

# Motivation, Mind-Wandering, and Rhythmic Response: An Area Under the Curve Extension Analysis of Metronome Response Task Performance

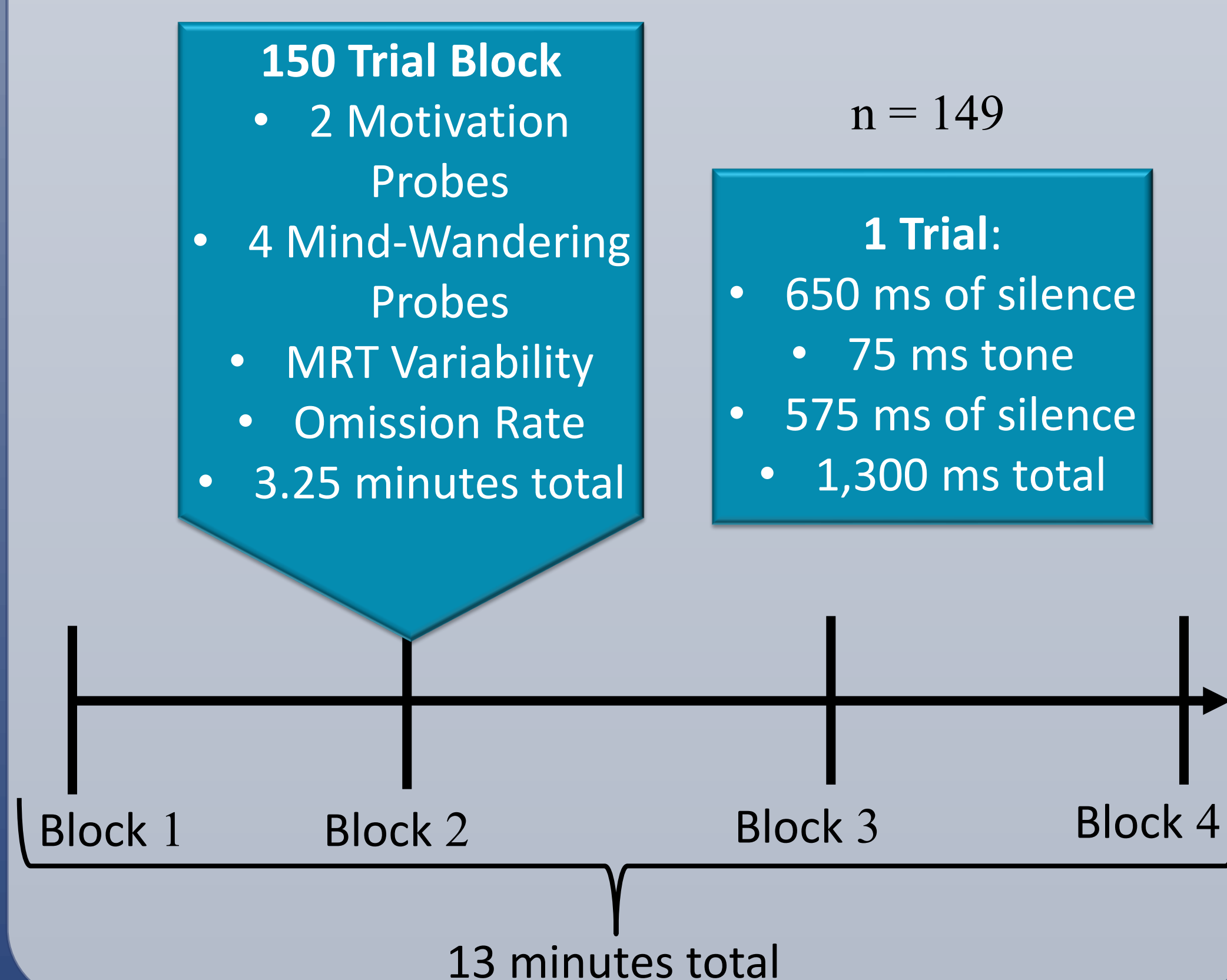
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## BACKGROUND

- **Brosowsky et al. (2020) Study**
  - Motivation tends to decline, and mind-wandering tends to increase over time on task
  - Low motivation may invite people to give way to mind-wandering, with decreases in performance
- **Attentional Allocation**
  - Bias toward mind-wandering tendencies
  - Vigilance tasks tax attention
    - Depletion of cognitive resources (Thomson et al., 2015)
- **Opportunity Cost Theory**
  - Higher subjective value of the task, greater effort, less mind-wandering (Kurzban et al., 2013; Seli et al., 2015; Kurzban 2016, Esterman & Rothlein, 2019)
  - Motivation shown to decrease attentional lapses (Esterman et al., 2016)
- **AUC Extension**
  - Area under the curve analyses (Pruessner et al., 2003) used to extend findings of Brosowsky et al. (2020) through cluster classification
- **Current Hypotheses**
  - Overall motivation will influence omission rate and task variability
  - Magnitude of the change in motivation will influence variability and omission rate
  - Inverse relationship between mind-wandering and motivation

## METHODS AND ANALYSES

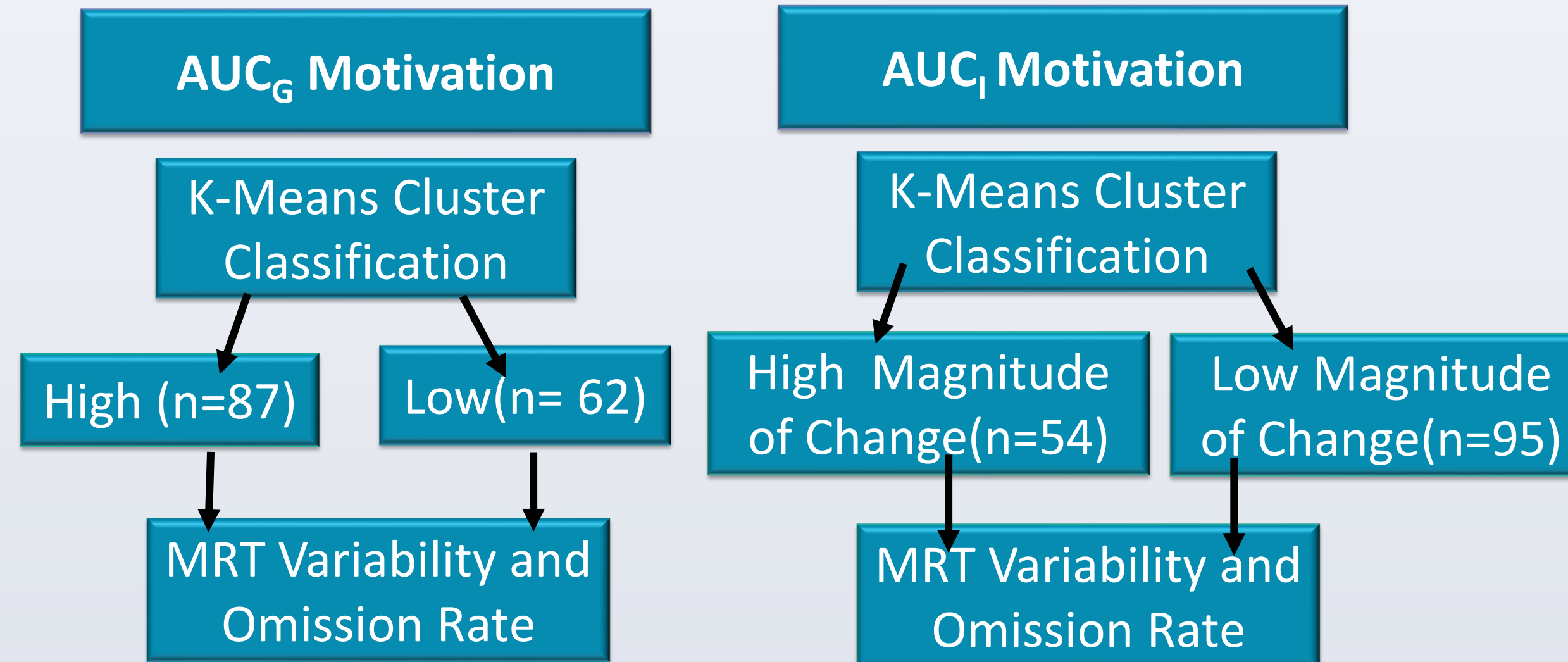
### Brosowsky et al. (2020) Metronome Response Task (MRT) Methods



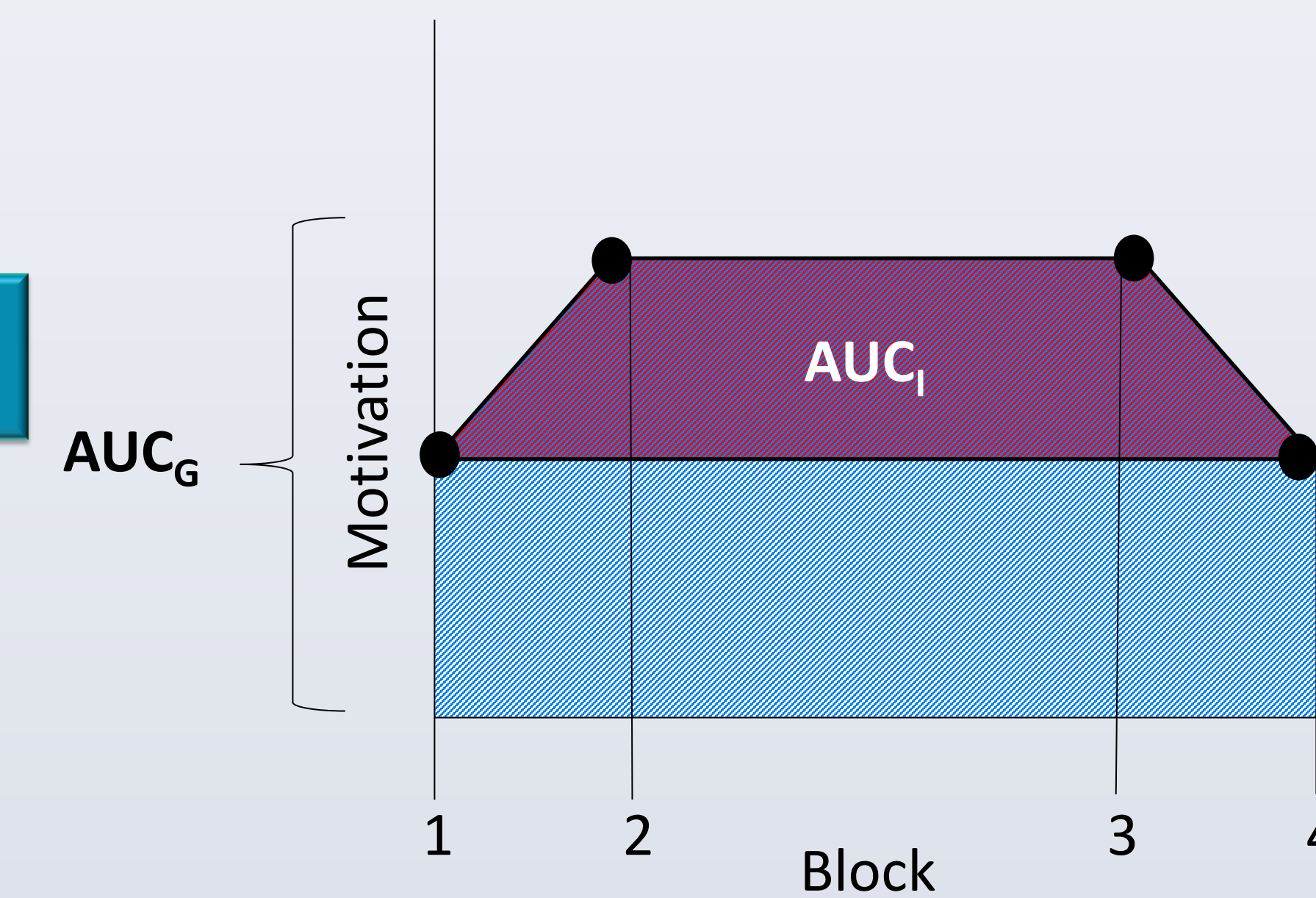
## METHODS AND ANALYSES CONTINUED

### Current Study Analytical Extension

- Data gathered from Open Science Framework
- Data reformatting and  $AUC_G$  and  $AUC_I$  calculations completed using MATLAB (Mathworks Inc., Natick, MA)

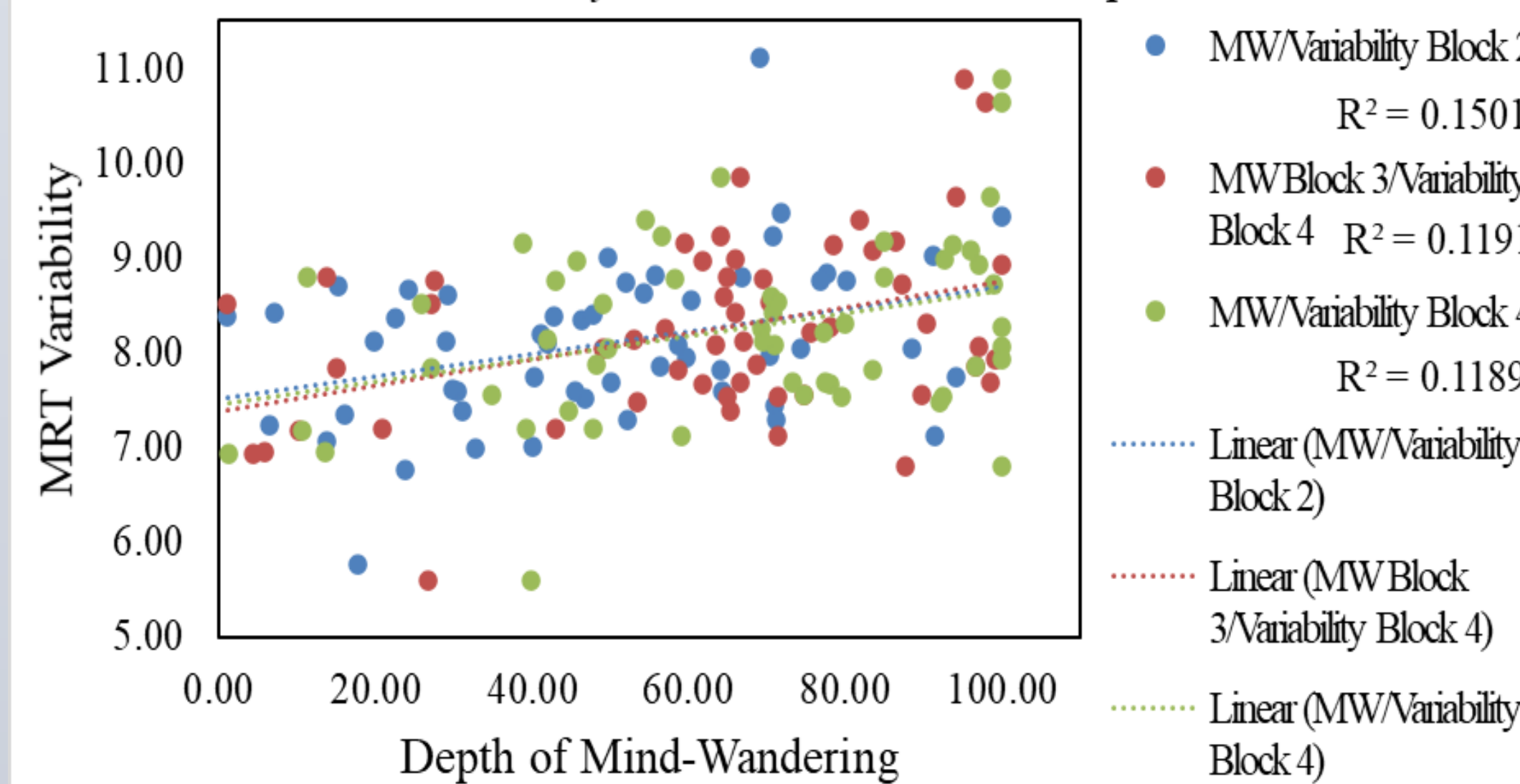


Variable	Low(S.D.)	High(S.D.)	F-Statistic	P-Value
$AUC_{Mot_G}$	6.89(1.80)	12.43(1.85)	332.60	$P < .001$
$AUC_{Mot_I}$	-3.43(1.33)	-0.15(0.94)	306.00	$P < .001$



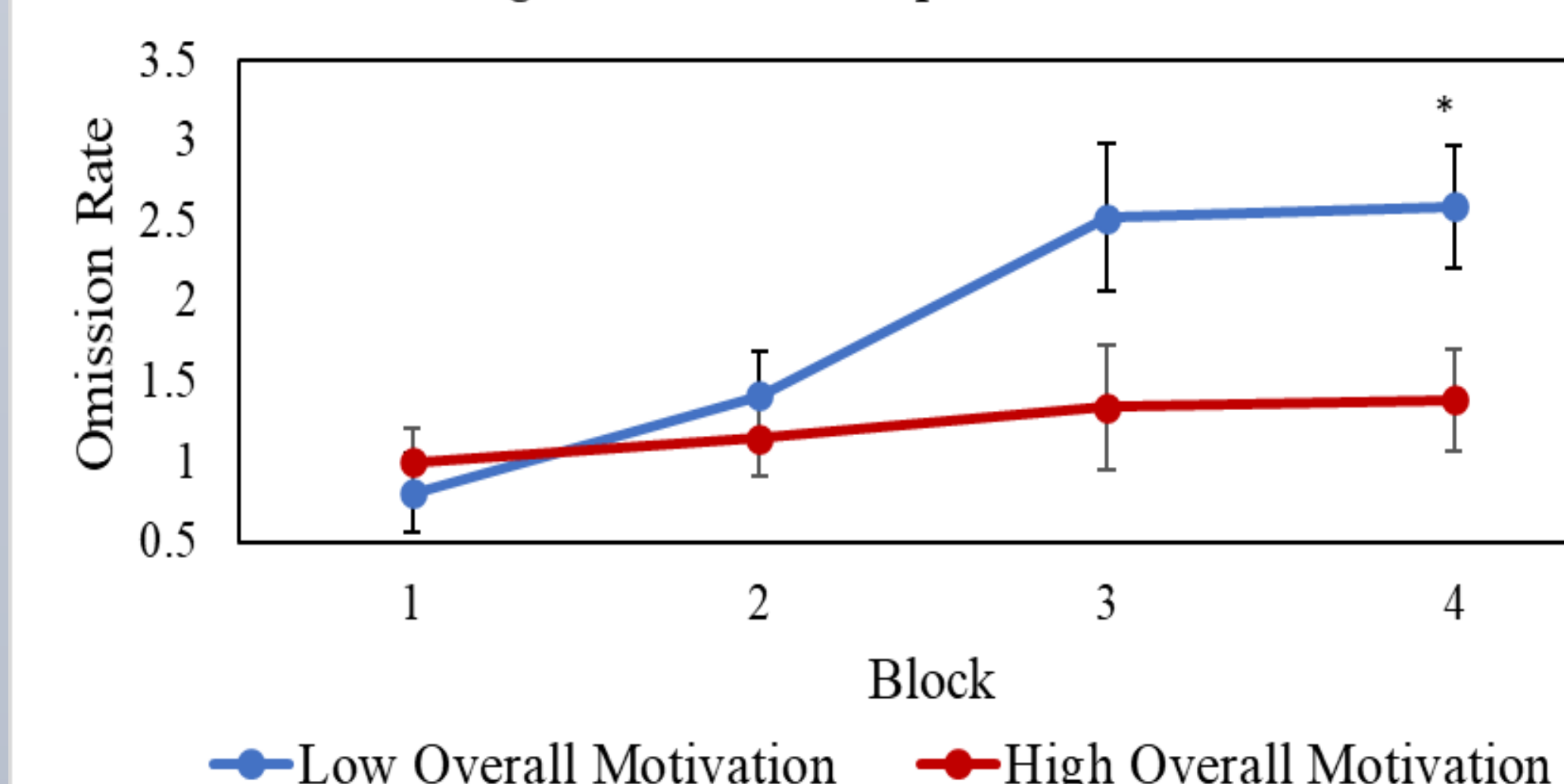
## RESULTS

Figure 1 High Motivational Change Group Mind-Wandering and MRT Variability Correlational Relationships



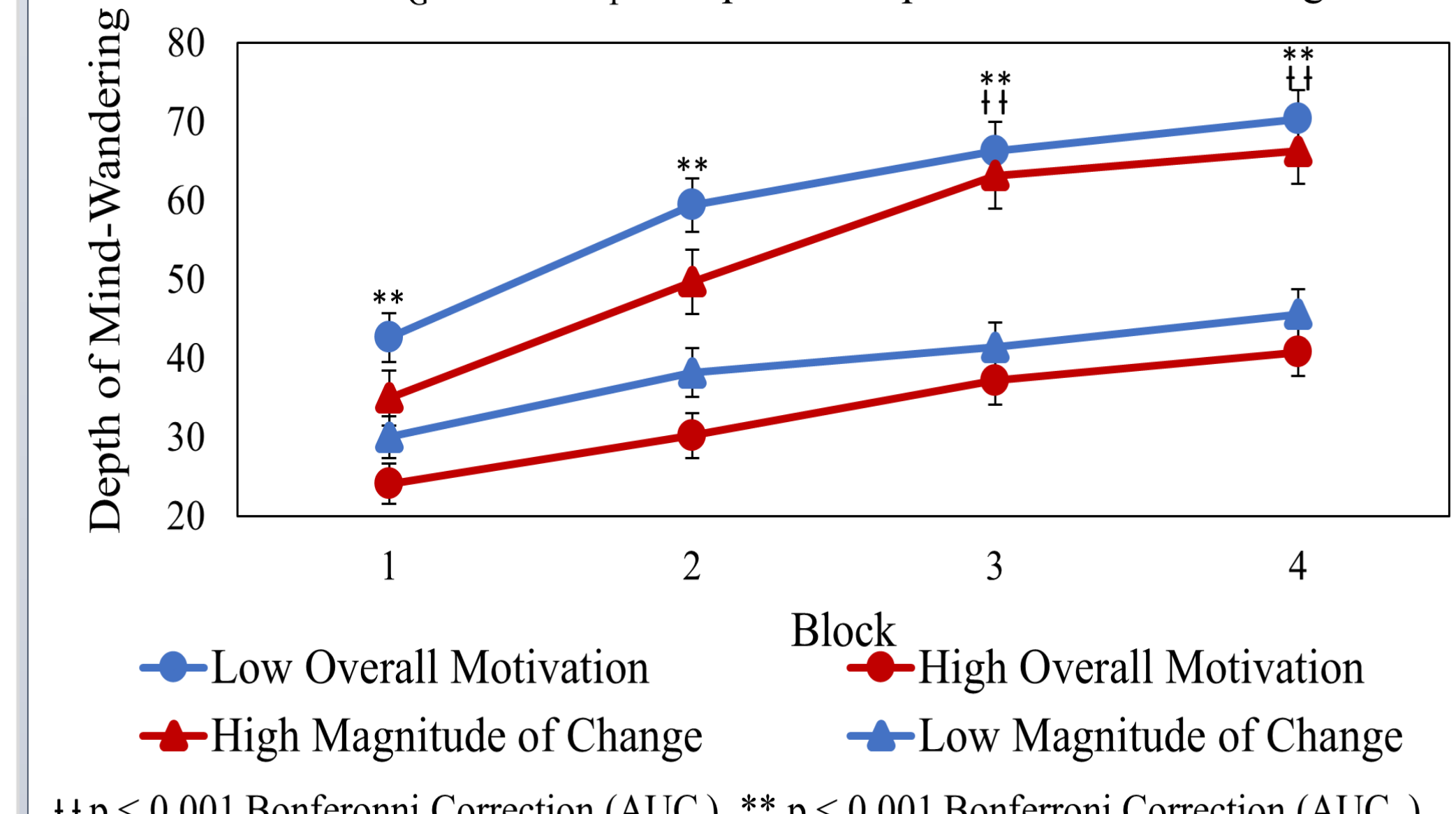
Significant positive correlations observed for the high magnitude of change group between MW and MRT variability.

Figure 3  $AUC_G$  Motivation Group Omission Rate



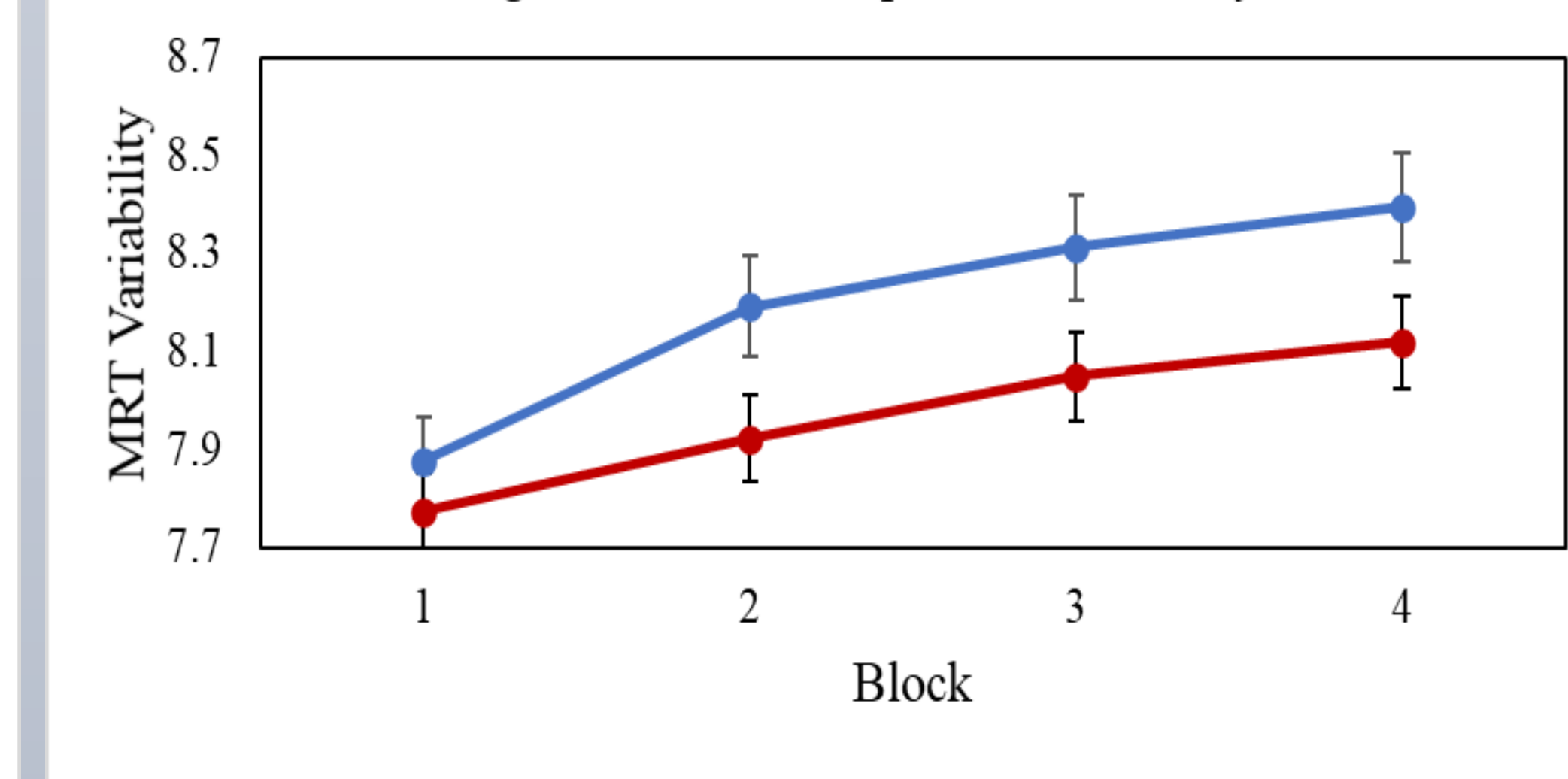
Block \*  $AUC_G$  interaction effect ( $F(3,441) = 3.979, p = 0.01$ ) on omission rate

Figure 2  $AUC_G$  and  $AUC_I$  Groups and Depth of Mind-Wandering



Block \*  $AUC_G$  interaction ( $F(3,441) = 4.599, p = 0.006$ ) and Block \*  $AUC_I$  interaction ( $F(3,441) = 9.932, p < 0.001$ ) on MW.  $AUC_G$  ( $F(1,147) = 45.322, p < 0.001$ ) and  $AUC_I$  ( $F(1,147) = 10.842, p = 0.001$ ) main effects on MW

Figure 4  $AUC_G$  Motivation Group MRT Variability



Trend for a main effect of group for  $AUC_G$  groups ( $F(1,147) = 3.395, p = 0.07$ ) on MRT variability

## CONCLUSIONS

- Mind-wandering increases over time with lower overall motivation and greater change in motivation
  - Larger motivational decrease, greater increase in mind-wandering
- The magnitude of the decrease in motivation matters in regard to MRT variability and mind-wandering
  - Large motivational change itself may influence mind-wandering, which in turn redirects cognitive resources away from the task at hand
- Individuals with low overall motivation exhibit increases in omission rate toward the end of the task
  - Low motivation more prone to mind-wandering and performance decrements
- Task variability tends to be higher for individuals with low overall motivation
  - Cognitive resources away from task, less stable RT

## REFERENCES

- Brosowsky, N. P., DeGutis, J., Esterman, M., Smilek, D., & Seli, P. (2020). Mind wandering, motivation, and task performance over time: Evidence that motivation insulates people from the negative effects of mind wandering. *Psychology of Consciousness: Theory, Research, and Practice*, 1-12. <https://doi.org/10.1037/cns0000263>
- Esterman, M., & Rothlein, D. (2019). Models of sustained attention. *Current Opinion in Psychology*, 29, 174-180. <https://doi.org/10.1016/j.copsyc.2019.03.005>
- Esterman, M., Grosse, M., Liu, G., Mitko, A., Morris, R., & DeGutis, J. (2016). Anticipation of monetary reward can attenuate the vigilance decrement. *PLoS One*, 11. <https://doi.org/10.1371/journal.pone.0159741>
- Kurzban, R. (2016). The sense of effort. *Current Opinion in Psychology*, 7, 67-70. <https://doi.org/10.1016/j.copsyc.2015.08.003>
- Kurzban, R., Duckworth, A., Kable, J. W., & Myers, J. (2013). An opportunity cost model of subjective effort and task performance. *Behavioral and Brain Sciences*, 36, 661-726. <https://doi.org/10.1017/S0140525X12003196>
- Pruessner, J. C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D. H. (2003). Two formulas for computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology*, 28, 916-931. [https://doi.org/10.1016/S0306-4530\(02\)00108-7](https://doi.org/10.1016/S0306-4530(02)00108-7)
- Seli, P., Cheyne, J. A., Xu, M., Purdon, C., & Smilek, D. (2015). Motivation, intentionality, and mind wandering: Implications for assessments of task-unrelated thought. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 41(5), 1417-1425. <https://doi.org/10.1037/xlm0000116>
- Thomson, D. R., Besner, D., & Smilek, D. (2015). A resource-control account of sustained attention: evidence from mind-wandering and vigilance paradigms. *Perspectives on Psychological Science*, 10(1), 82-96. <https://doi.org/10.1177/1745691614556681>

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