

# Cognitive Control Network Activates and Default Mode Network Deactivates Following SART Errors

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## ABSTRACT

Electrophysiological data was used to examine the neural activity associated with mind wandering and refocusing attention during the Sustained Attention to Response Task. Results indicated an increase in cognitive control network activity immediately after commission errors, followed by a decrease in activity in the Default Mode Network.

## INTRODUCTION

- Mind wandering (MW) episodes occur when individuals drift into thinking about past or future events while engaged in a cognitive attention task.
- The states of MW and focused attention have been shown to activate different neural networks including:

1. Default Mode Network (DMN) is associated with MW episodes.
2. Dorsal Attention Network (DAN) is connected to externally focused attention and continuous performance monitoring.
3. Frontoparietal Control Network (FPCN) is

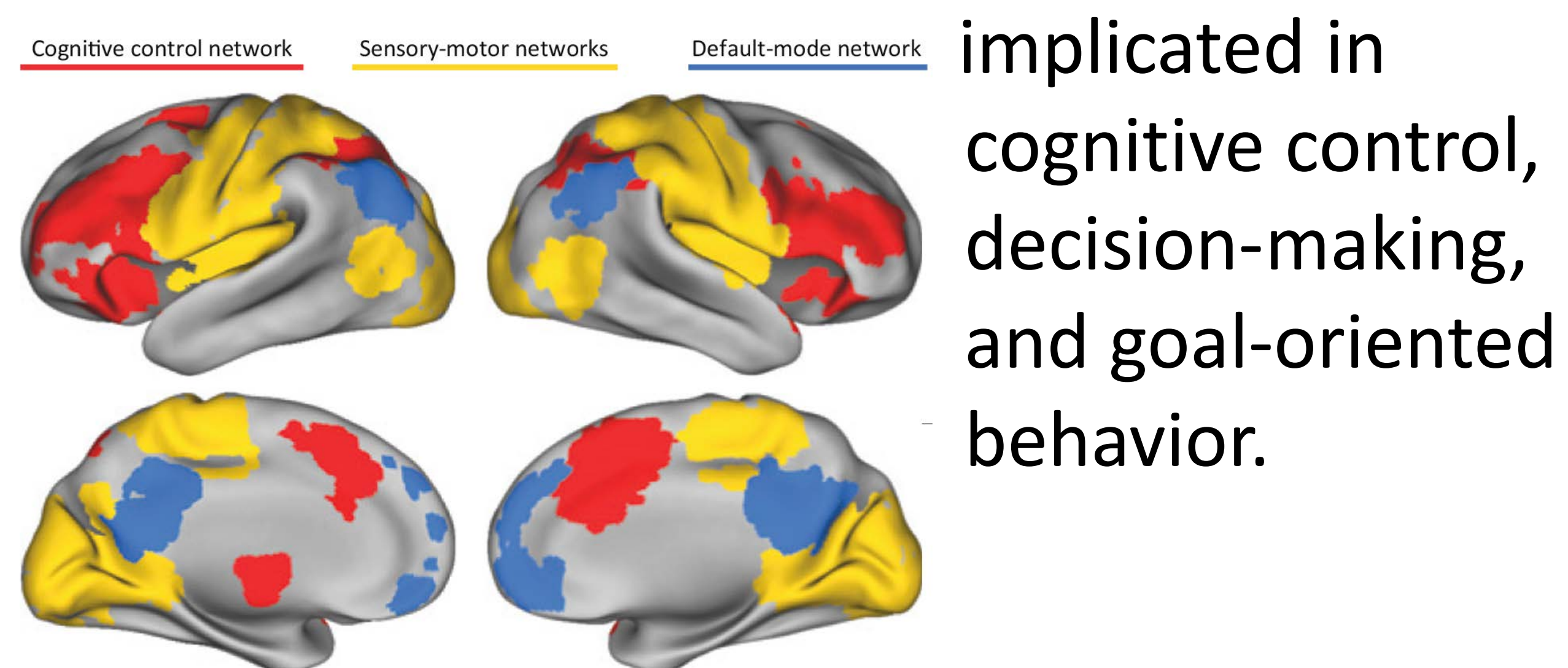
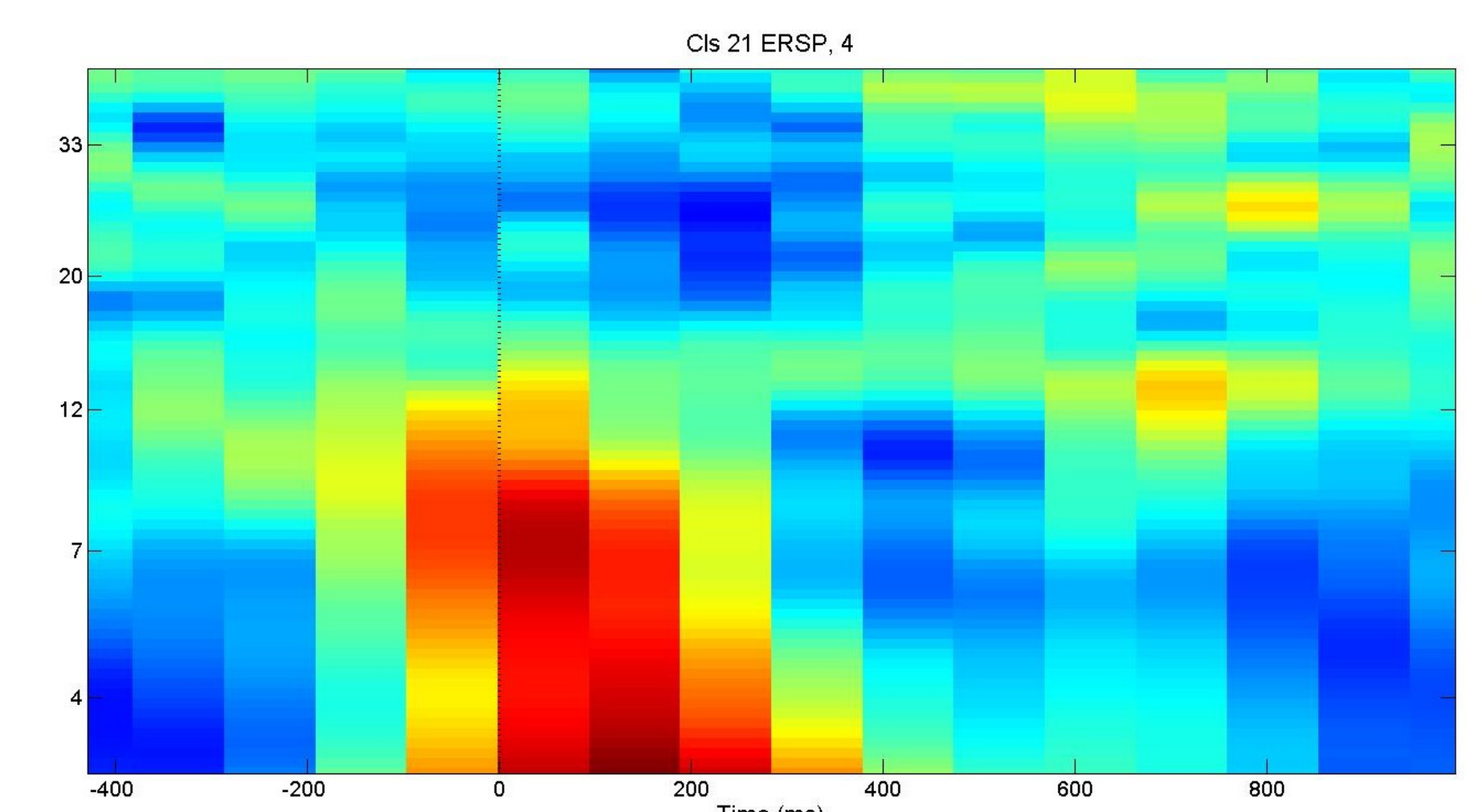
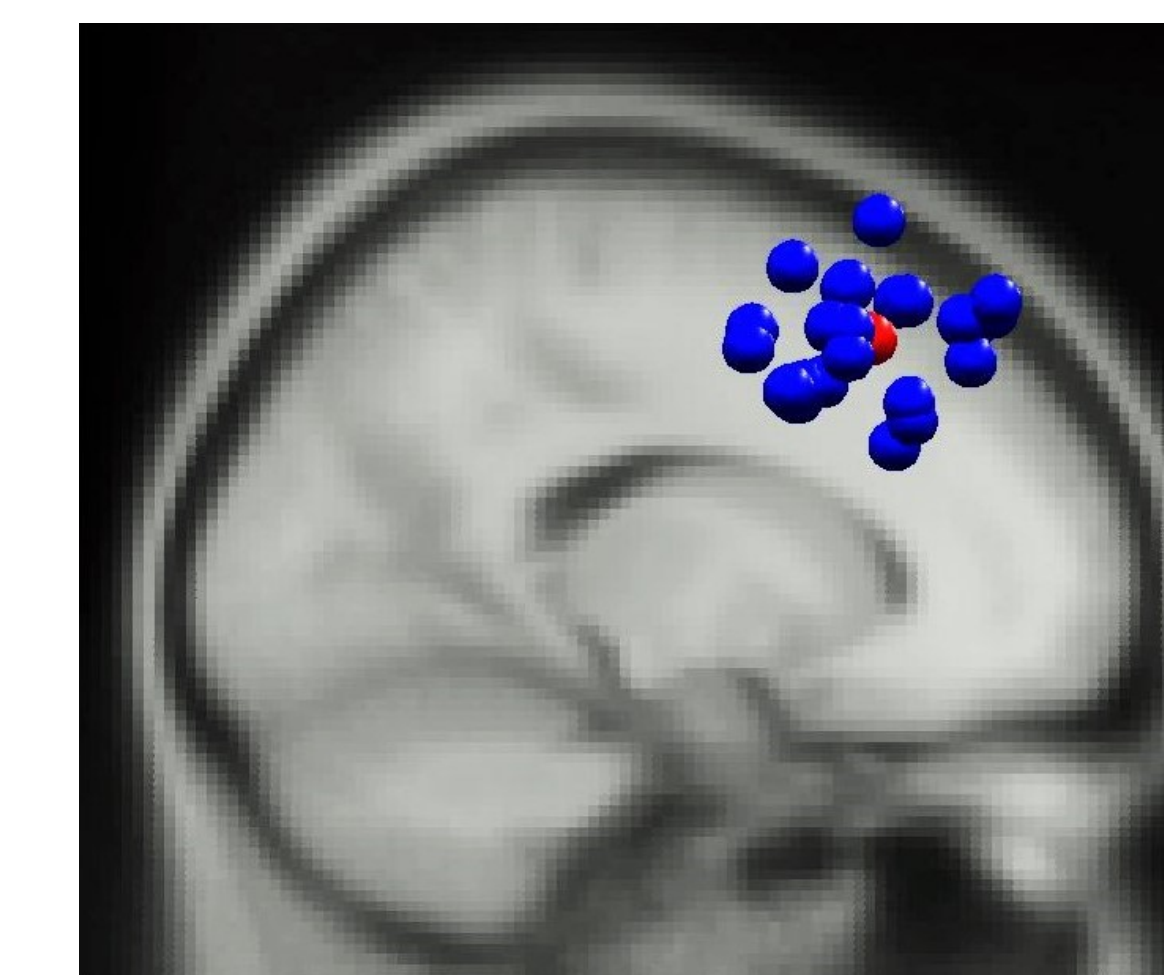


Figure 1: Anticevic, Cole, Murray, Corlett, Wang, & Krystal, 2012

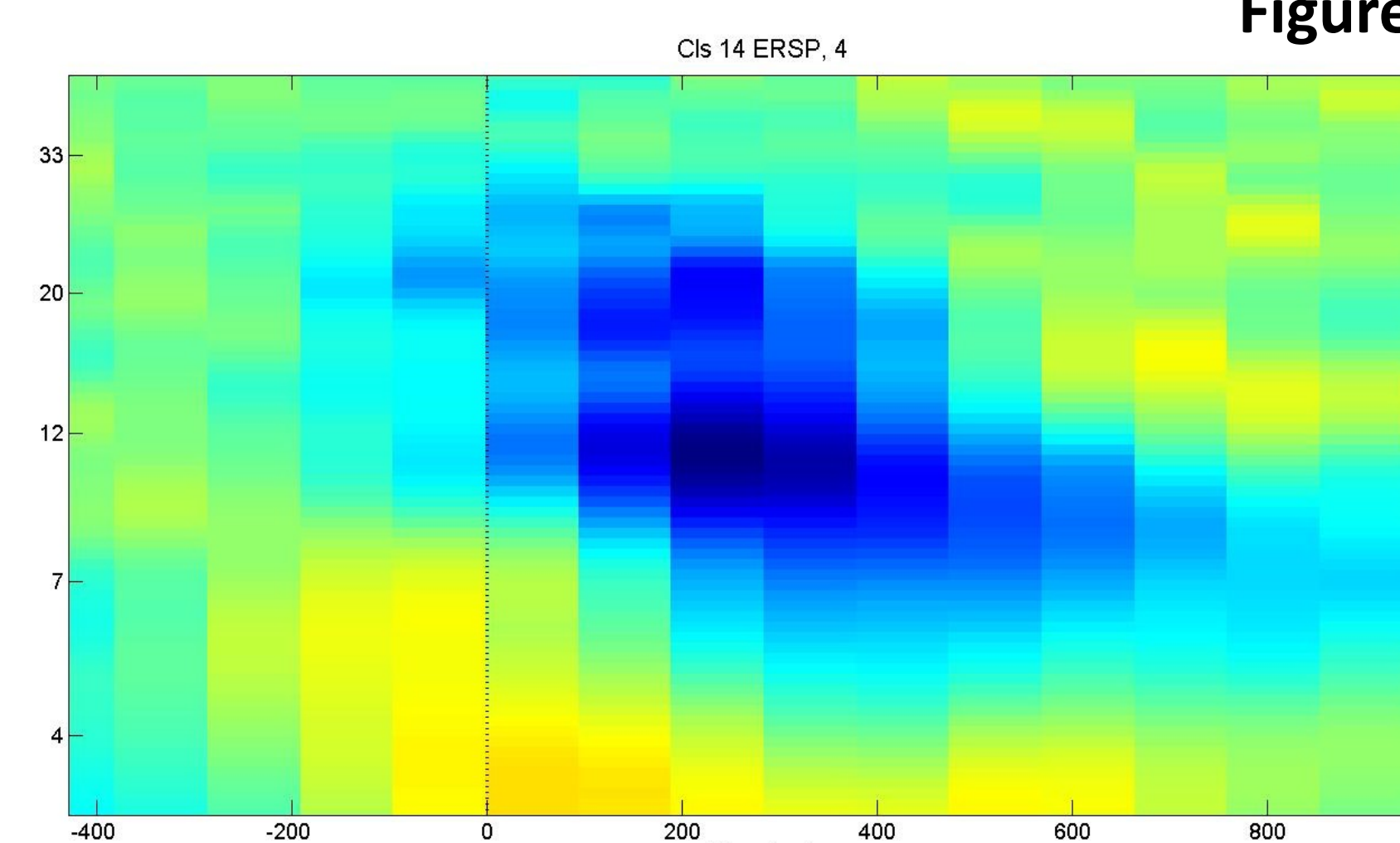
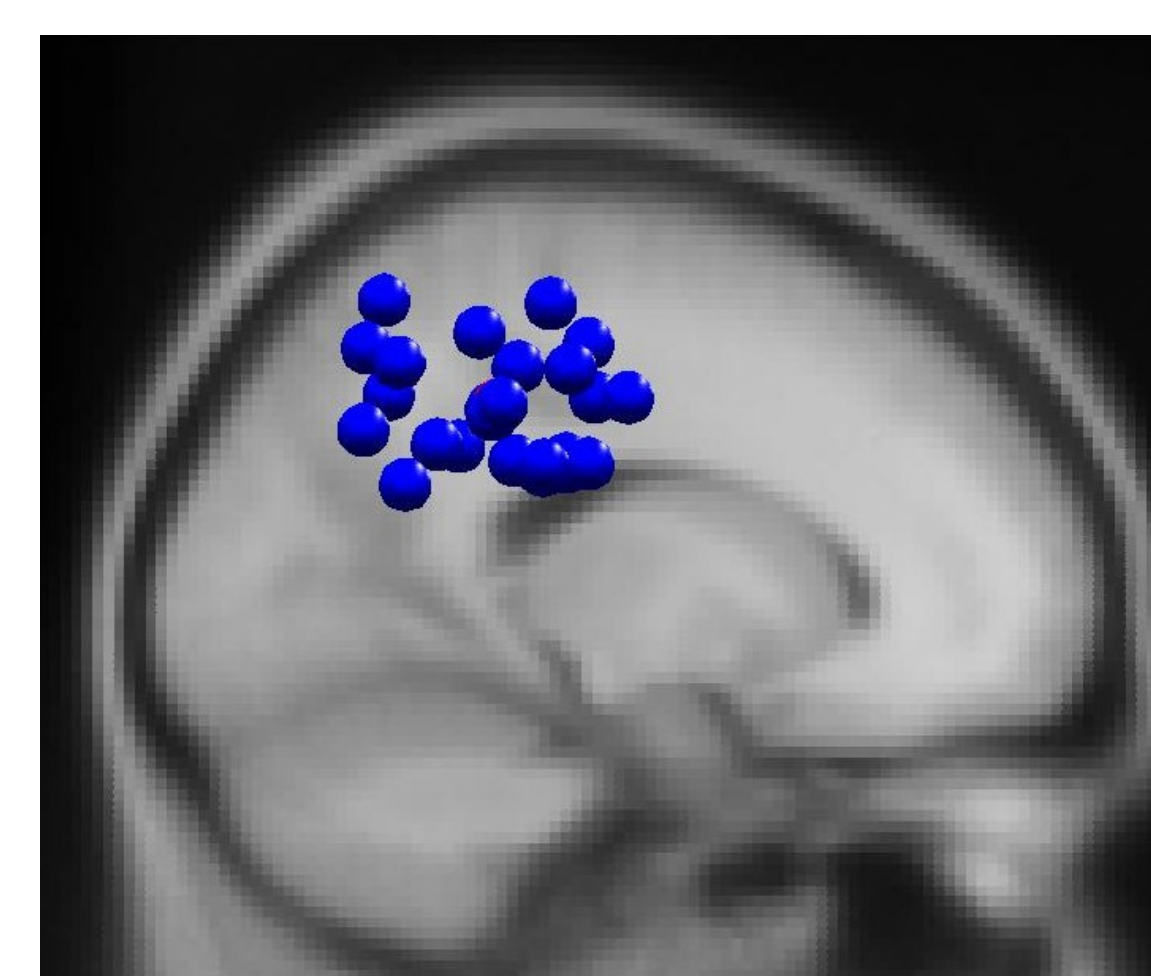
implicated in cognitive control, decision-making, and goal-oriented behavior.

## METHODS & RESULTS

- Electroencephalographic (EEG) data was recorded during the Sustained Attention to Response Task (SART) performance to detect the neural activity associated with MW and refocusing attention.
- Infomax Independent Component Analysis (ICA) and dipole source modeling was performed to estimate the brain sources of independent patterns within the EEG data.
- Patterns of event-related synchronization (ERS) and event-related desynchronization (ERD) of independent component activity were analyzed across.
- Results indicated a robust delta (1-4 hz) and theta (4-7 hz) band ERS occurring within 200ms after commission errors originating in the ACC (Figures 2 and 3 on right).



Figures 2 and 3: Dipole source modeling indicating ACC ERS following commission error.



Figures 4 and 5: Dipole source modeling indicating PCC ERD following commission error.

- An alpha (8-12 hz) and beta (13-30 hz) band ERD was observed over a longer time period (0-600ms) after commission errors originating from the PCC (Figures 4 and 5 on left).

## CONCLUSION

- The ACC, a component of the FPCN, increased delta and theta activity immediately following commission errors, suggesting the cognitive control network was recruited to refocus attention.
- The PCC, a component of the DMN, was found to have lower alpha and beta activity after commission errors which may be indicative of a reduction in MW.
- Due to the ACC ERS occurring slightly before the PCC ERD, results suggest the FPCN is coordinating the suppression of MW by reducing DMN activity.

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