

# Targeted Memory Reactivation of Face-Name Associations Depends on Undisturbed Slow-Wave Sleep

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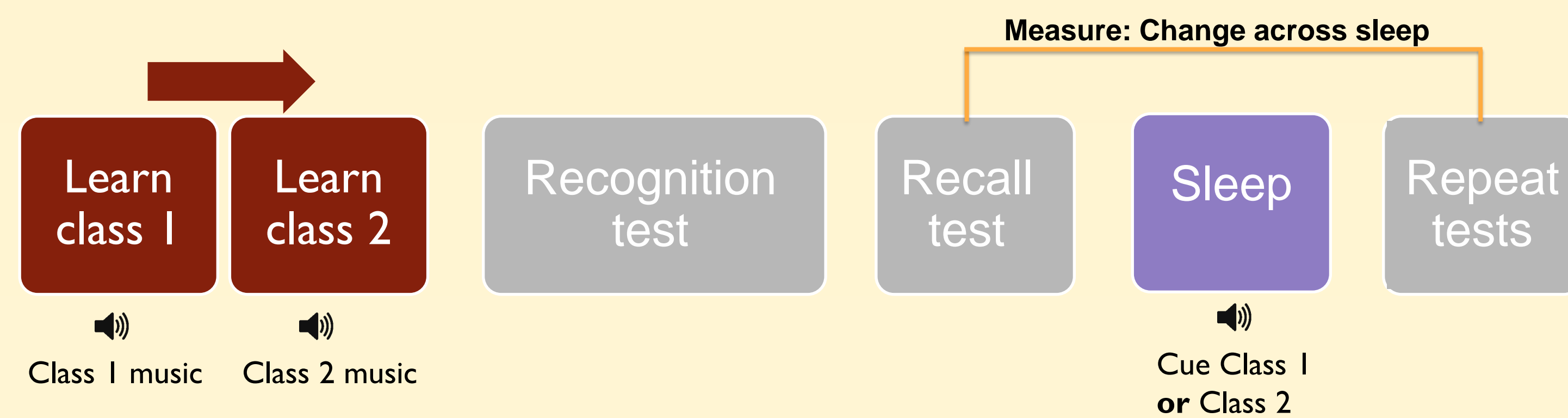
## Targeted Memory Reactivation (TMR)

Consolidation is thought to occur during sleep as memories are spontaneously replayed. Targeted Memory Reactivation (TMR) is a method in which newly acquired information is paired with a sound to be later played during slow-wave sleep to selectively reactivate these memories.

TMR typically reduces forgetting for reactivated memories, but some studies have found either null or reversed effects (increased forgetting)<sup>1</sup>. Using data from a study on face-name learning, we tested the hypothesis that the effects of TMR depend on sleep quality and sleep disruption by sound cues.

## Procedure

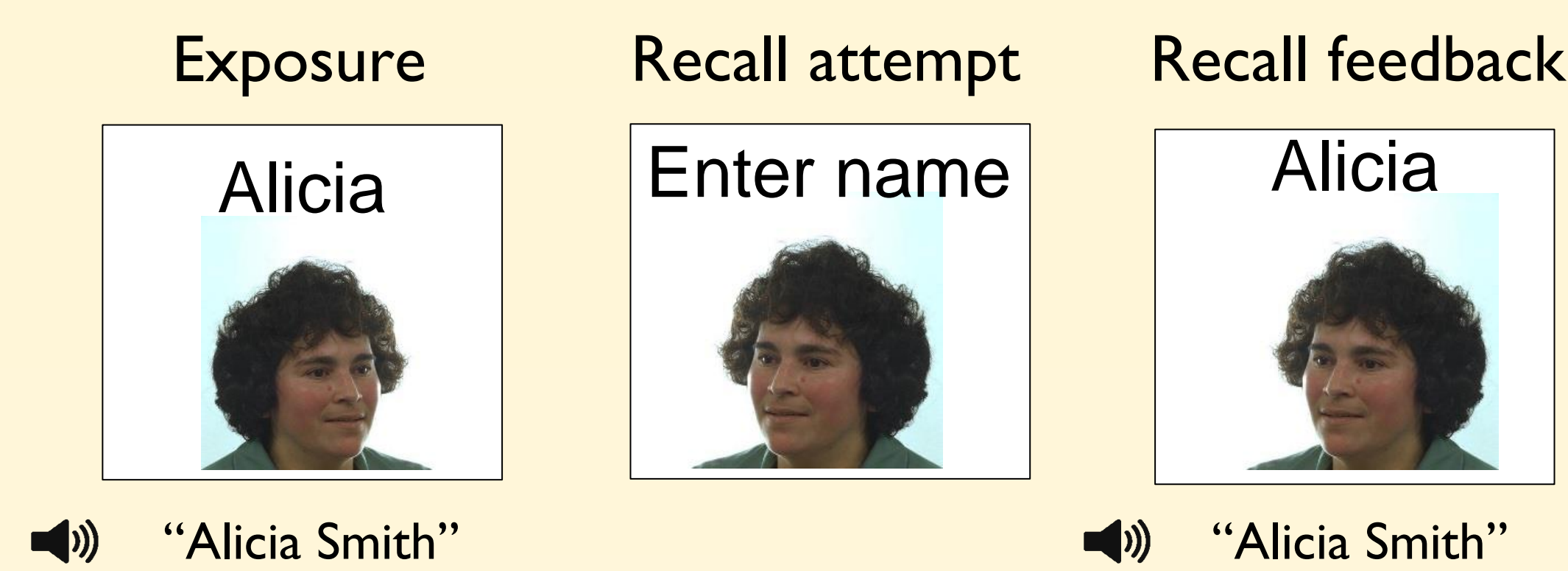
“You are a teacher with two new classes. Your job is to learn the names of the students in both classes.”



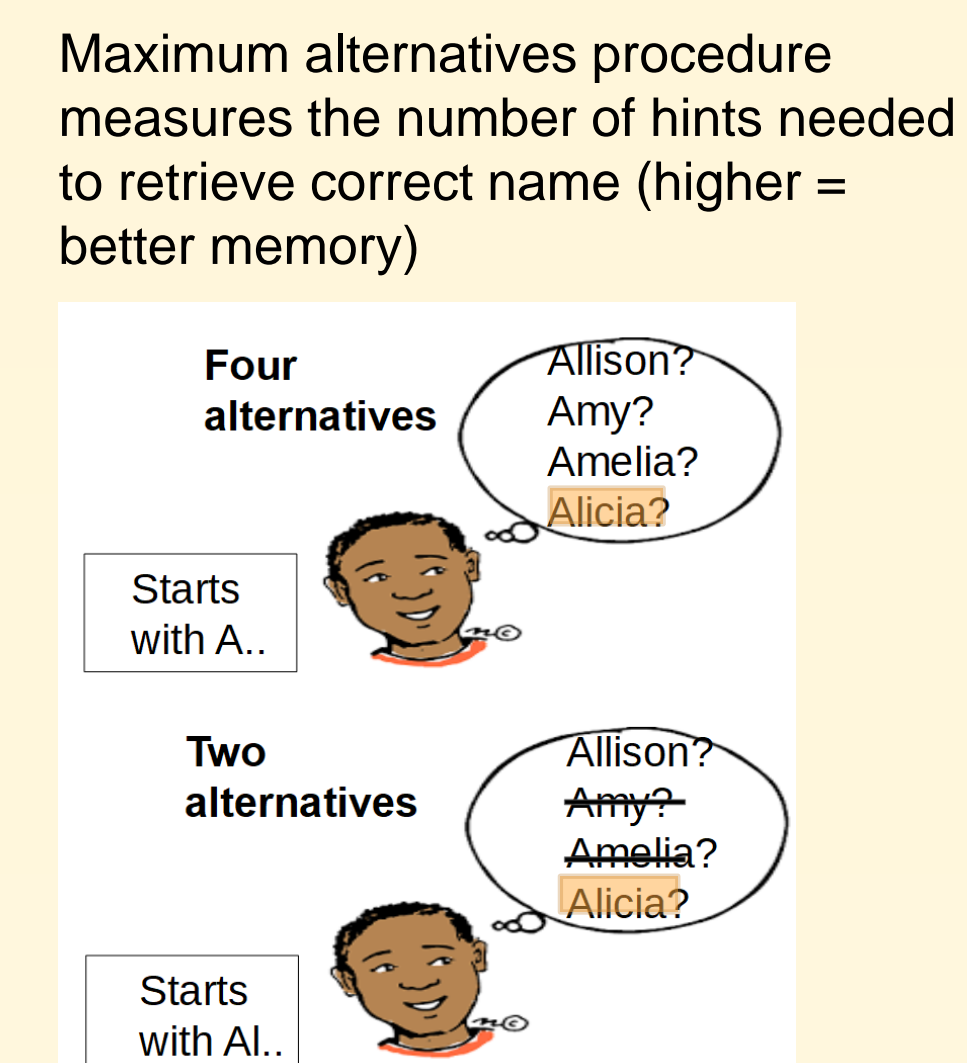
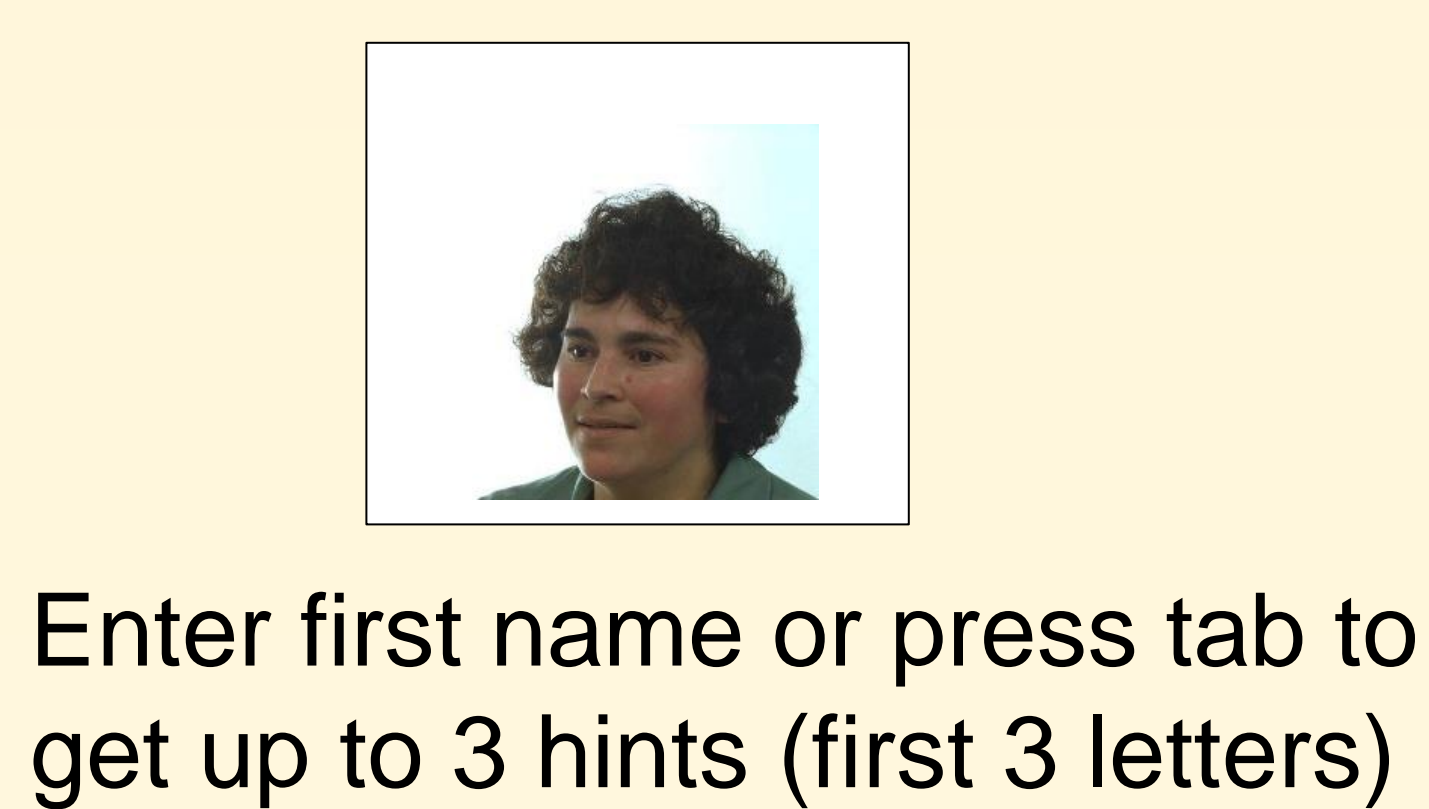
Participants were 25 undergraduates (24 had usable EEG data and were included in analysis)

### Learning

- Participants were shown and tested on two classes of 40 people each. Participants saw each face in two orientations, saw a biographical fact about the person, and heard the name spoken.

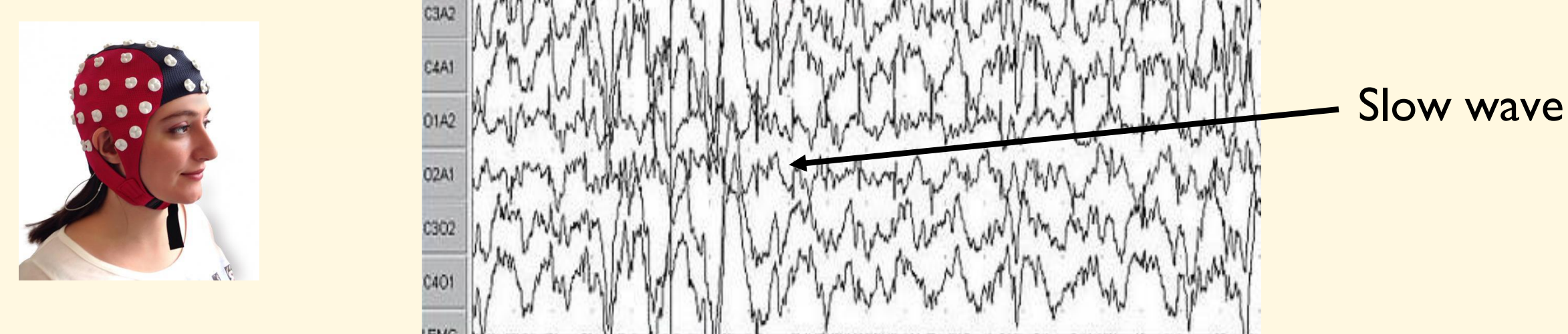


### Recall



### Sleep memory reactivation

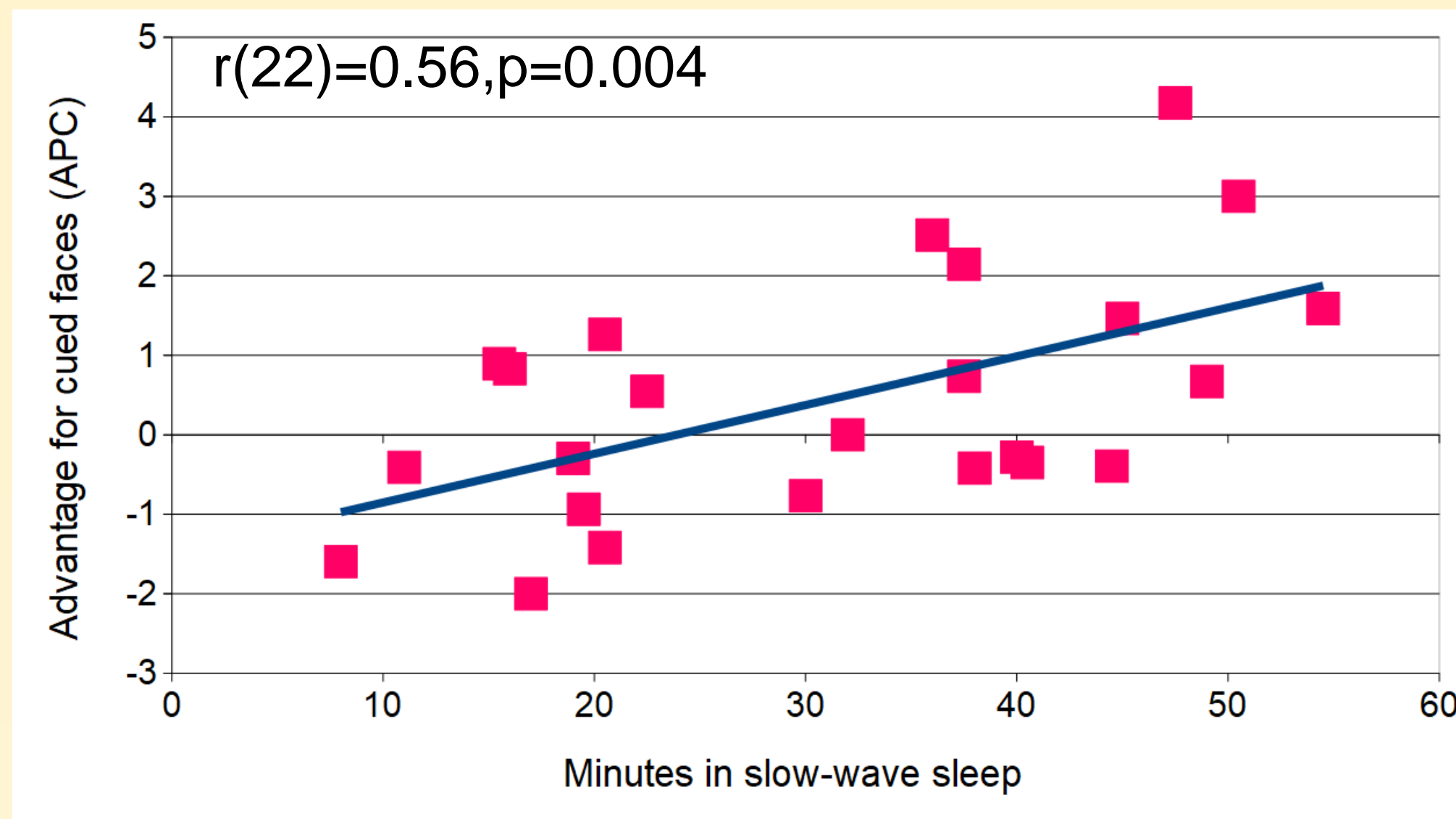
Music and names from **one** class played within intervals of N2 and slow-wave sleep during a 90-min nap.



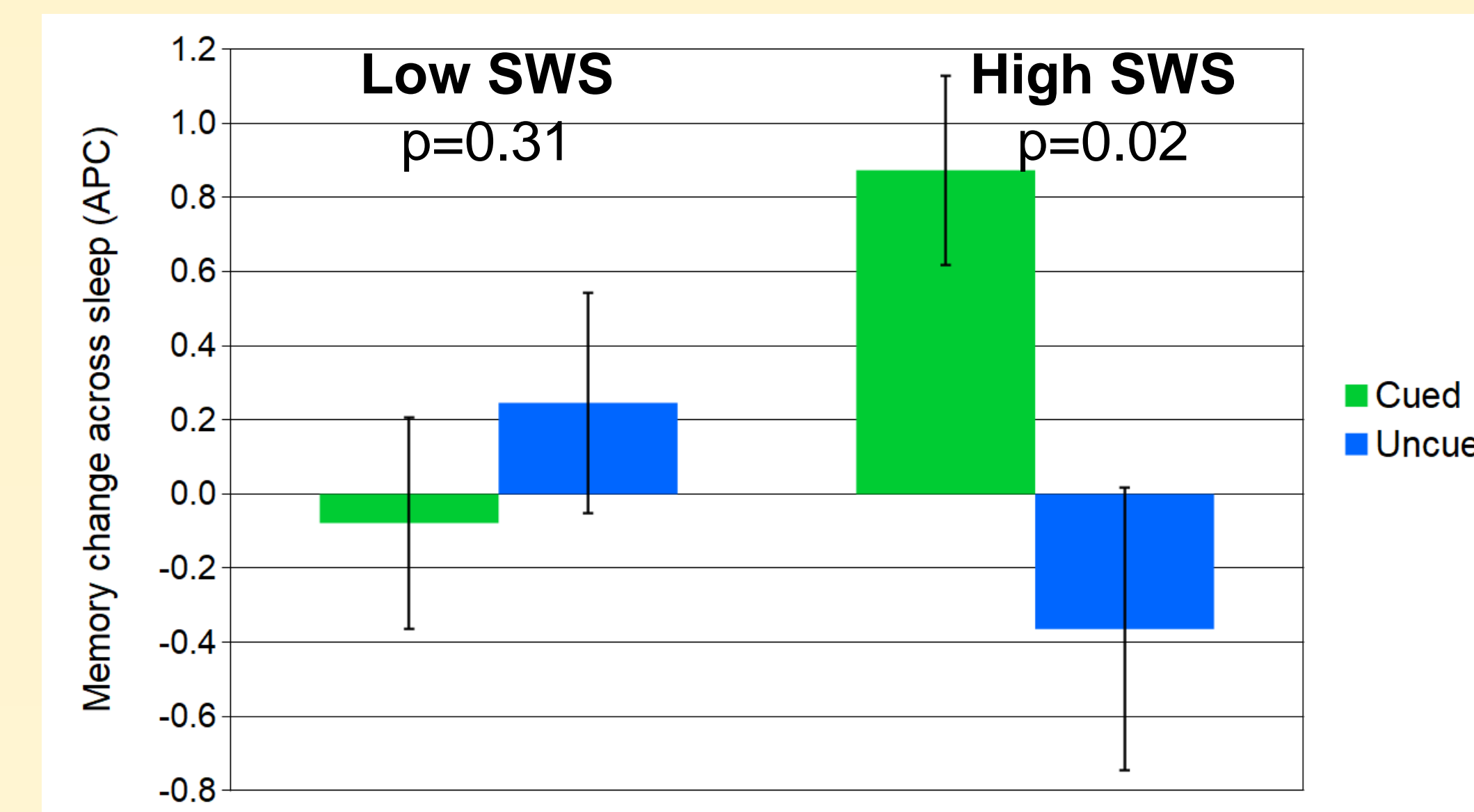
## Results

### Participants with longer slow-wave sleep (SWS) duration show larger memory effects.

SWS duration correlates with TMR effects



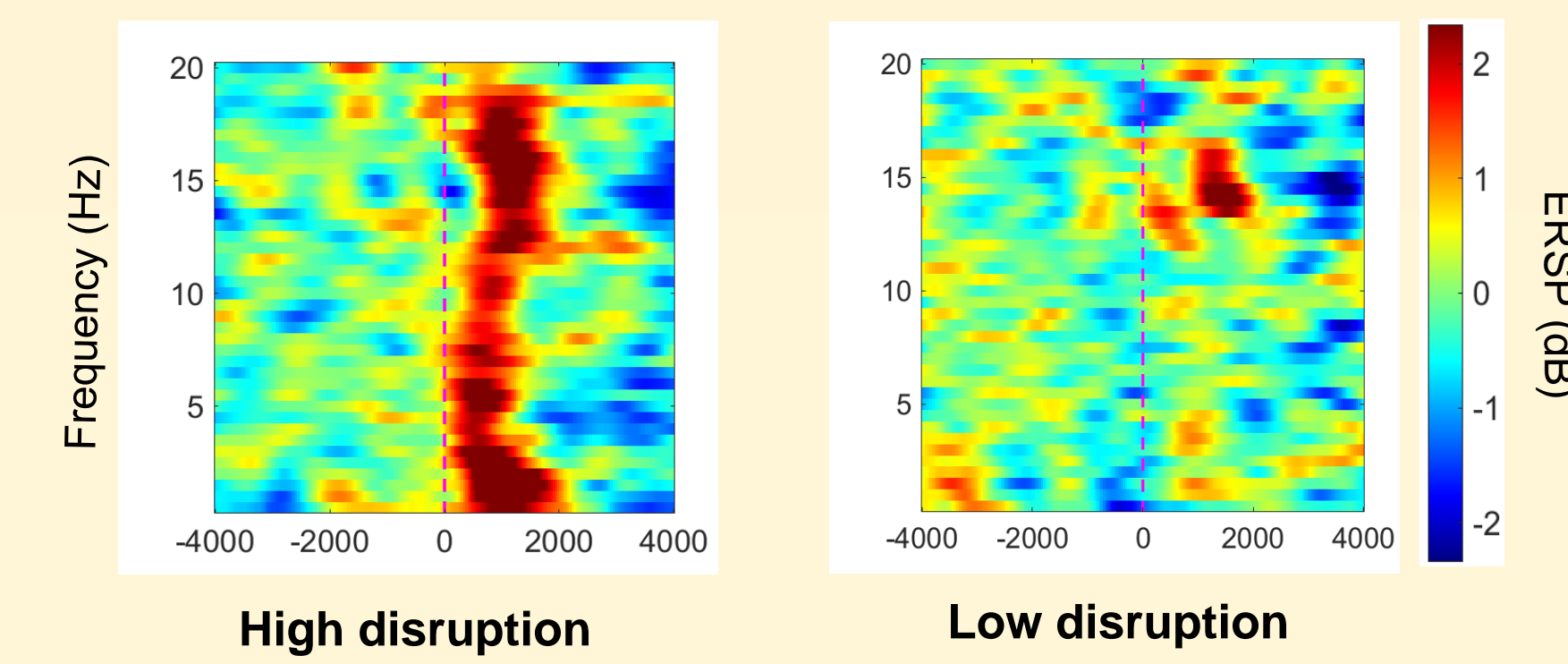
TMR significantly affected memory only in participants with high SWS duration



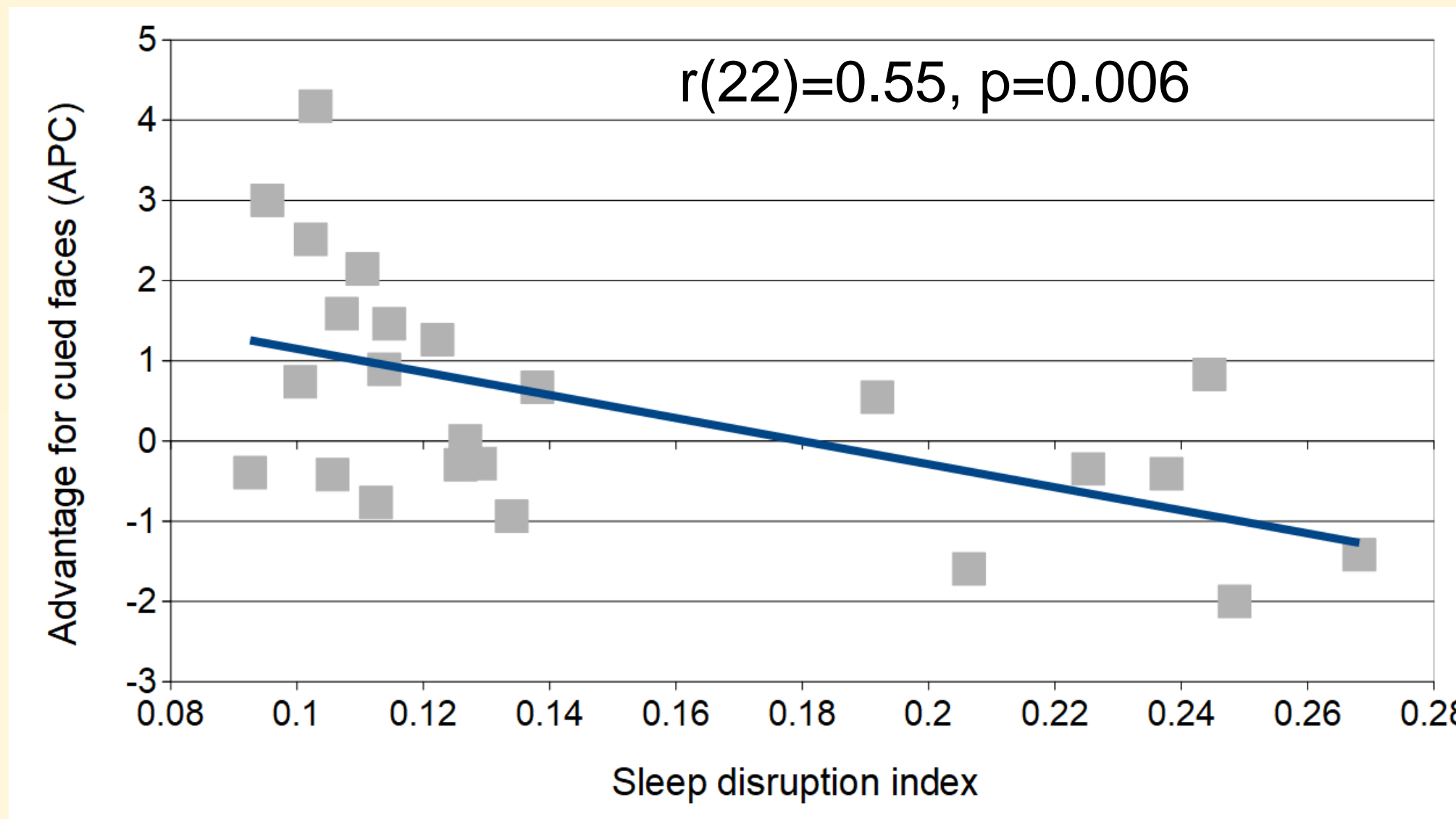
Total sleep time and N1, N2, and REM duration were not significantly associated with memory effects of TMR.

### Participants with less sleep disruption from cues show larger memory effects

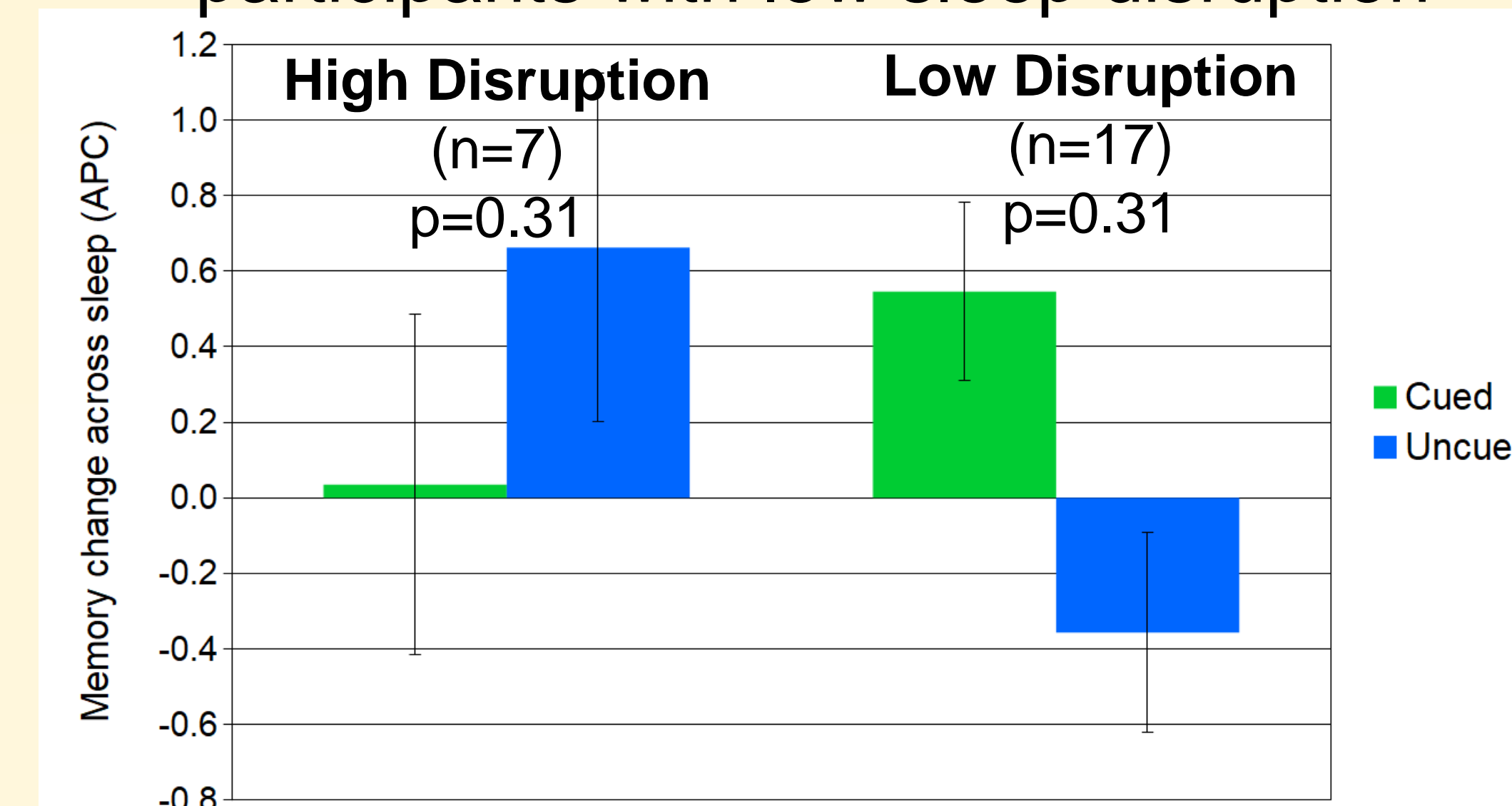
Sleep disruption index: Measures total perturbation of the power spectrum from 0.5-20 Hz at Cz.



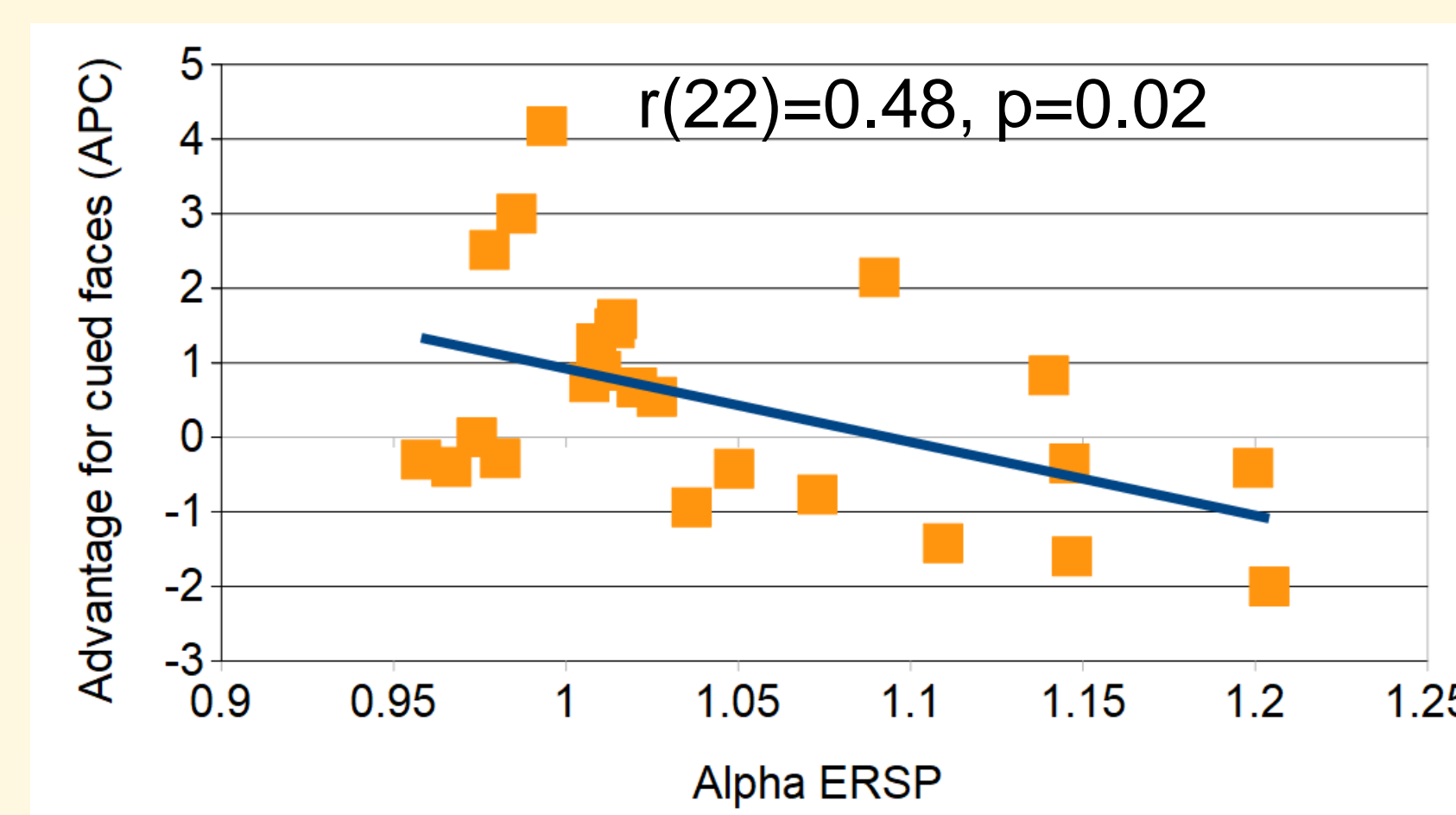
Sleep disruption index negatively correlates with TMR effects



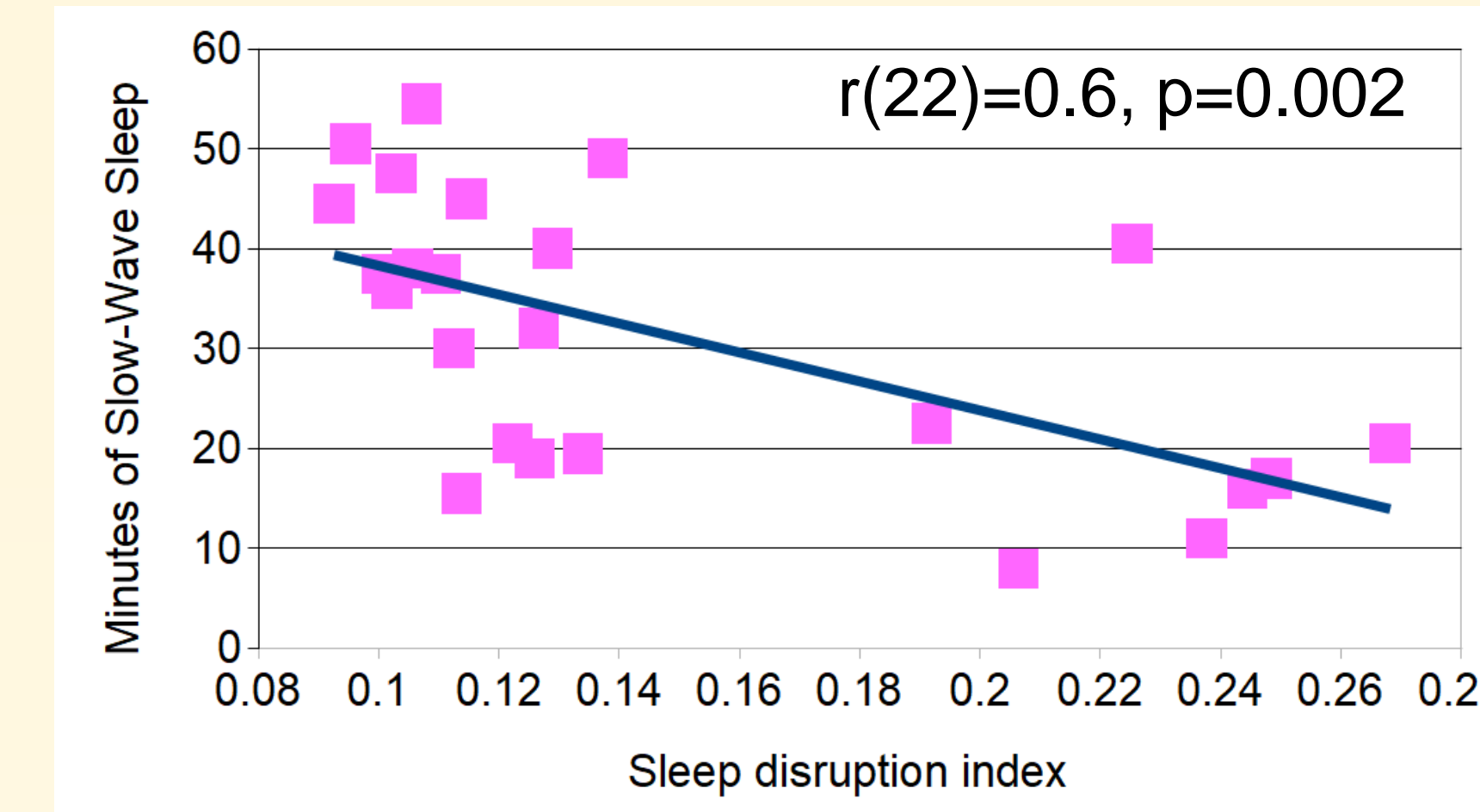
TMR significantly affected memory only in participants with low sleep disruption



Low alpha (7-10.3 Hz) power after the cue predicts the size of memory effects



Sleep disruption index and slow-wave sleep duration are highly correlated.



Power in other frequency bands was not significantly associated with memory effects

## Summary

- In this study, TMR was effective only in a subgroup of participants with higher slow-wave sleep durations and little sleep disruption by cues
- Duration and disruption were highly correlated, suggesting the two may measure a common factor.
- Sleep disruption may represent an overlooked source of variability in TMR experiments.

## Questions

- Do the effects of sleep disruption depend on the timing of the disruption relative to memory reactivation?
- Does sleep disruption affect memory by interrupting consolidation of specific items, or by reducing overall sleep quality?

## References

- Göldi, M., & Rasch, B. (2019). Effects of targeted memory reactivation during sleep at home depend on sleep disturbances and habituation. *NPJ Science of Learning*, 4, 5.

## Acknowledgments

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