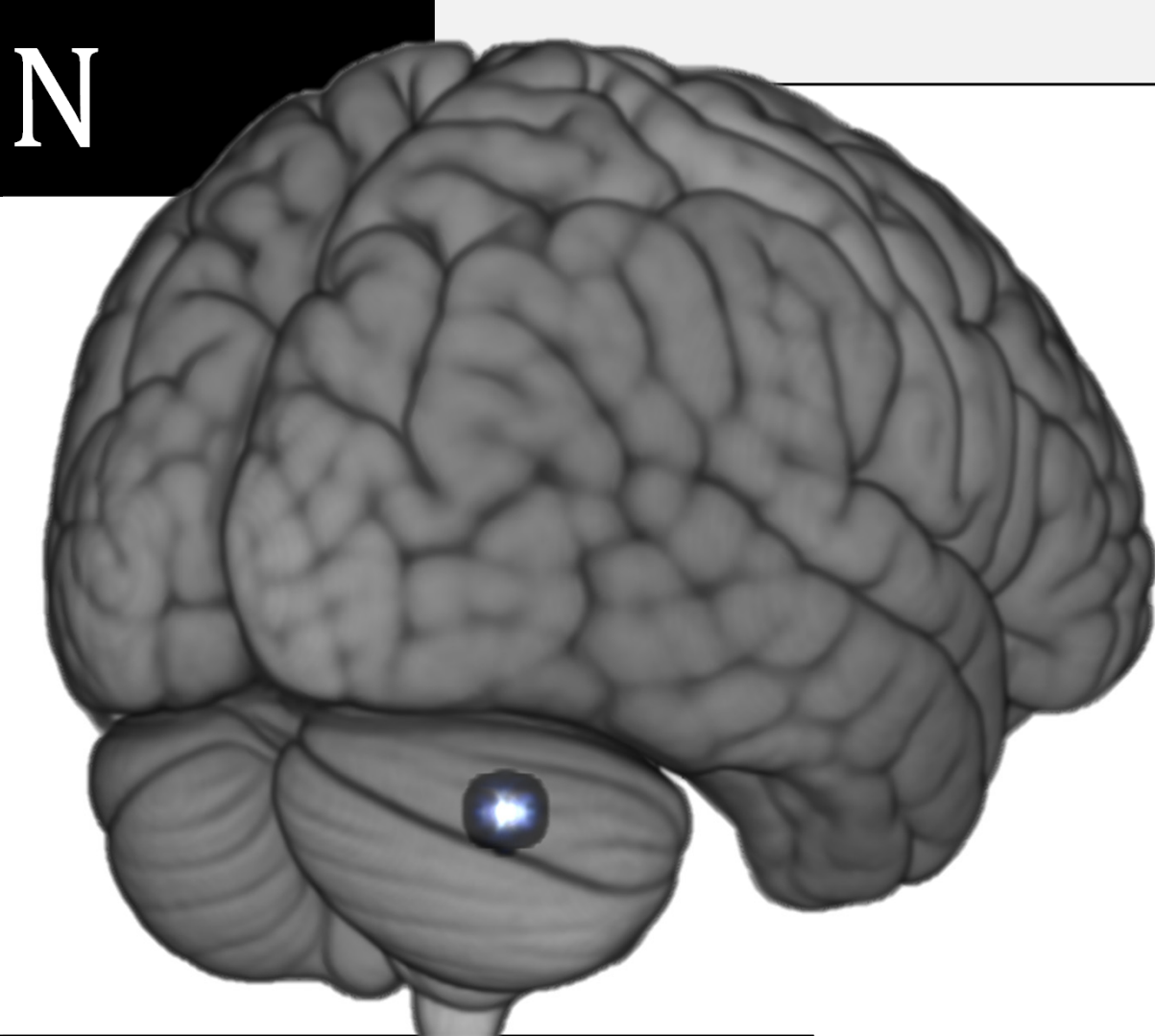


INTRODUCTION



- Complex cognitive function is supported by coordinated neural activity across large-scale brain networks. Several association cortex networks interface with the **right lateral cerebellum**.¹

Question: how does the right lateral cerebellum engage with distinct networks to accomplish different cognitive functions?

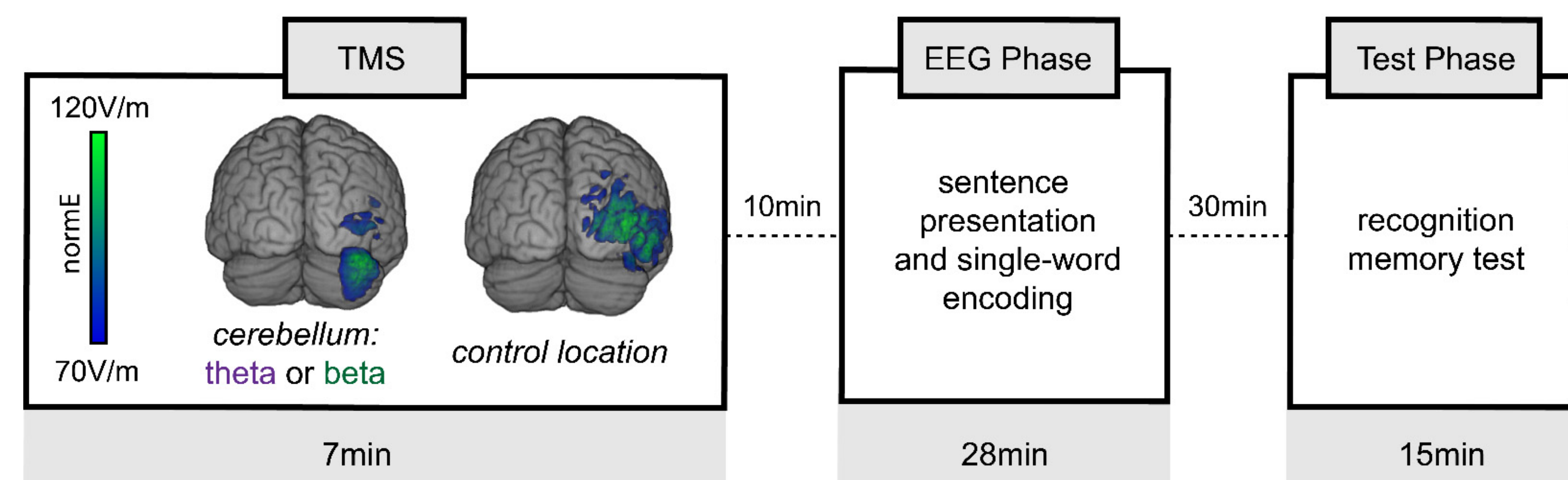
HYPOTHESIS

- Cerebellar contributions to cognition are guided by neural oscillations with function-specific frequency bands.**
- Cognitive networks have preferred endogenous rhythms, e.g.:
 - The **episodic memory network shows increased theta (3-8Hz)** synchrony during encoding.²
 - Linguistic prediction during reading tasks has been linked to increased beta (13-30 Hz)** power across the language network.³

Test: can we bias cerebellar participation in episodic memory versus linguistic prediction by noninvasively stimulating with **theta versus beta rhythmic TMS**?

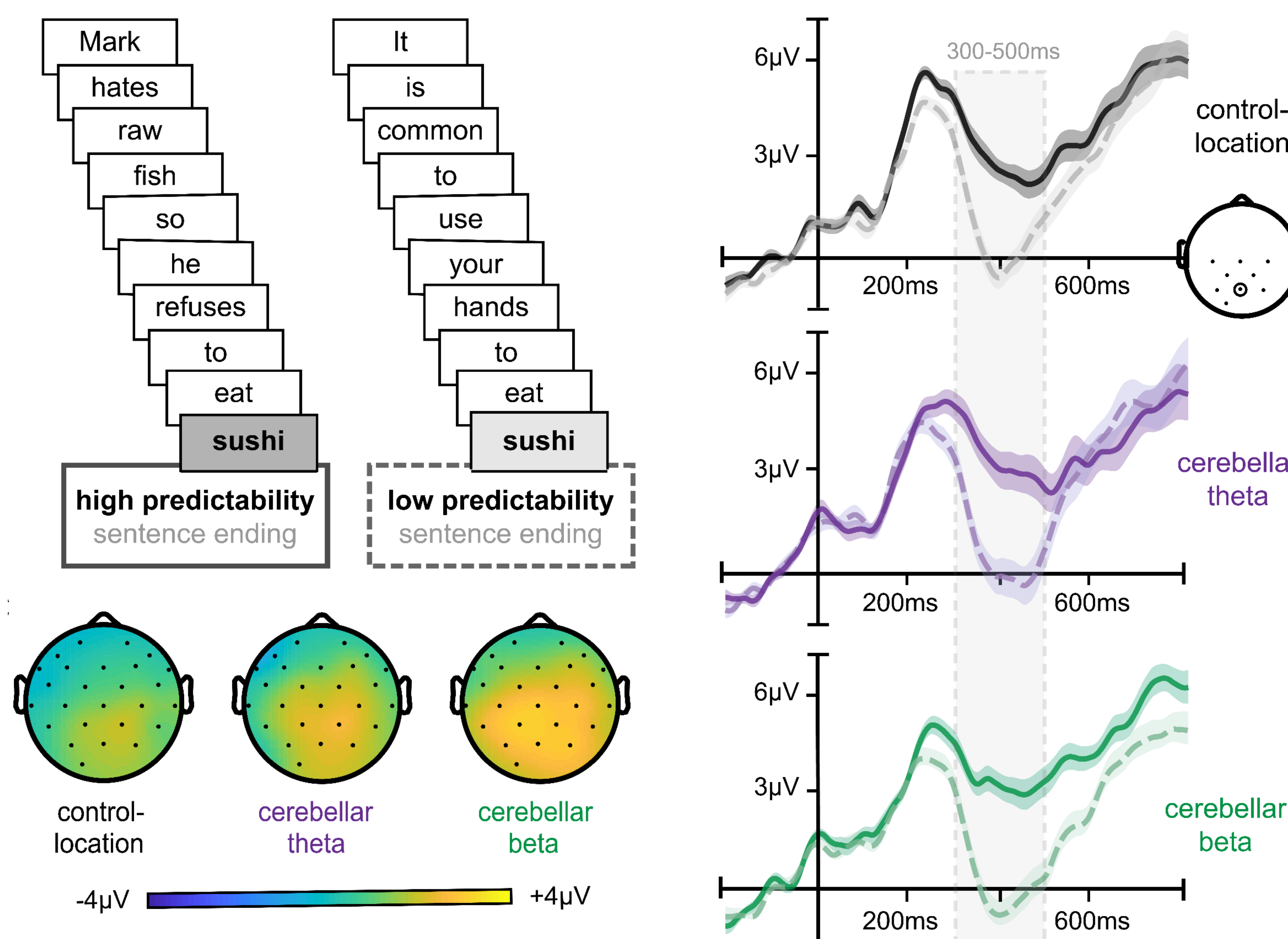
STUDY DESIGN

- Across 3 sessions, 24 subjects received each of 3 TMS conditions: **cerebellar theta**, **cerebellar beta**, or occipital **control-location** stimulation (theta or beta) (illustrated via the induced electrical field (normE)).
- Following stimulation, subjects performed a mixed sentence reading and single-word encoding task while EEG was recorded. After a delay, we tested recognition memory for words studied during the EEG phase.

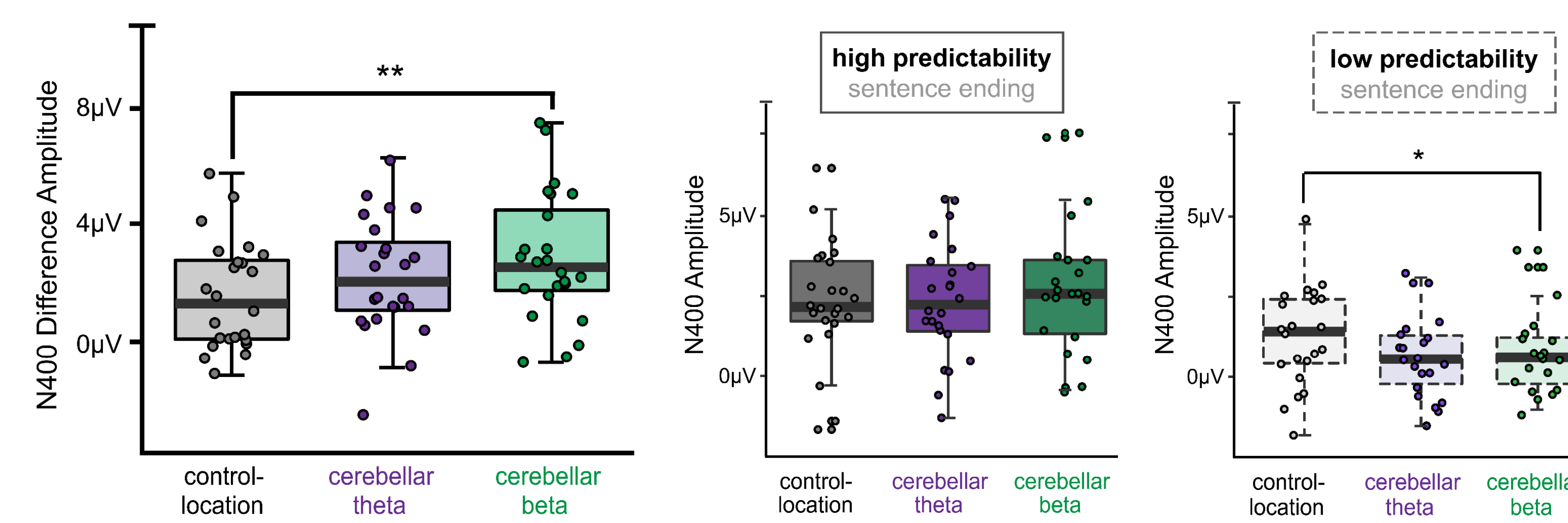


STIMULATION FREQUENCY EFFECTS ON LINGUISTIC PREDICTION

- Subjects read sentences ending with high or low predictability words. ERP activity to these endings showed typical N400 effects of linguistic predictability were elicited across all stimulation conditions.



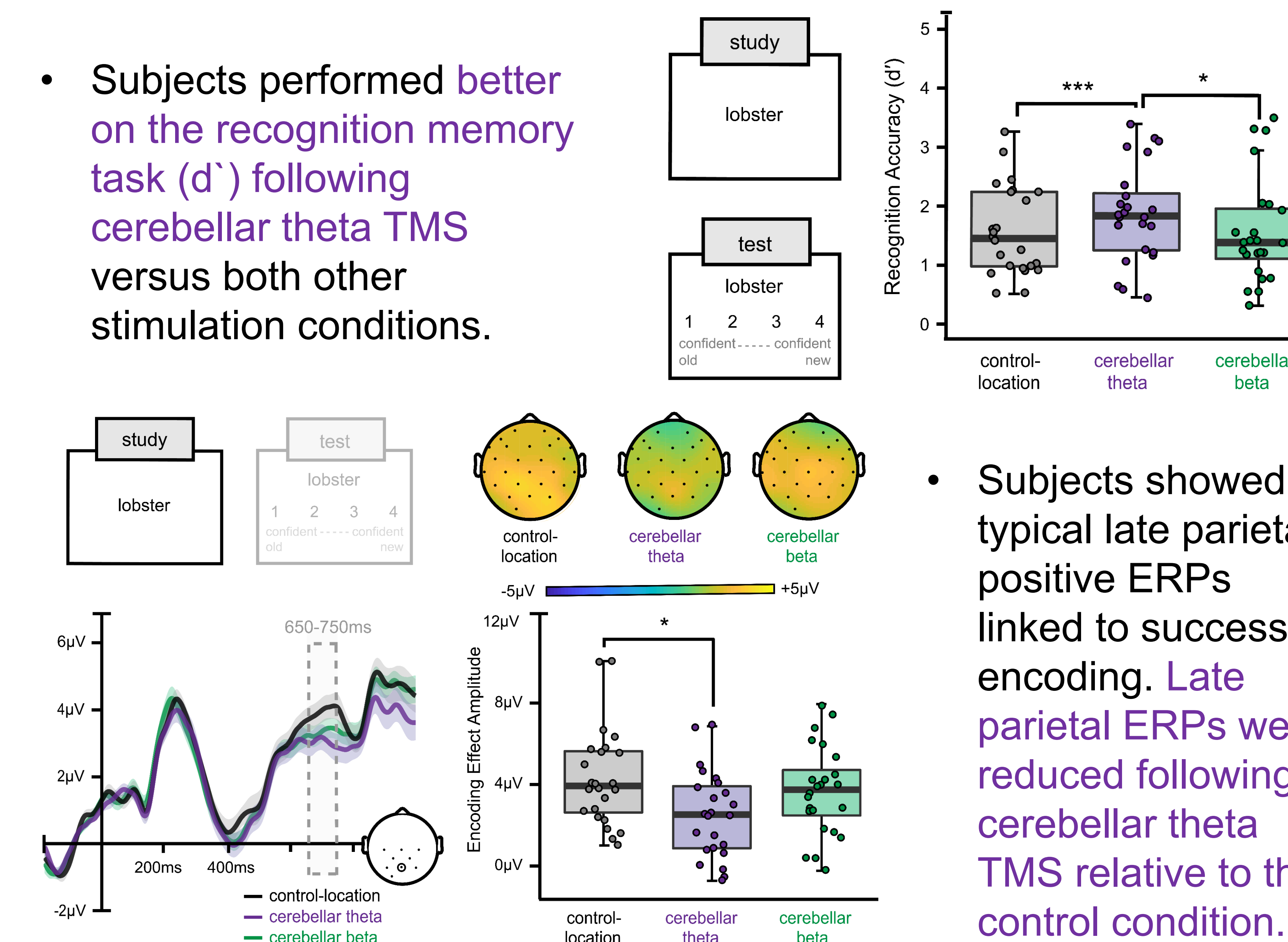
- N400 amplitudes over centro-posterior electrodes increased following cerebellar beta TMS relative to the control condition.** Beta TMS weakly increased N400 amplitude to predictable words and significantly decreased N400 activity to less predictable words.



Contextual predictability more strongly influenced word processing following language network-preferred beta rhythmic TMS

STIMULATION FREQUENCY EFFECTS ON MEMORY ENCODING

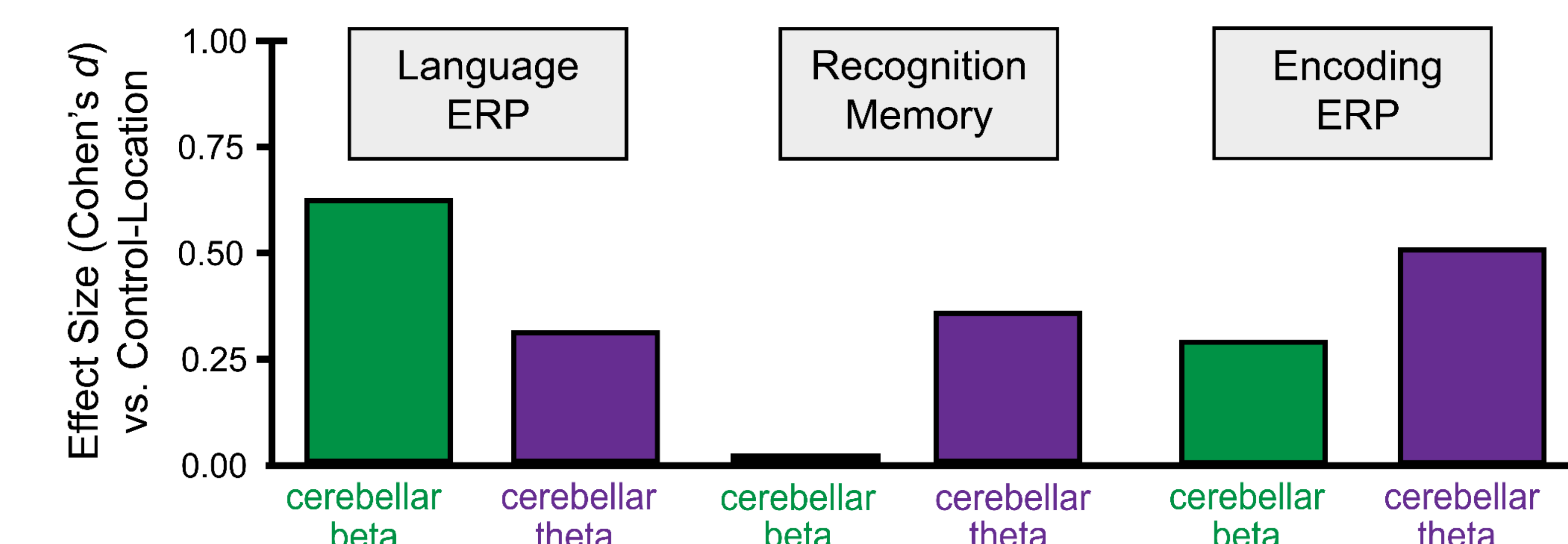
- Subjects performed **better on the recognition memory task (d')** following **cerebellar theta TMS** versus both other stimulation conditions.



- Subjects showed typical late parietal positive ERPs linked to successful encoding. **Late parietal ERPs were reduced following cerebellar theta TMS relative to the control condition.**

Neural and behavioral correlates of memory encoding were influenced by episodic memory network-preferred theta rhythmic TMS

DISCUSSION



- Beta vs. theta cerebellar TMS had opposite effects on linguistic prediction and episodic memory, supporting a double dissociation of cognitive function by TMS frequency. These findings provide evidence that **cerebellar involvement in network functions may be guided by function-specific frequency bands.**