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Background

- Musical experience may enhance cognitive function^{1,2}
- It is unclear whether musical training may remediate age-related declines in temporal attention (expectation) and working memory^{3,4}

Hypothesis: Rhythm training will improve temporal attention ability in older adults & facilitate working memory via expectation-based mechanisms

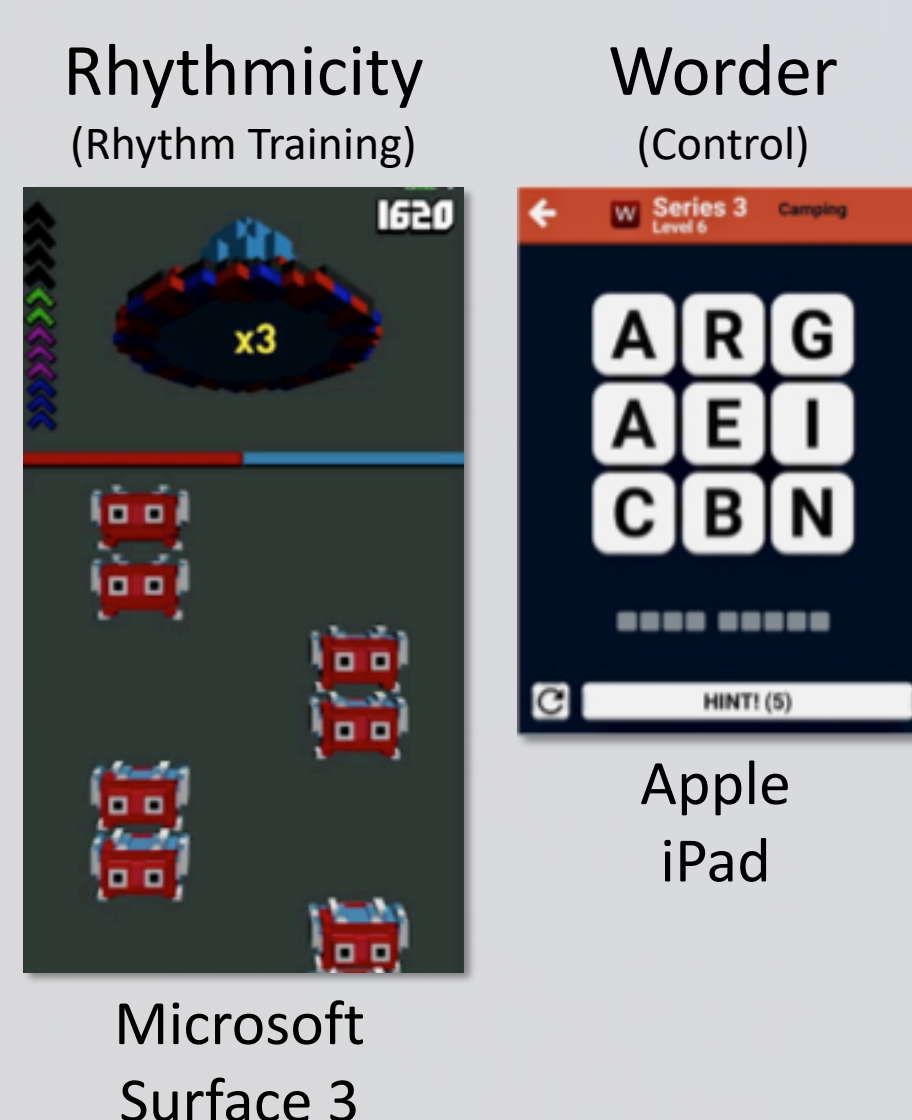
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Conclusions

- Preliminary results indicate rhythm training improves temporal attention (lowered variability) and working memory (increased accuracy) in older adults
- Increased expectation-based mechanisms (entrainment and alpha activity) may underlie improvements in cognitive performance
- Future research will solidify whether these effects on performance are due to changes in expectation-based mechanisms

Methods

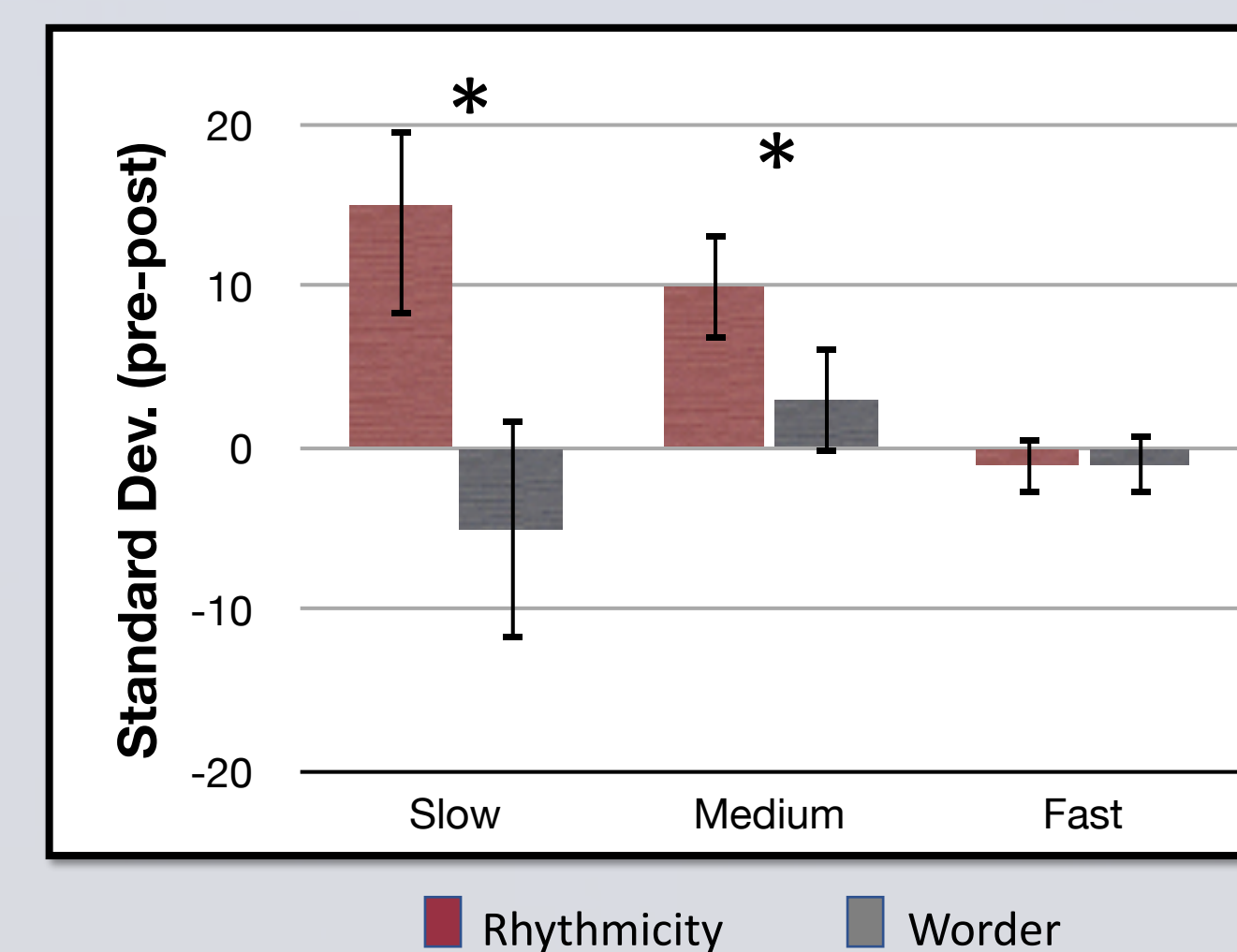
- Double-blinded, randomized trial
- Rhythmicity (rhythm training) N = 25
- Worder (word search control) N = 23
- 7 dropped out of Rhythmicity
- 4 dropped out of Worder
- 8 weeks of training at home (5 days/wk)
- ~13.3 hrs. total training (20 min/day)
- Rhythmicity: tap pattern with visual cues (weeks 1-4) and without cues (weeks 5-8)
- Worder: Find words using adjacent letters
- Outcome measures assessed pre/post training (Behavior + 64-electrode EEG)



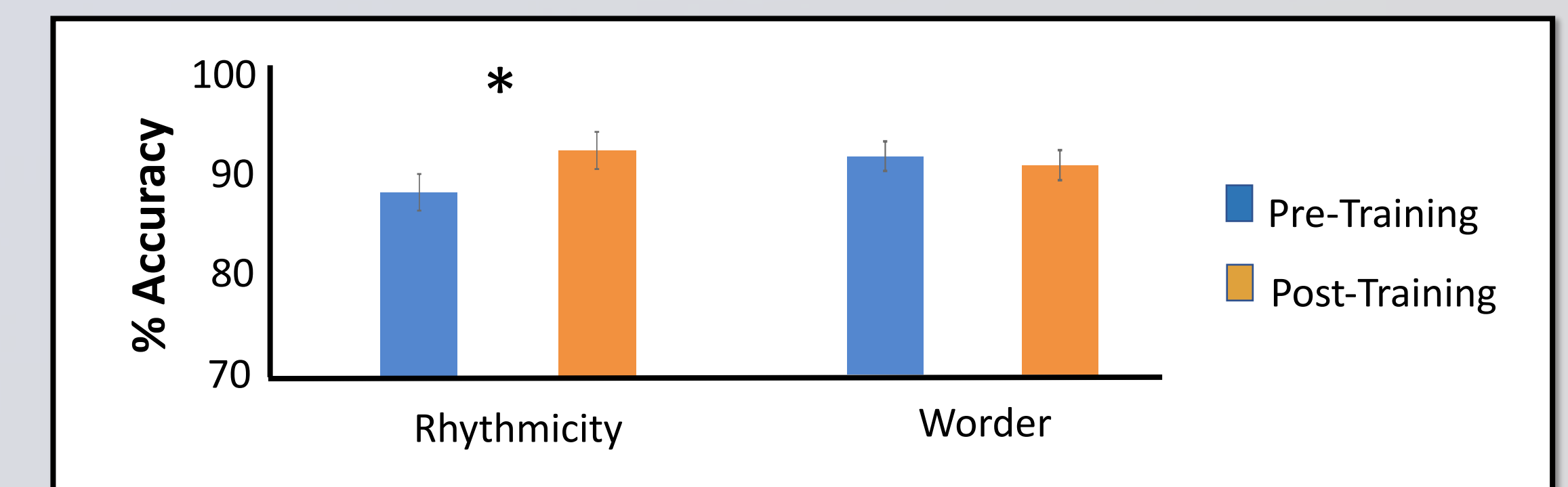
Results: Temporal Attention (Behavior)

Group x Visit x Tempo Interaction
 $F(2,66) = 4.27$; $p = 0.03$; $\eta_p^2 = 0.11$

- Rhythm training reduced variability in sensorimotor synchronization
- Asynchrony not changed
- RT to random stimuli not changed (task & data not shown)
- Indicates improvements in temporal attention (expectation), not sensory or motor processes



Results: Working Memory (Behavior)

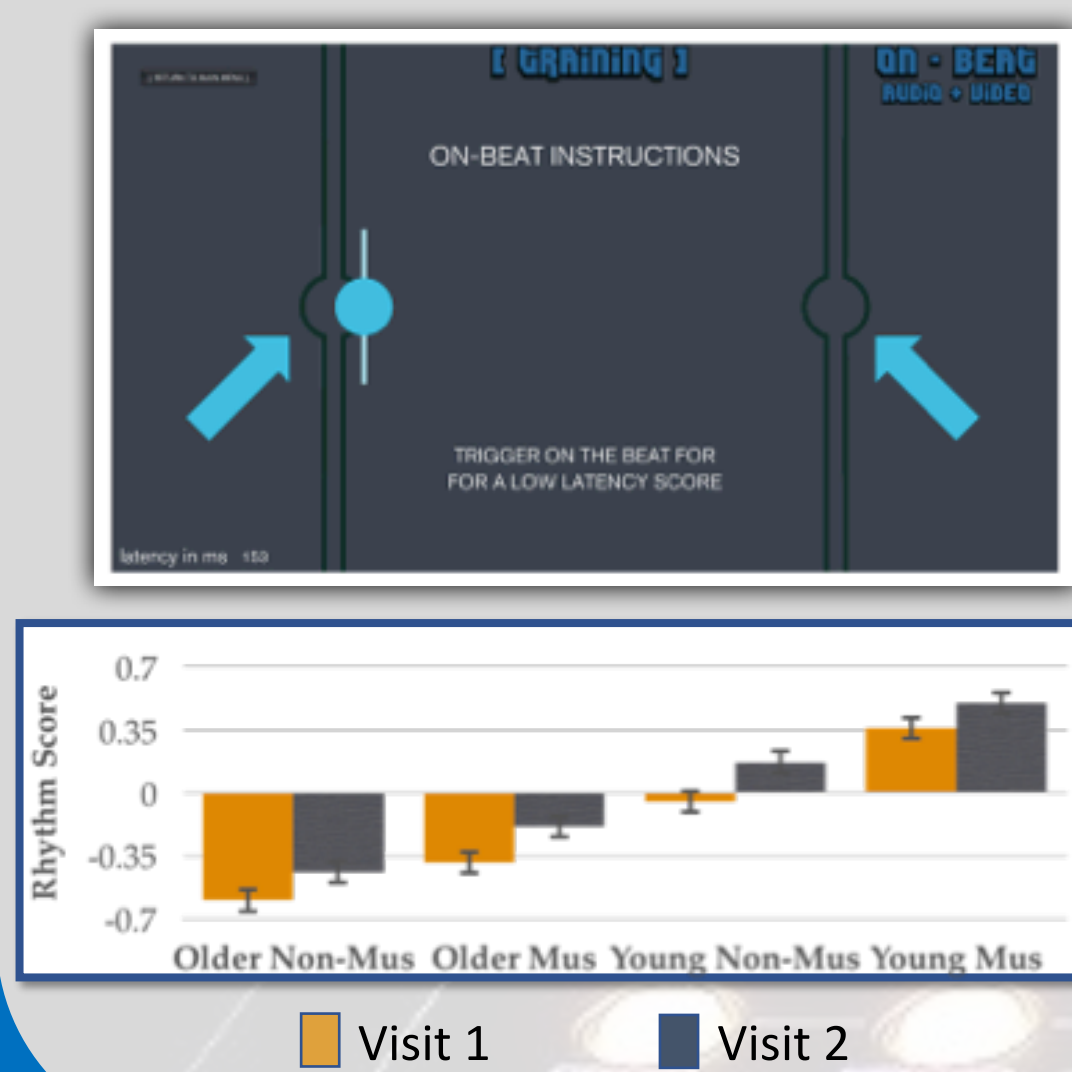


Group x Visit Interaction

$F(1,58) = 5.43$; $p = 0.02$; $\eta_p^2 = 0.09$

- Rhythm training improved working memory accuracy
- RT not changed

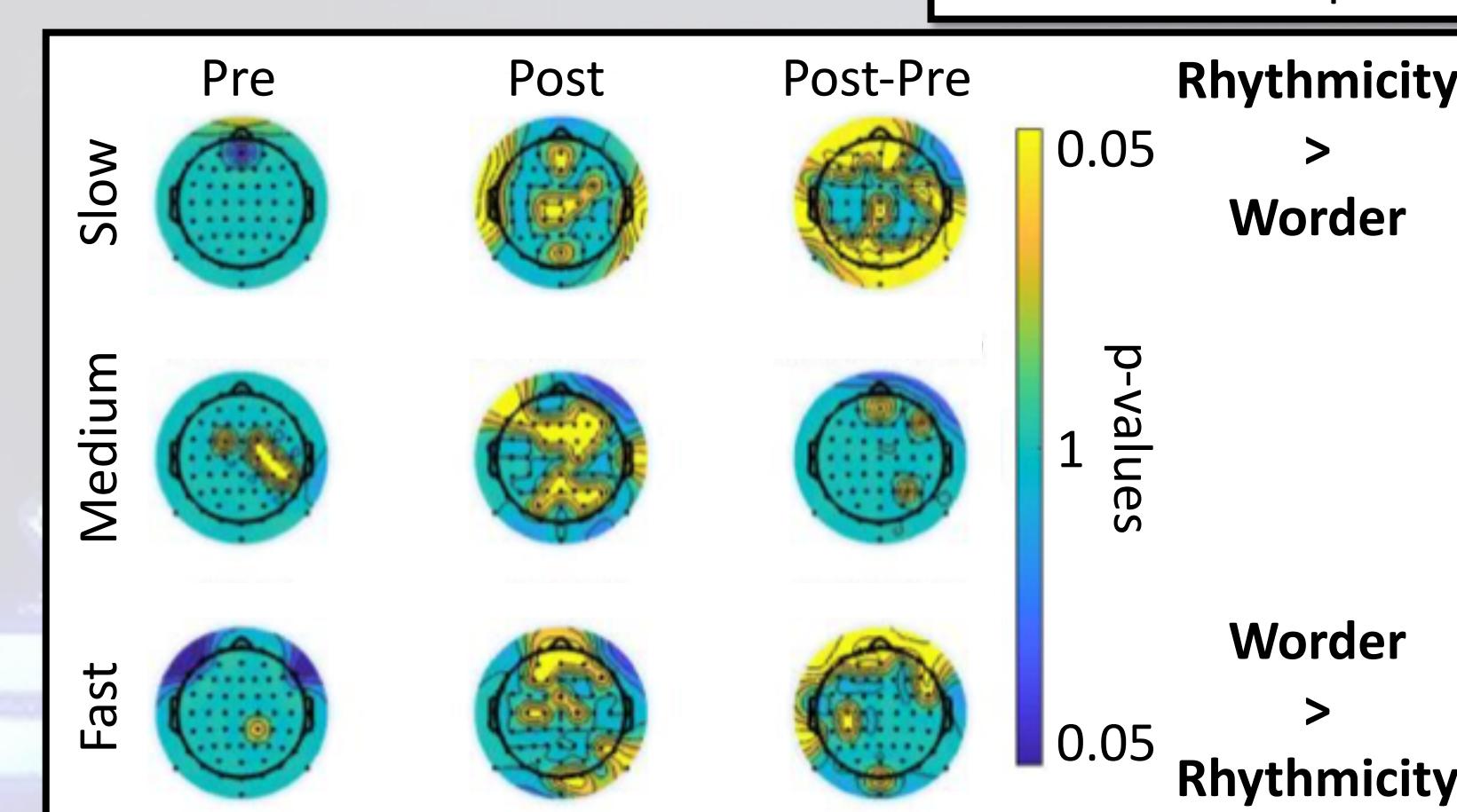
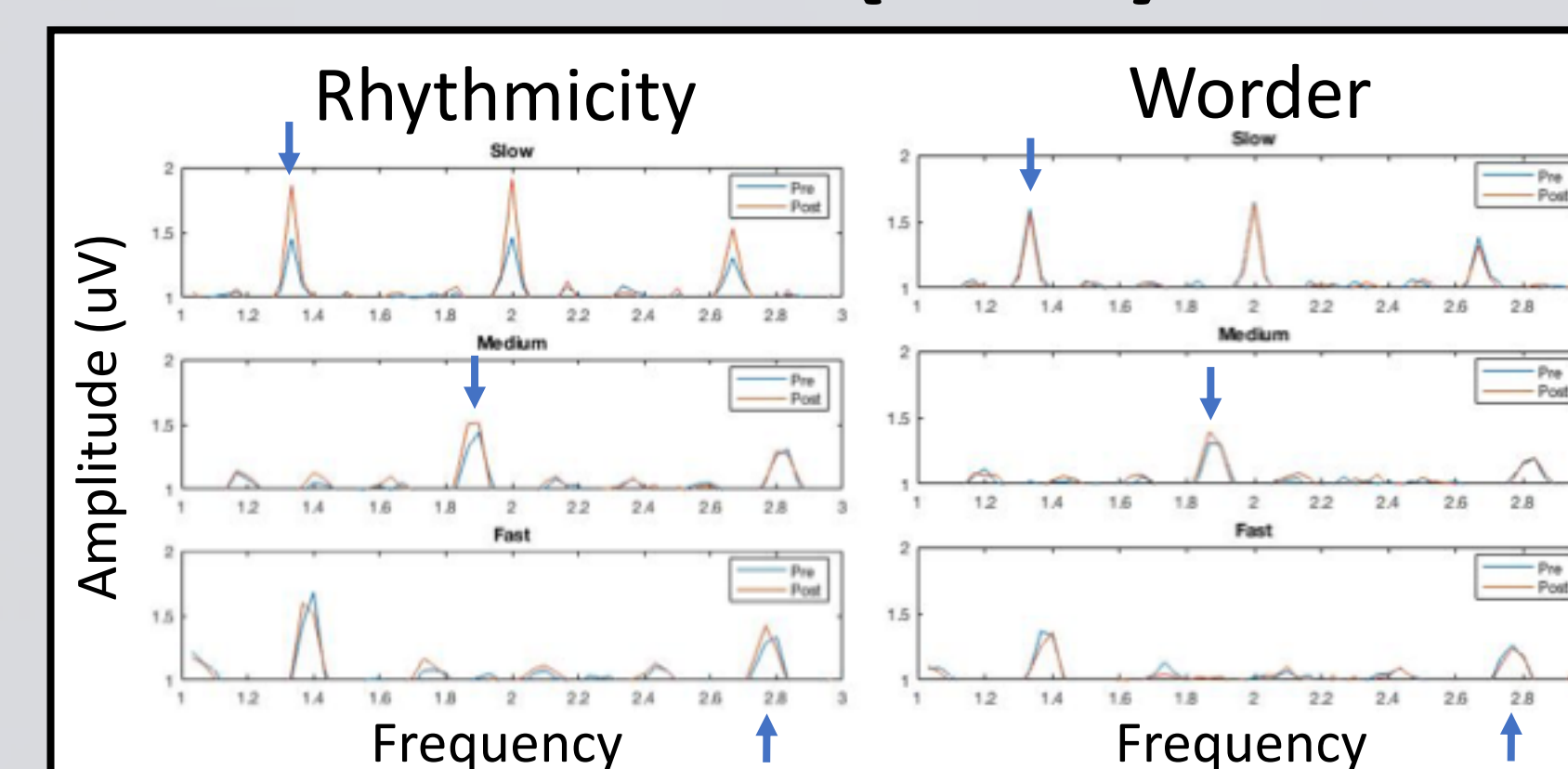
Outcome Measure 1: Temporal Attention (near transfer)



- 3 tempos: slow (750ms IOI; 1.33 Hz), medium (525ms IOI; 1.90 Hz), and fast (360ms IOI; 2.77 Hz)
- 3 stimulus types: audio-visual, audio-only, and visual-only
- 3 tasks: on-beat, off-beat, and continuation
- Previously observed older adults exhibit deficient performance³
- Analysis focused on asynchrony (tap offset) and variability (standard deviation)
- EEG focused on frequency entrainment

Results: Temporal Attention (EEG)

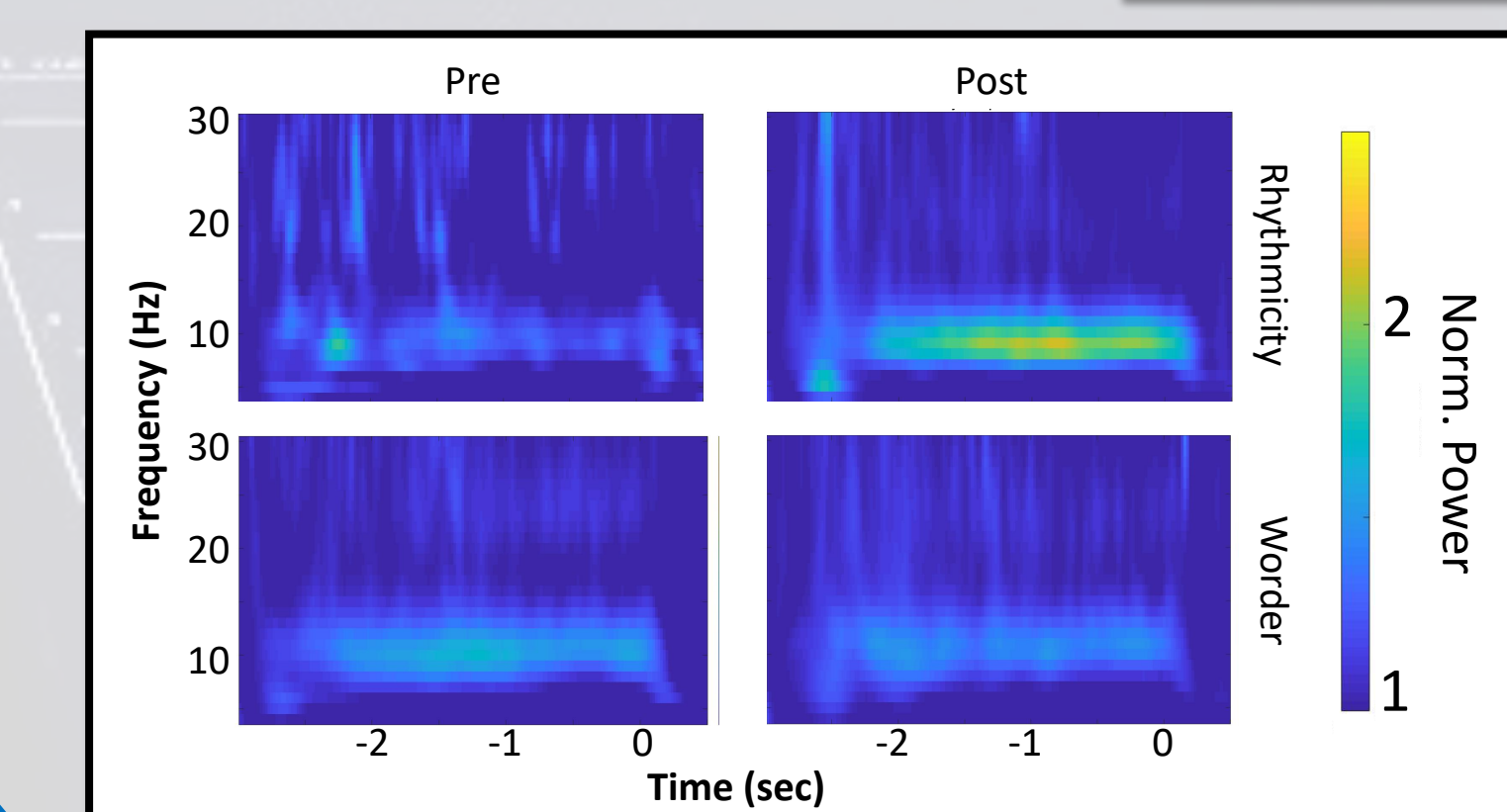
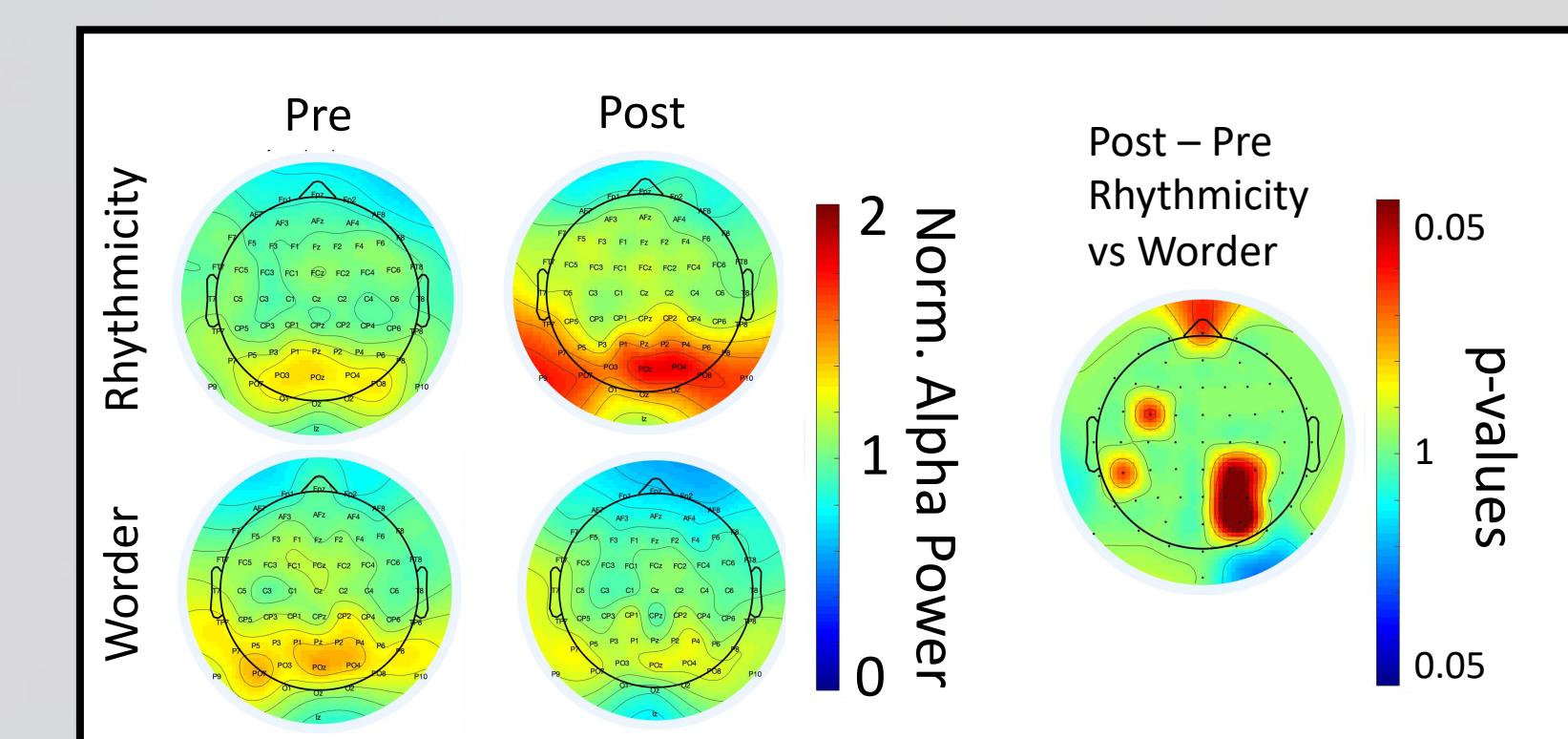
- Global (all electrodes) amplitude spectrum shows frequency specificity at stimulus tempo
- Rhythm training enhanced entrainment at slowest tempo



- Rhythm training enhanced entrainment at slowest tempo in frontal and posterior electrodes
- Cluster correction required
- Source locational needed

Results: Working Memory (EEG)

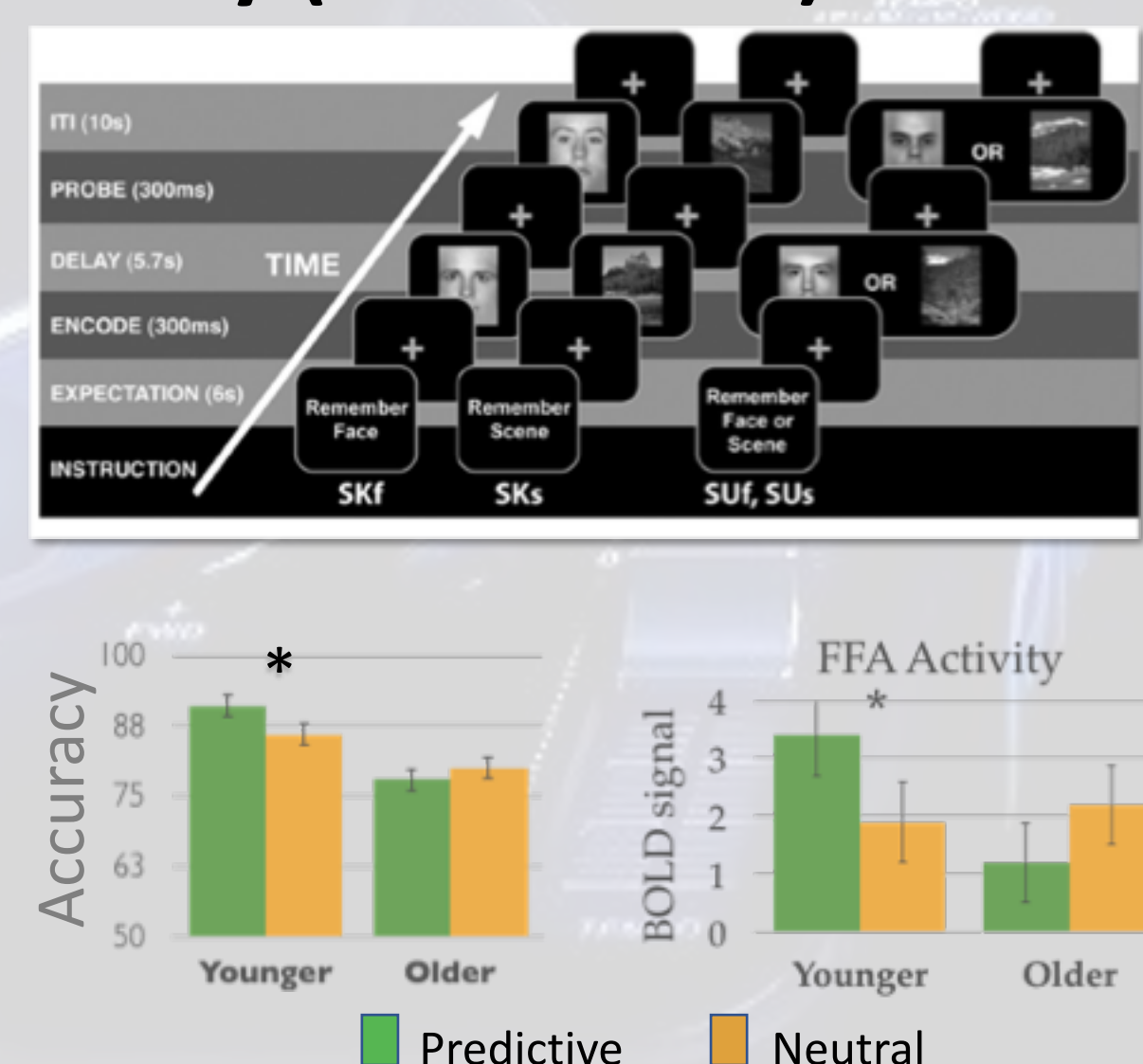
- Rhythm training increases anticipatory alpha power
- Results greatest in right lateralized parietal-occipital electrodes



- Global (all electrodes) spectrogram shows frequency specificity in alpha band
- Increased anticipatory alpha observed through most of the delay period

Outcome Measure 2: Working Memory (far transfer)

- 3 conditions: remembers faces, remember scenes, and remember faces or scenes
- Previously observed older adults exhibit deficient performance⁴
- Behavioral analysis focused on accuracy and RT
- EEG focused on pre-stimulus alpha power (8-12 Hz)



References

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2. Mathias, Palmet, Perrin, Tillman (2015). Sensorimotor learning enhances expectations during auditory perception. *Cerebral Cortex*, 25(8): 2238-2254.
3. Zanto, Padgaonkar, Nourishad, Gazzaley (2019). A tablet based assessment of rhythmic ability. *Frontiers in Psychology*, 10: 2471.
4. Bollinger, Rubens, Masangkay, Gazzaley (2011). An expectation-based memory deficit in aging. *Neuropsychologia*, 49: 1466-1475.

Acknowledgements

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