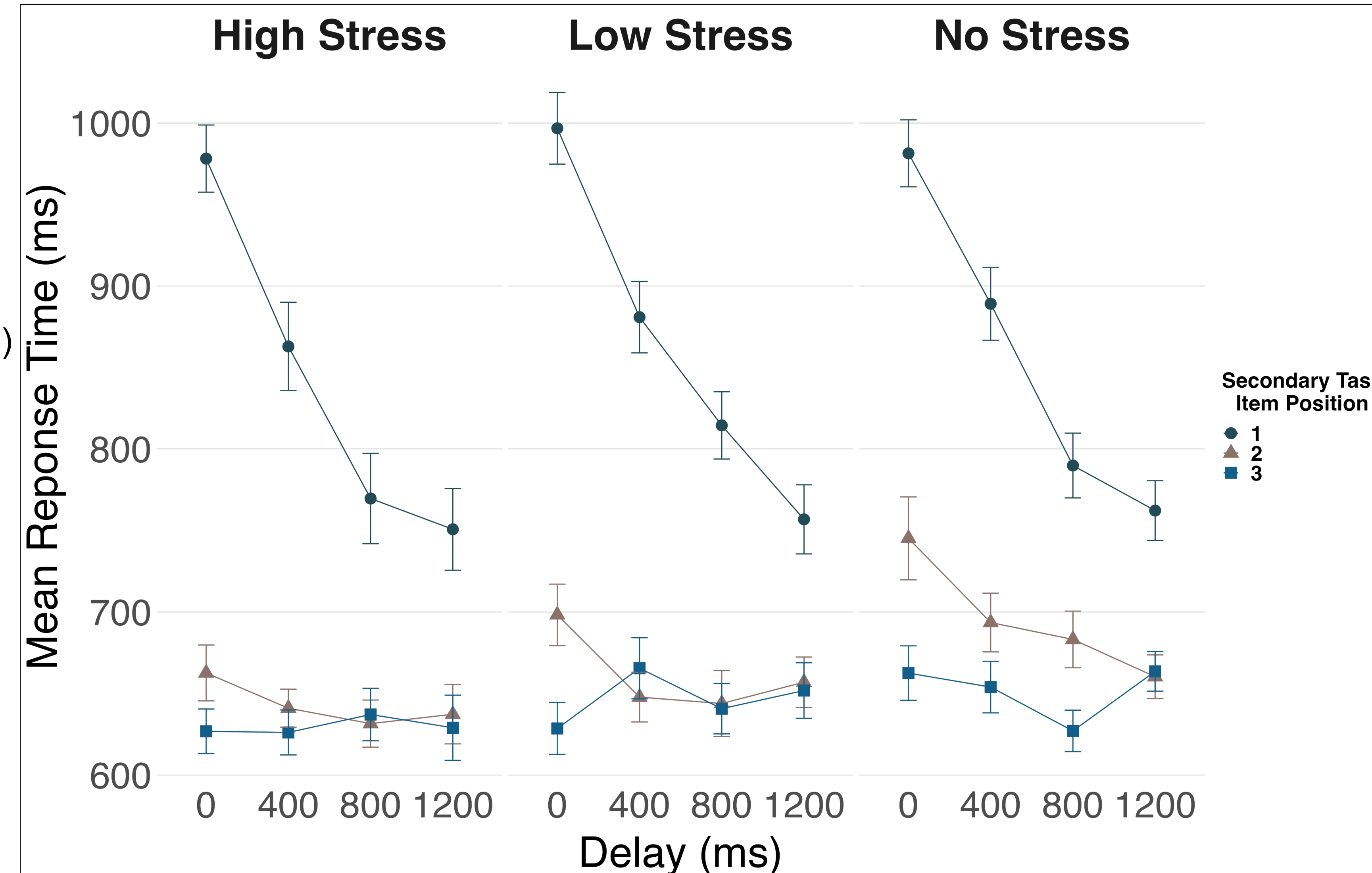


Figure 4. Delay and stress effect on secondary task response time. Error bars represent standard error.

Stress has different impact on the efficacy and speed of working memory consolidation.

Working memory recall error is not more affected by attentional narrowing under stressful conditions.

- Working memory recall error: central < peripheral items
- Effect not stronger after stress

Increased time for working memory consolidation did not lead to differences in working memory accuracy.

- No effect of delay length on recall error
- No differences across stress conditions

Stress may lead to faster working memory consolidation.

- More consolidation time = faster response time for first item
- Stress groups show faster response time at shortest delay compared to no stress group