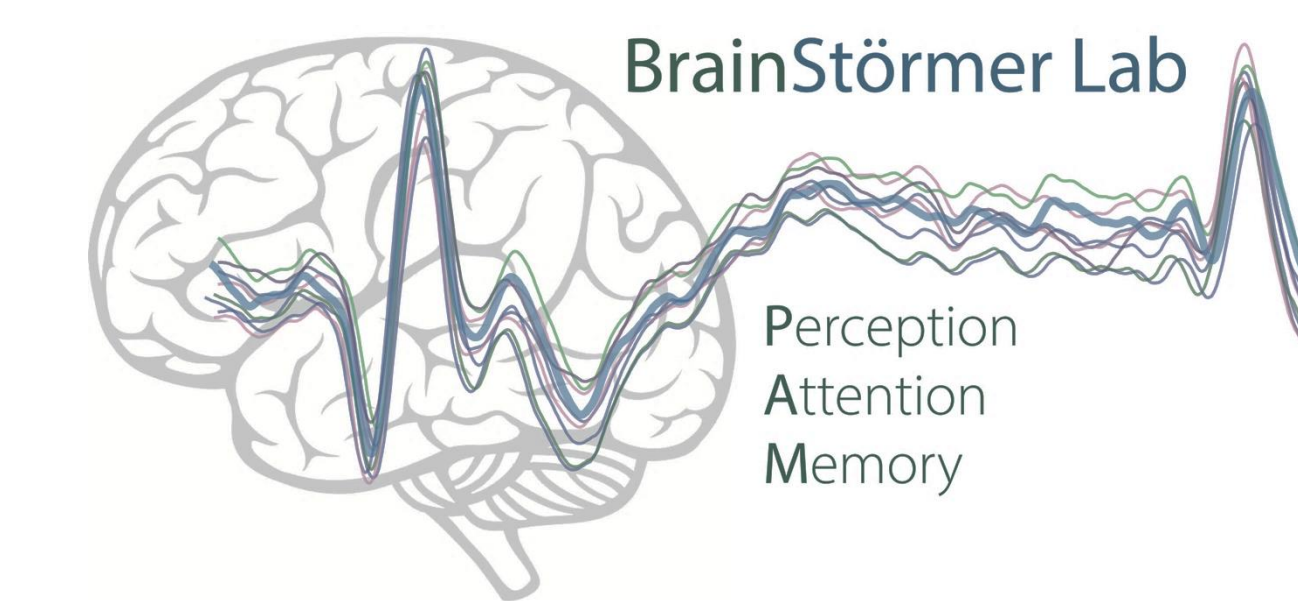




# Sustained Auditory Spatial Attention Facilitates Visual Processing

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## Background

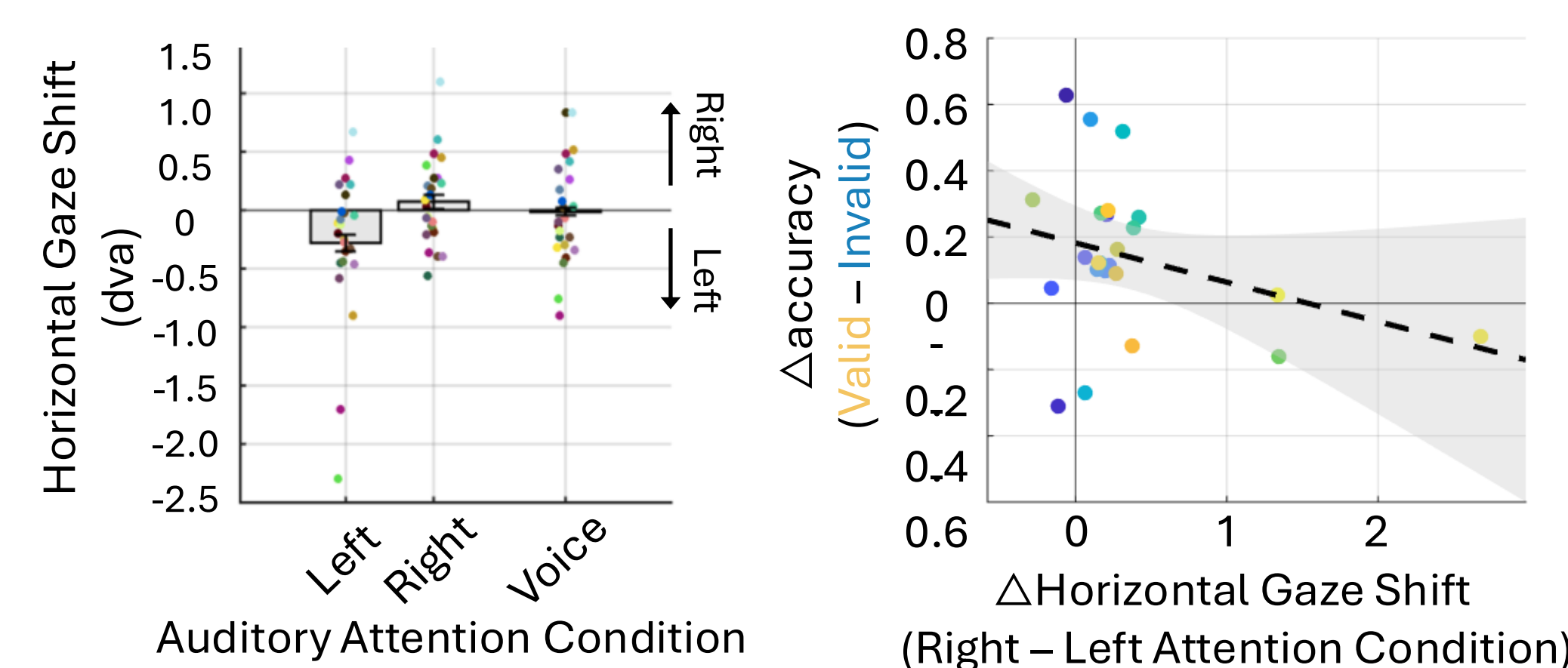


- We integrate sensory information from multiple modalities to perform complex behaviors.
- A brief, task-irrelevant sound captures spatial attention and facilitates visual processing at a congruent location<sup>1</sup>.
- Real-world listening often demands sustained, voluntary spatial attention to a sound stream (e.g., cocktail party)

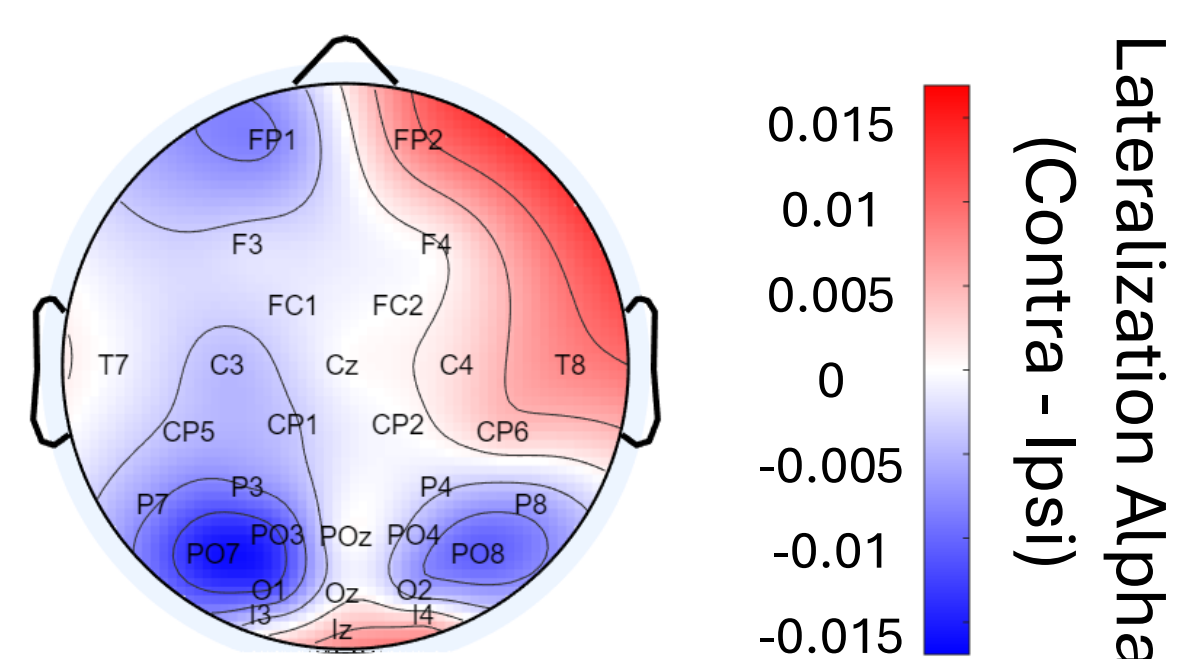
## How does sustained auditory spatial attention shape visual processing?

## Supplemental Results

**Eye Gaze:** Auditory spatial attention attracted gaze but did not drive the cross-modal effect<sup>2</sup>.



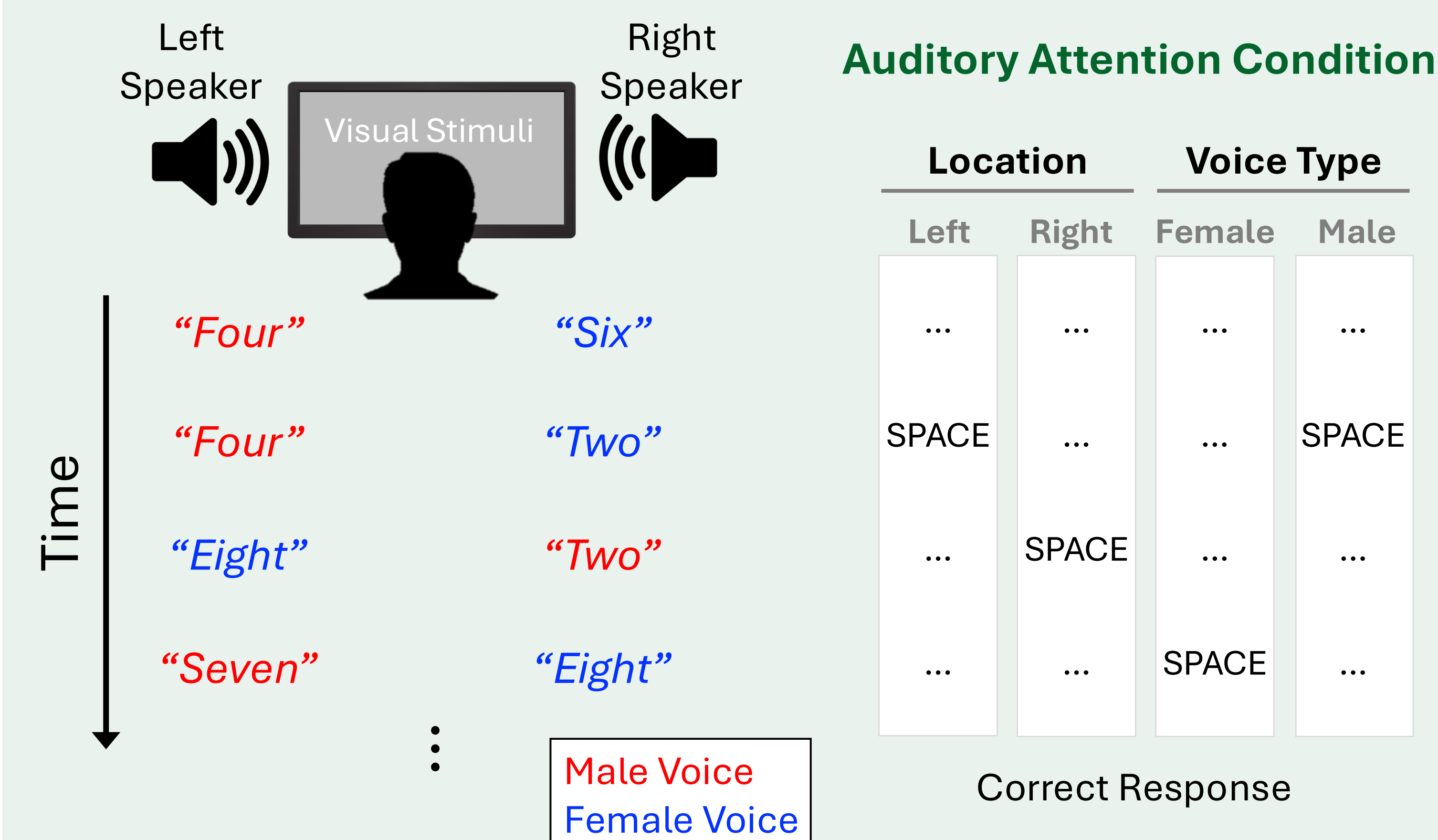
**Alpha Activity:** Auditory spatial attention reduced alpha-band amplitude over contralateral occipito-parietal cortex<sup>3</sup>.



## Methods & Results

### Dichotic listening paradigm

“Attend to the left speaker and press SPACE whenever the same digit is repeated twice in a row”

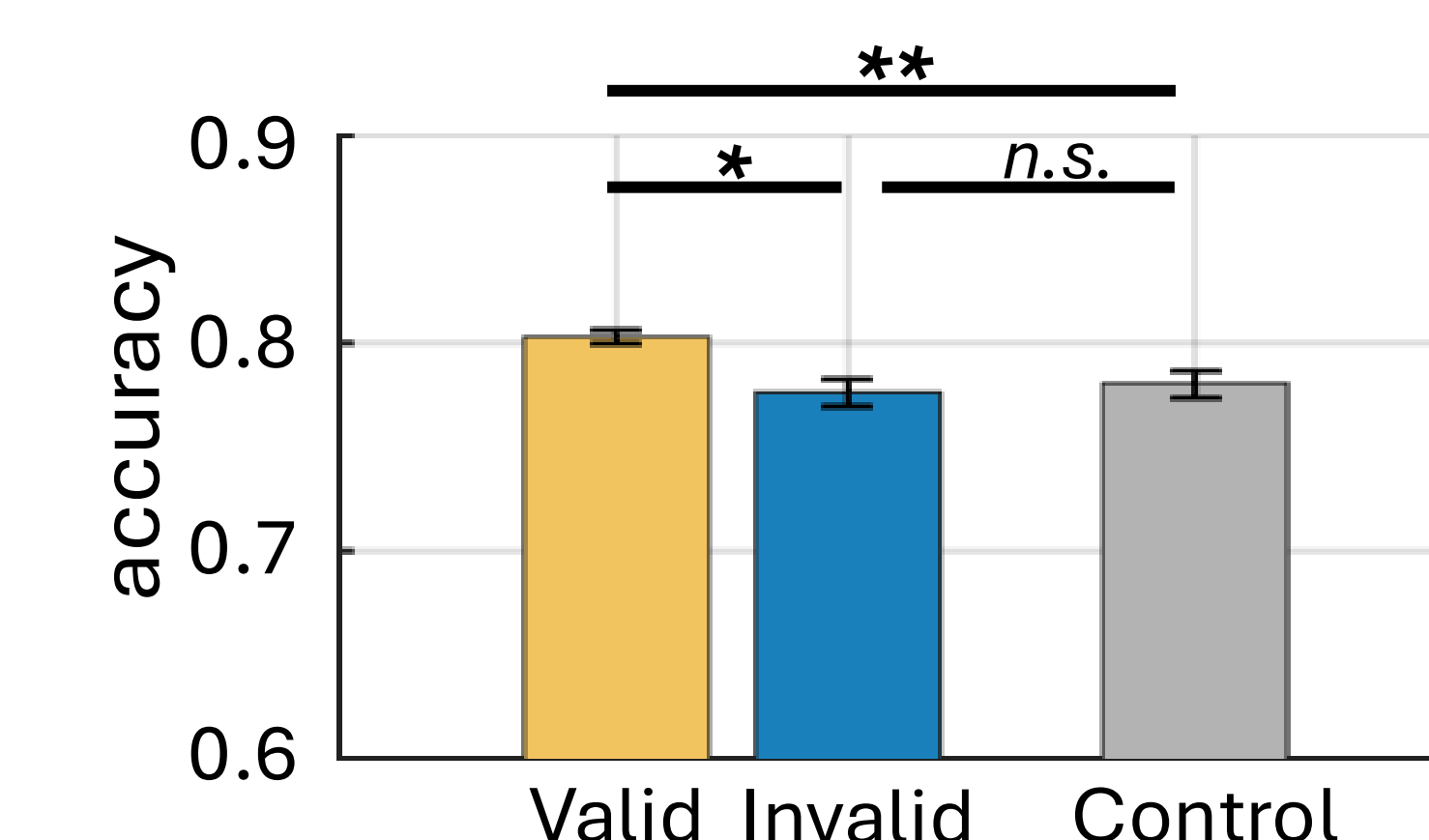
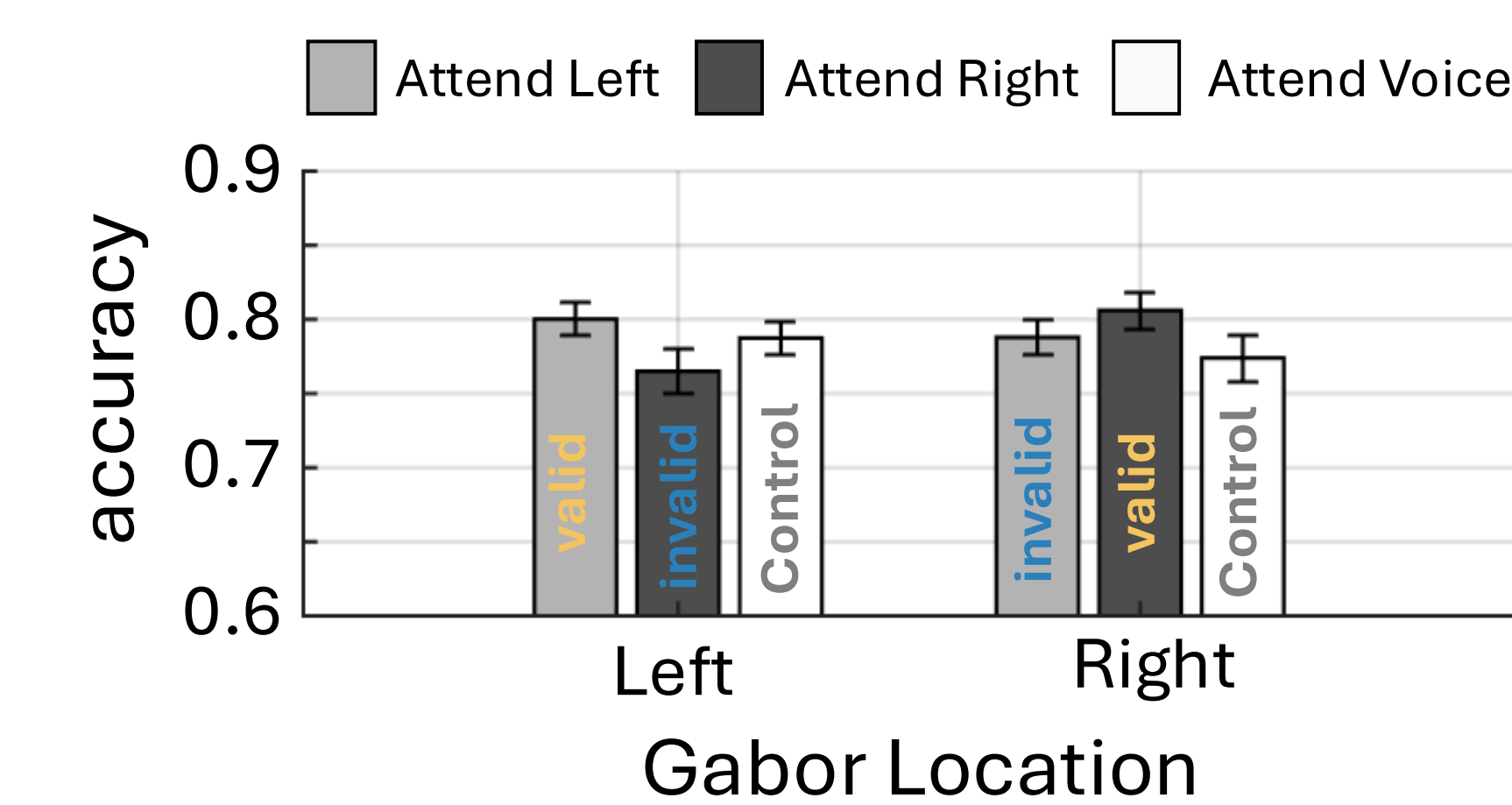
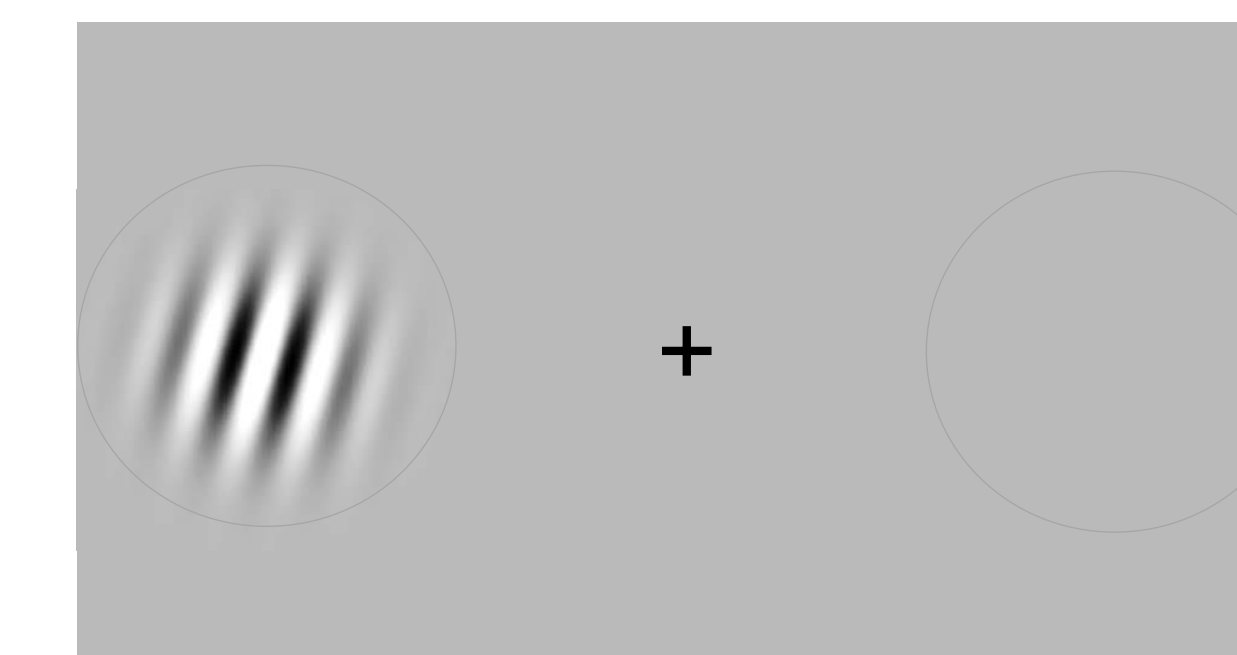


## Behavioral Experiment (N=24)

### Q. How does sustained auditory attention modulate visual perception?

- In a block design, subjects directed attention to the left, right speaker, or voice type (male or female) in separate blocks.
- A near-threshold Gabor patch was intermittently flashed in the left or right visual field for an orientation discrimination task.

“Report whether Gabor was tilted clockwise or counterclockwise”

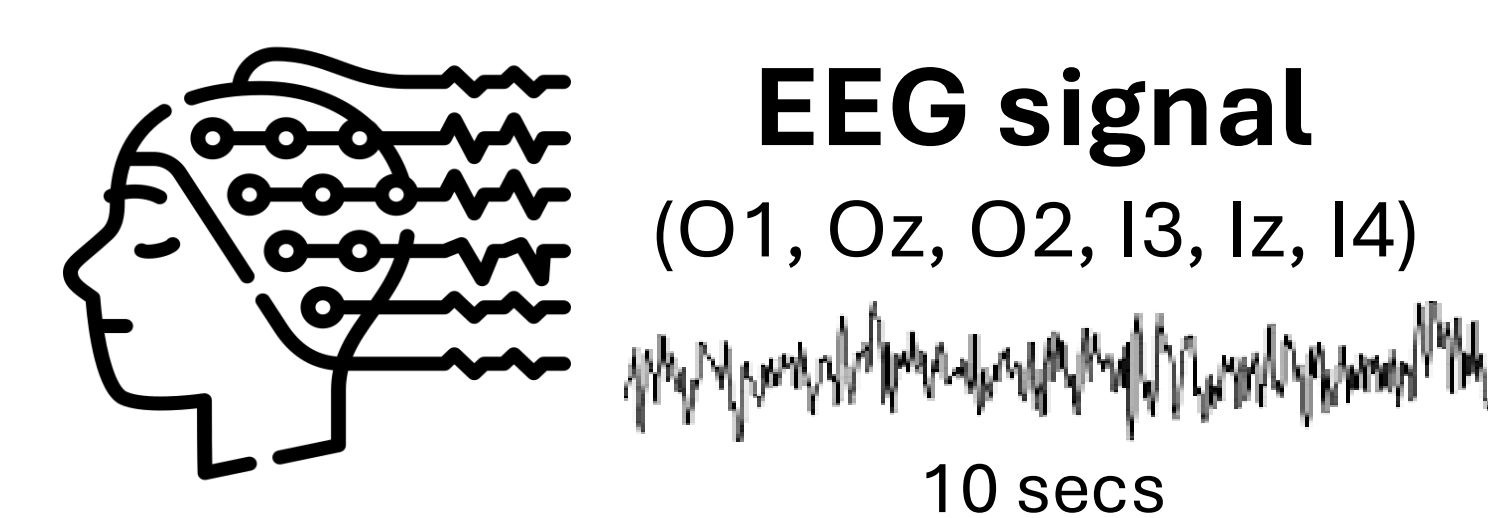
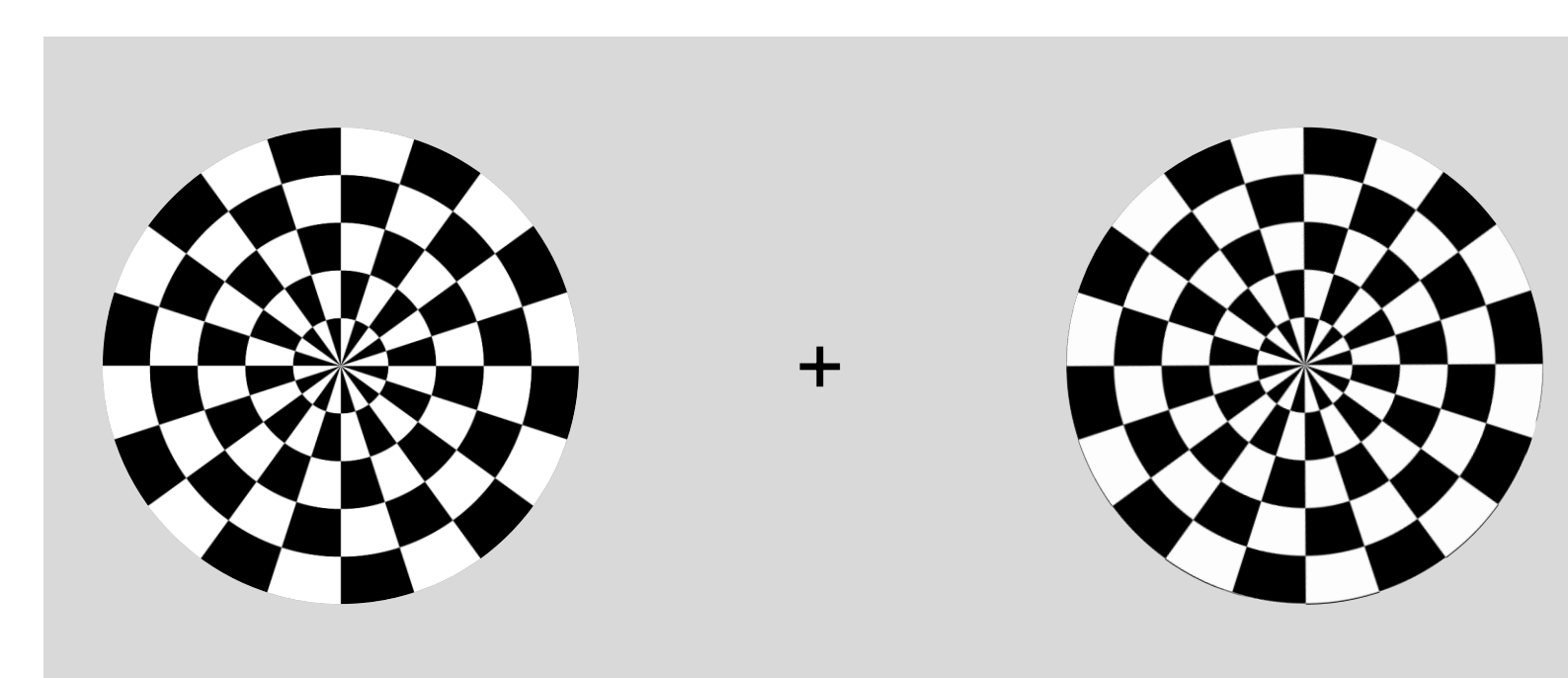


✓ **Auditory spatial attention enhanced visual sensitivity at spatially congruent locations.**

## EEG Experiment (N=14)

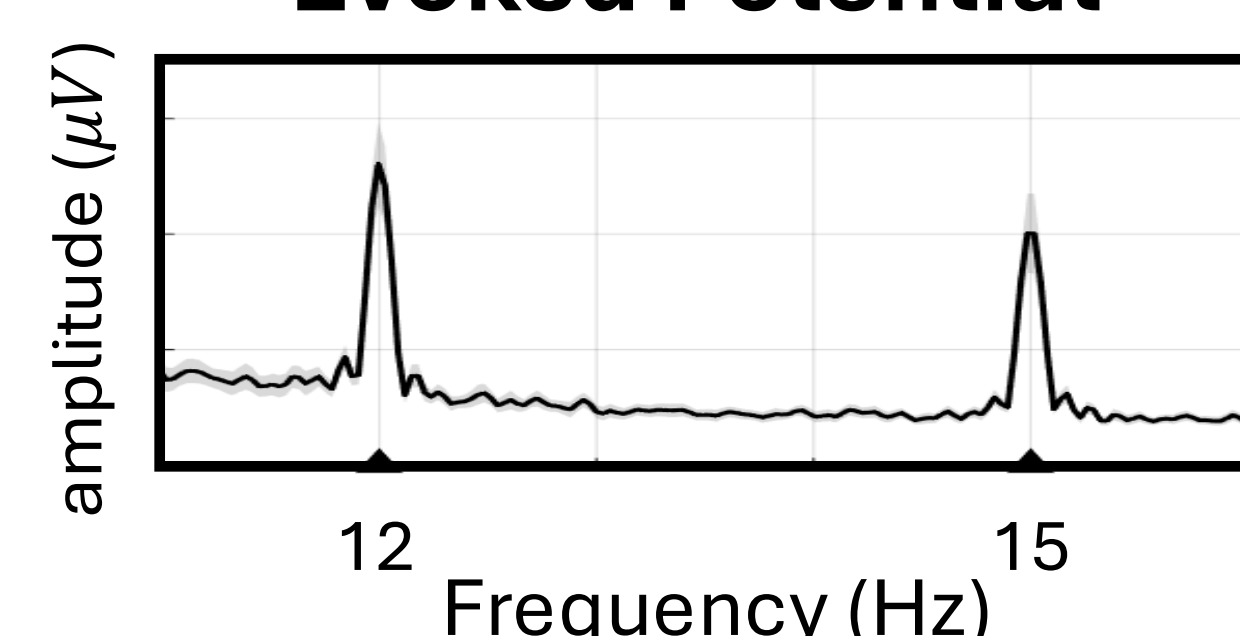
### Q. Does sustained auditory attention modulate visuo-cortical activity?

- We presented two task-irrelevant checkerboard patterns, flickering at different rates (12 or 15 Hz).

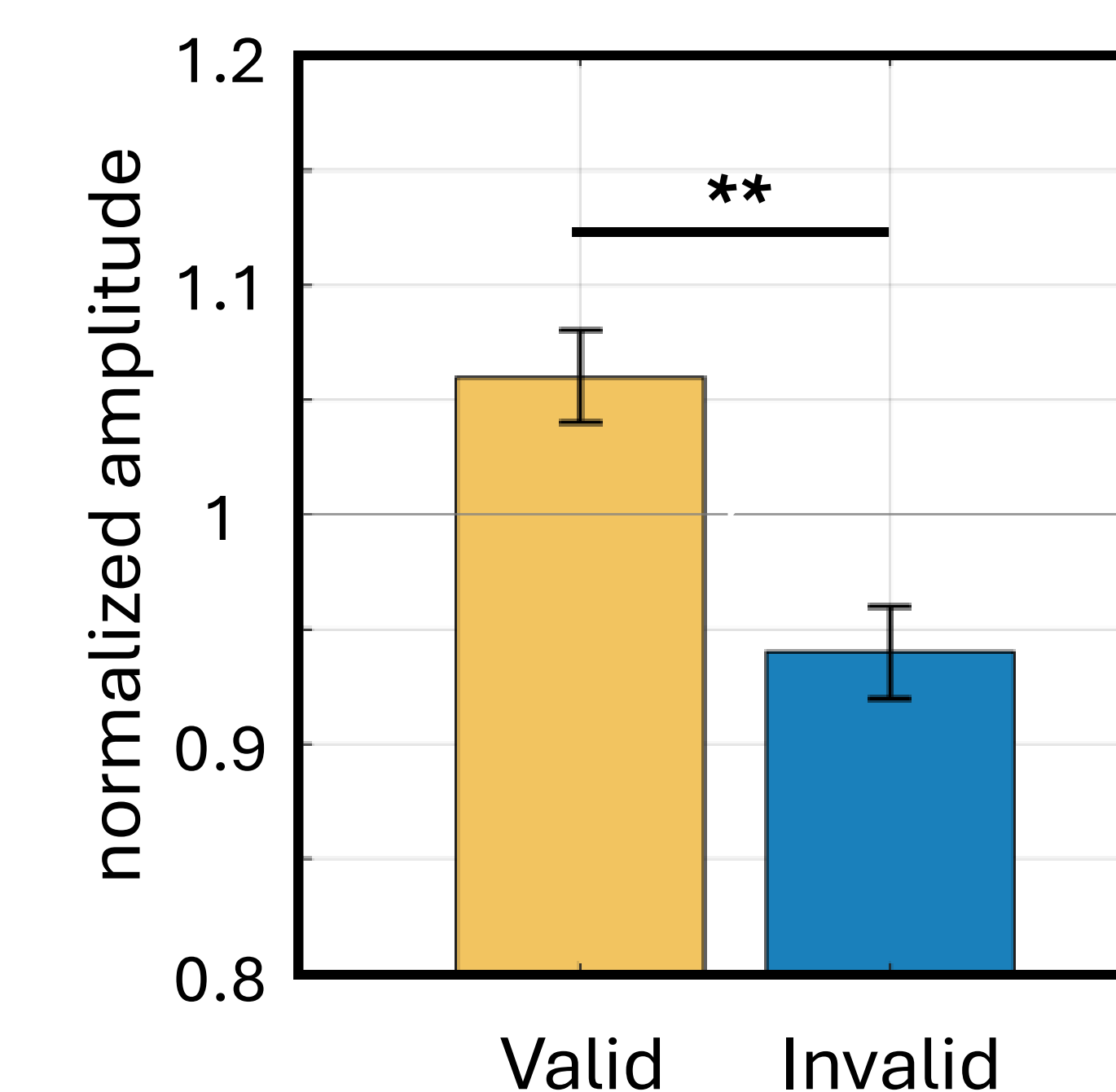
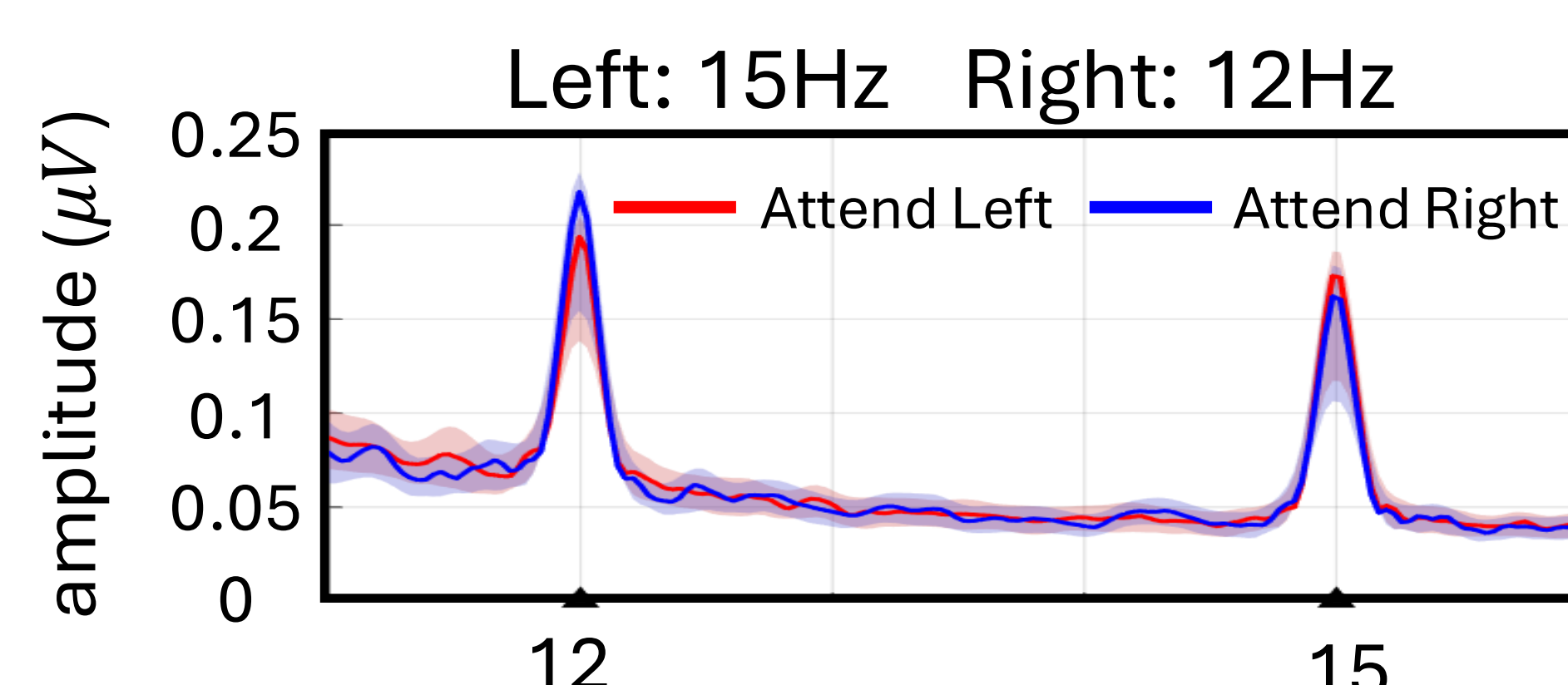
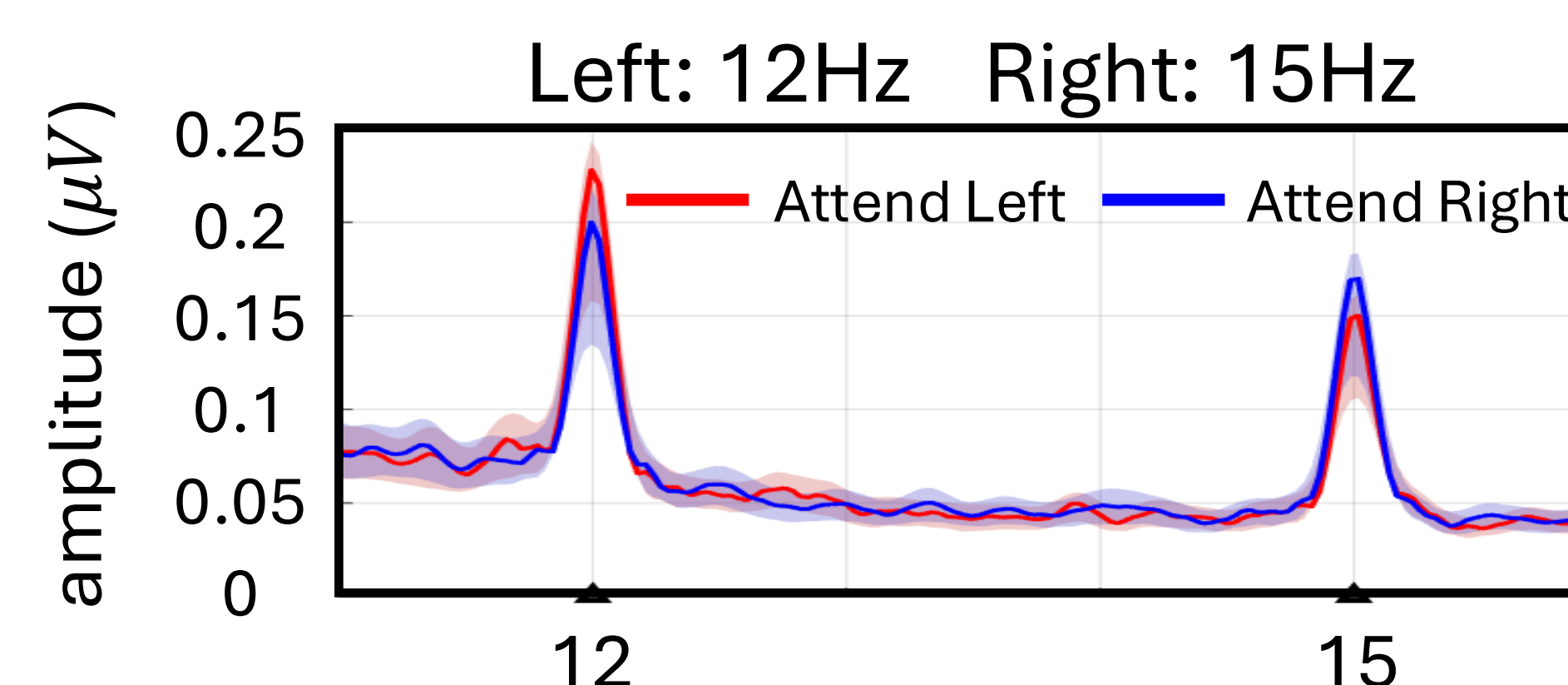
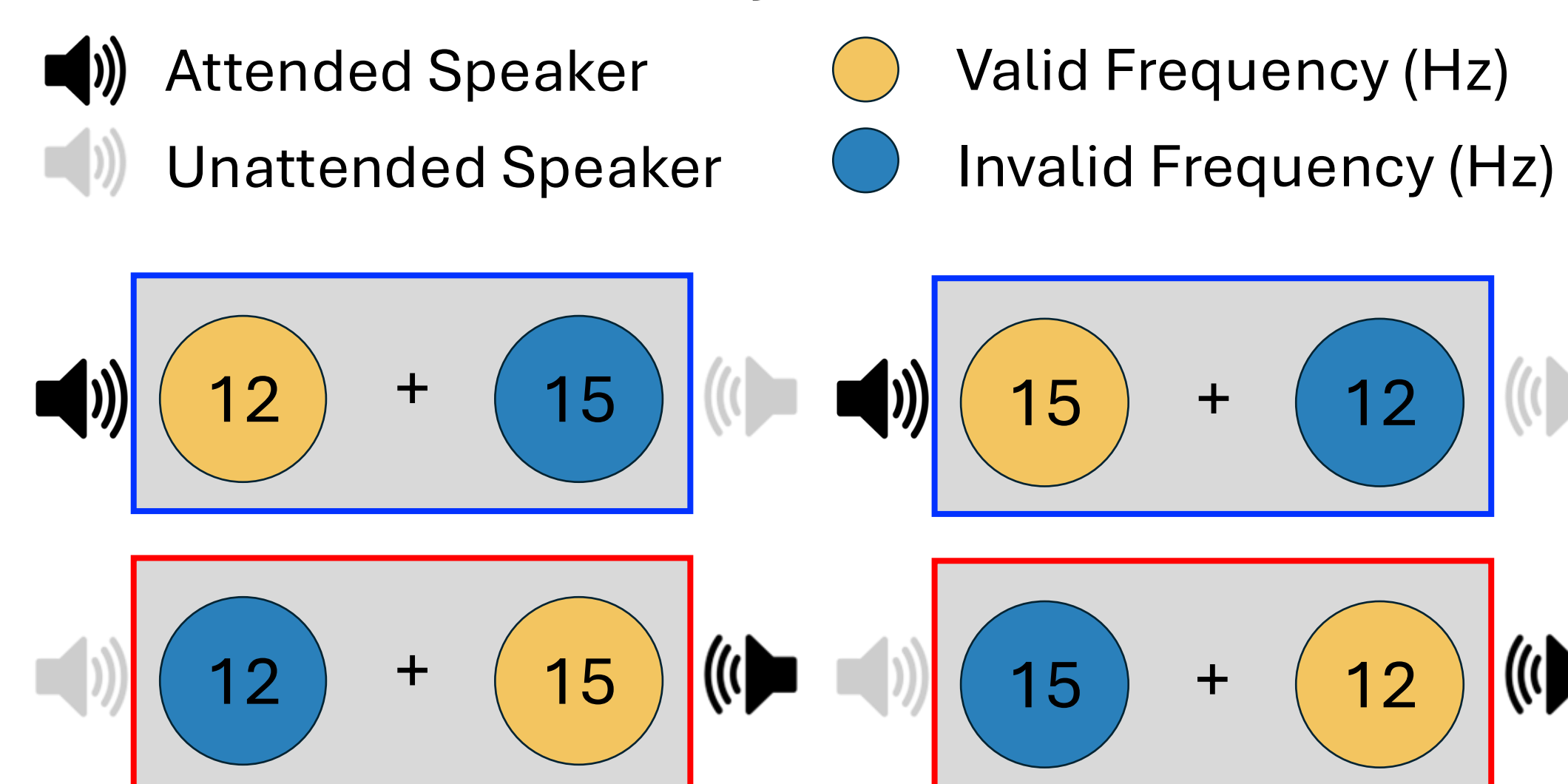


Fourier Transformation

### Steady-State Visual Evoked Potential



### Within-subject conditions



✓ **Sustained auditory spatial attention enhances visual-cortical processing in the congruent hemifield.**

✓ **Enhanced visual processing occurs even when the visual modality is completely task-irrelevant.**

## Conclusion

- We found behavioral and neural evidence indicating facilitation of visual processing under sustained auditory attention.
- The facilitation was spatially specific and emerged even when visual modality was entirely task-irrelevant.
- Together, these results suggest tight coupling between spatial attention across modalities.

## References

- Störmer et al. (2009). Cross-modal cueing of attention alters appearance and early cortical processing of visual stimuli. PNAS, 106(52), 22456-22461.
- Keefe & Störmer. (2021). Lateralized alpha activity and slow potential shifts over visual cortex track the time course of both endogenous and exogenous orienting of attention. NeuroImage, 225, 117495.
- Popov et al. (2023). Brain areas associated with visual spatial attention display topographic organization during auditory spatial attention. Cerebral Cortex

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