

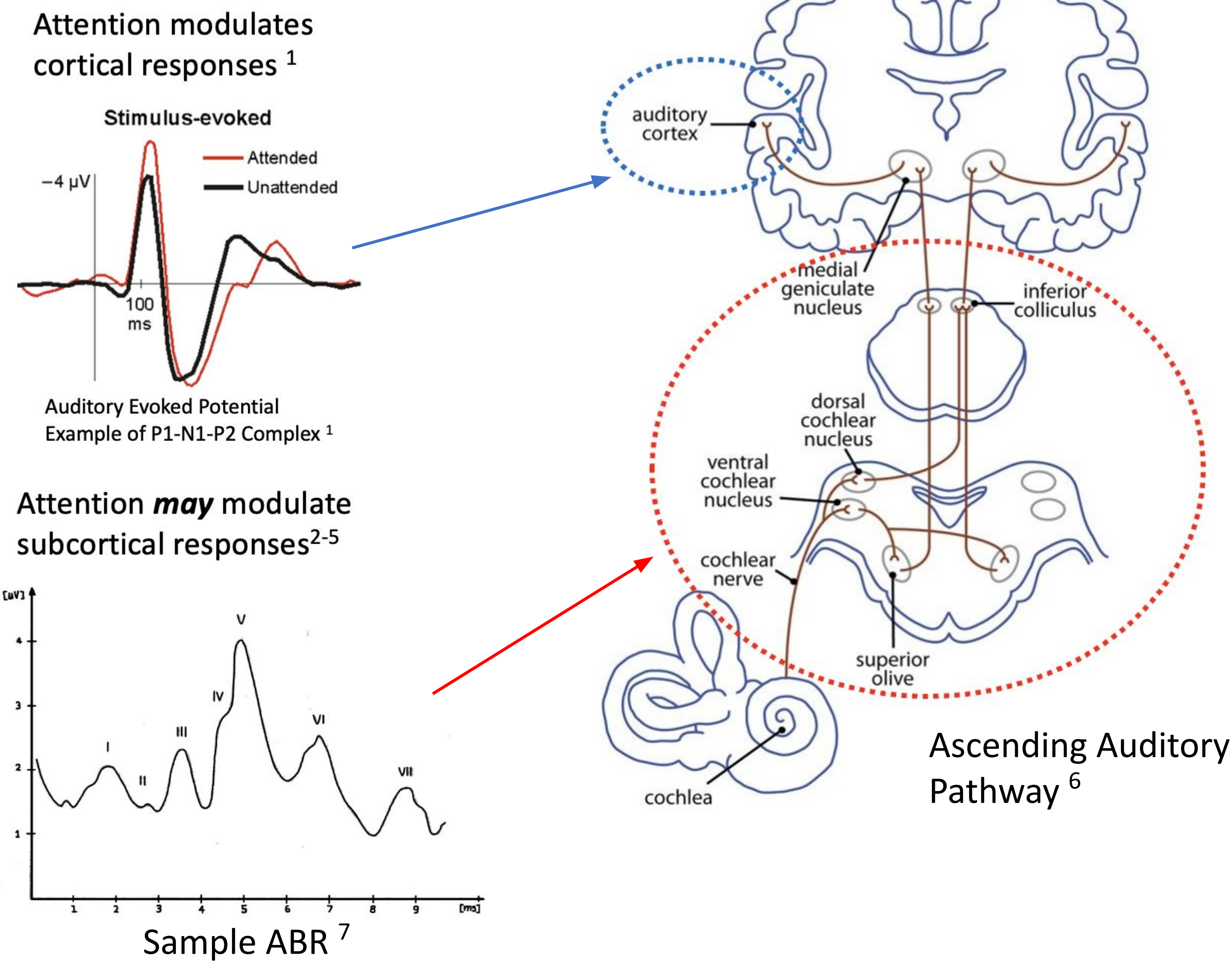
Effect of Attentional Modulation on Cortical and Subcortical Responses to Competing Streams Using EEG

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Does attention modulate subcortical responses?

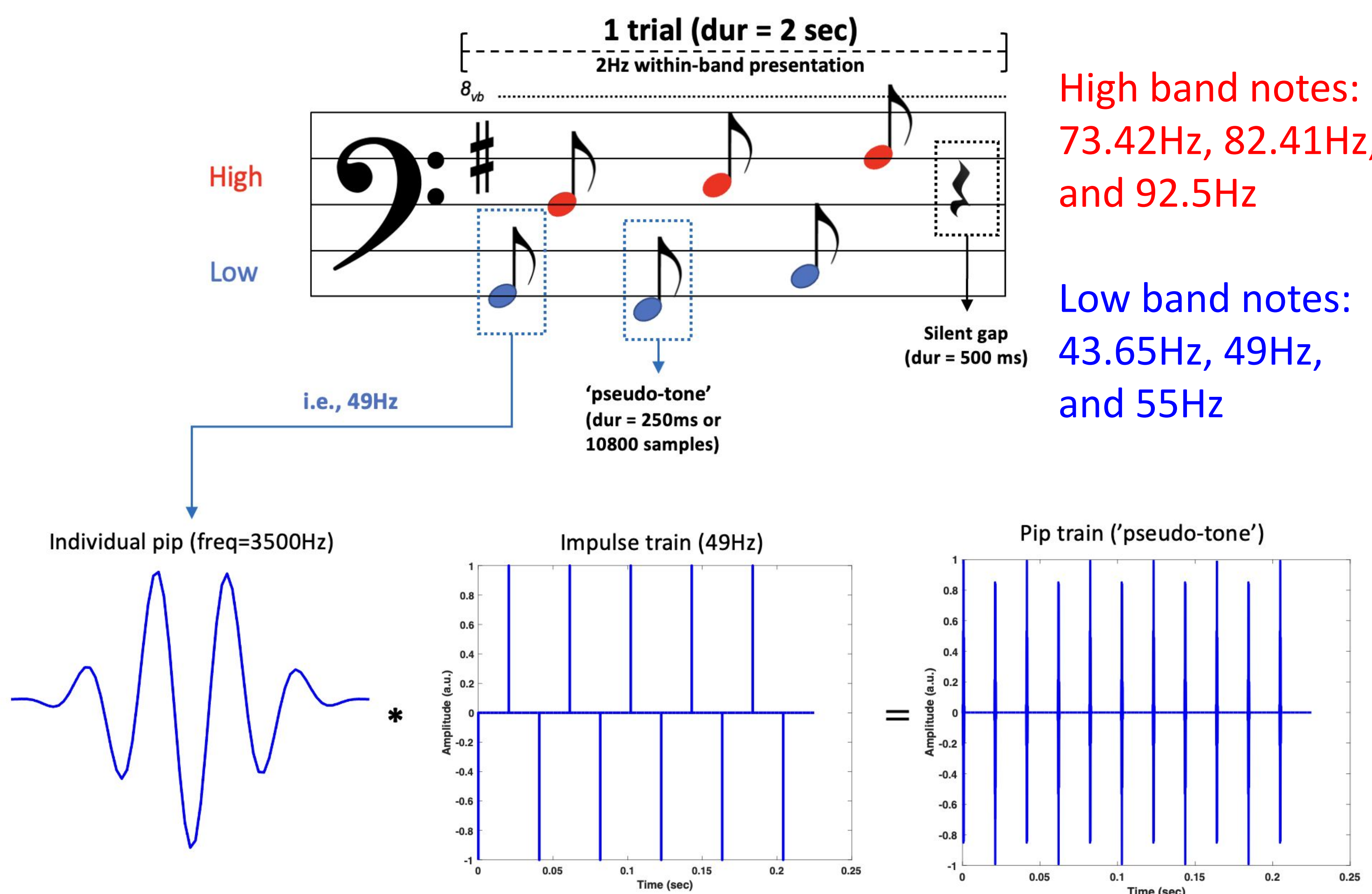
1. Introduction



• Aims: In the same dataset,

1. Show that attention modulates phase of *cortical* responses to temporally interleaved, competing streams
2. Determine whether top-down attention modulates *subcortical* responses (auditory brainstem responses, ABR) to competing streams

2. Stimuli Generation

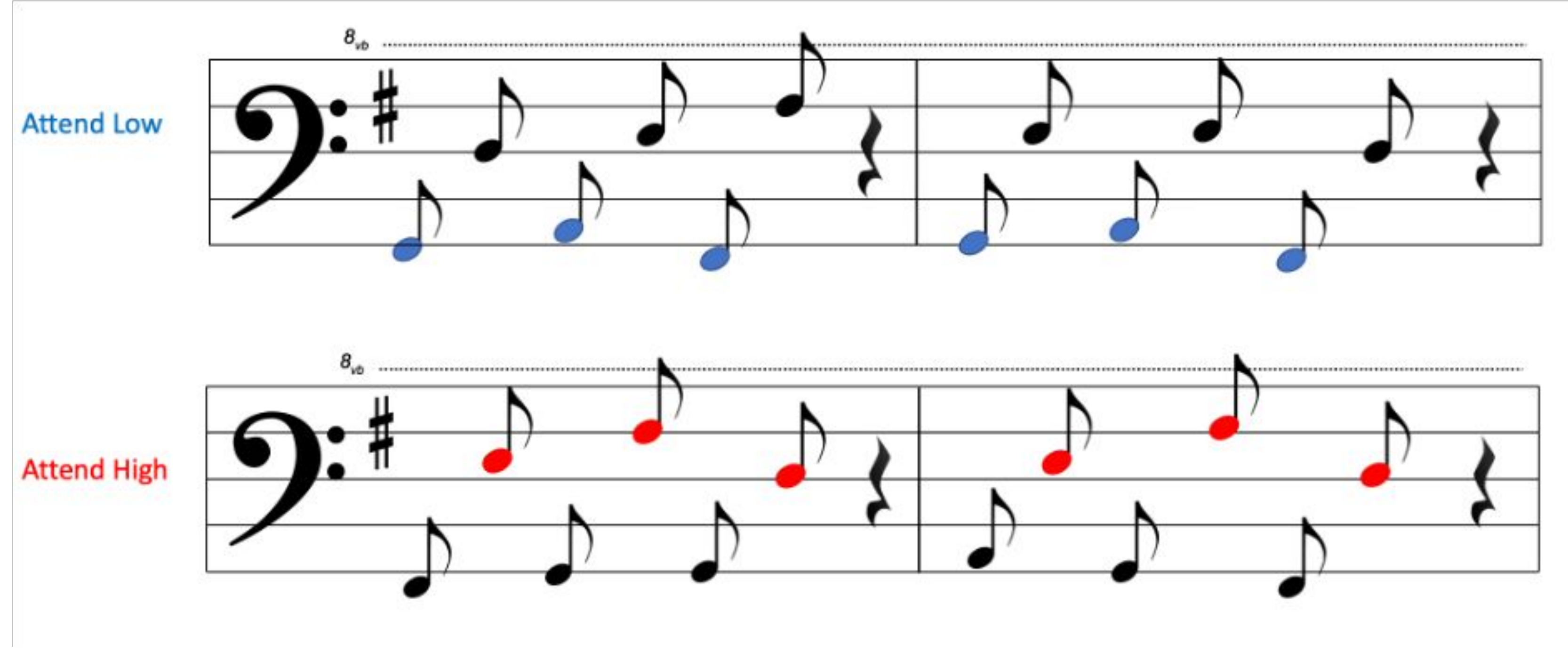


- Streams separated in space & pitch, requiring top-down attention⁸⁻¹⁰
- Notes comprise complex, narrowband tone-pips, evoking robust ABRs¹¹⁻¹²

3. Methods

- **Presentation:** Dichotic at 65 dB SPL
 - High carrier/pitch: right ear
 - Low carrier/pitch: left ear
- **Subjects:** 6 (3 F/3 M), normal hearing

- **1-back task:** Respond if the previous 3-note sequence was a repeat

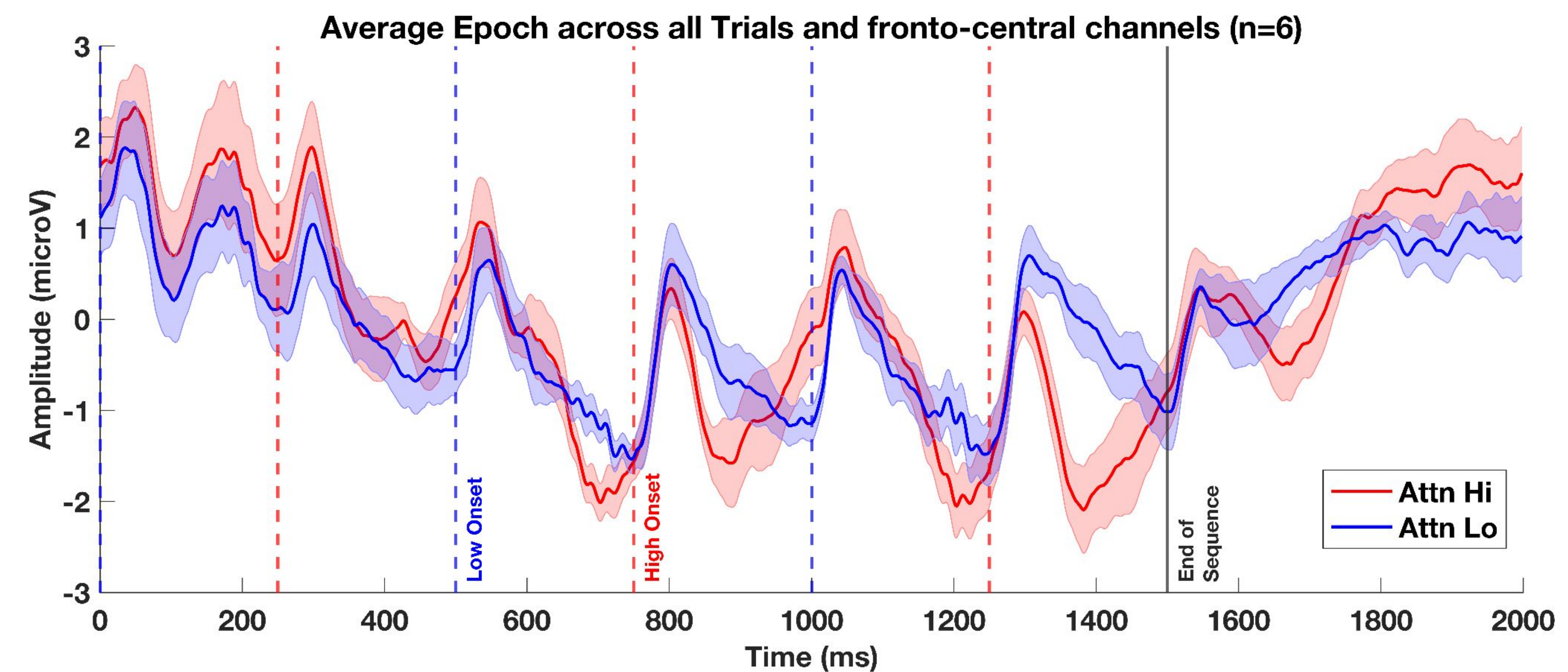


4. Data Collection and Analyses

- 32-Channel EEG (ear lobe reference), Biosemi ActiveView EEG System (16 kHz)
- Cluster of fronto-central electrodes
- Cortical Processing
 - Downsample to 500Hz
 - Bandpass filter (0.3-30Hz)
 - Artifact removed with ICA
 - Epoch length of 1 trial (2 sec)
 - Average epochs for each condition
- ABR Processing
 - Bandpass filter (30-1500Hz)
 - Epoch length of one tone pip (-5 to 15ms)
 - Average epochs across tone pips for each condition

5. Attention modulates cortical responses

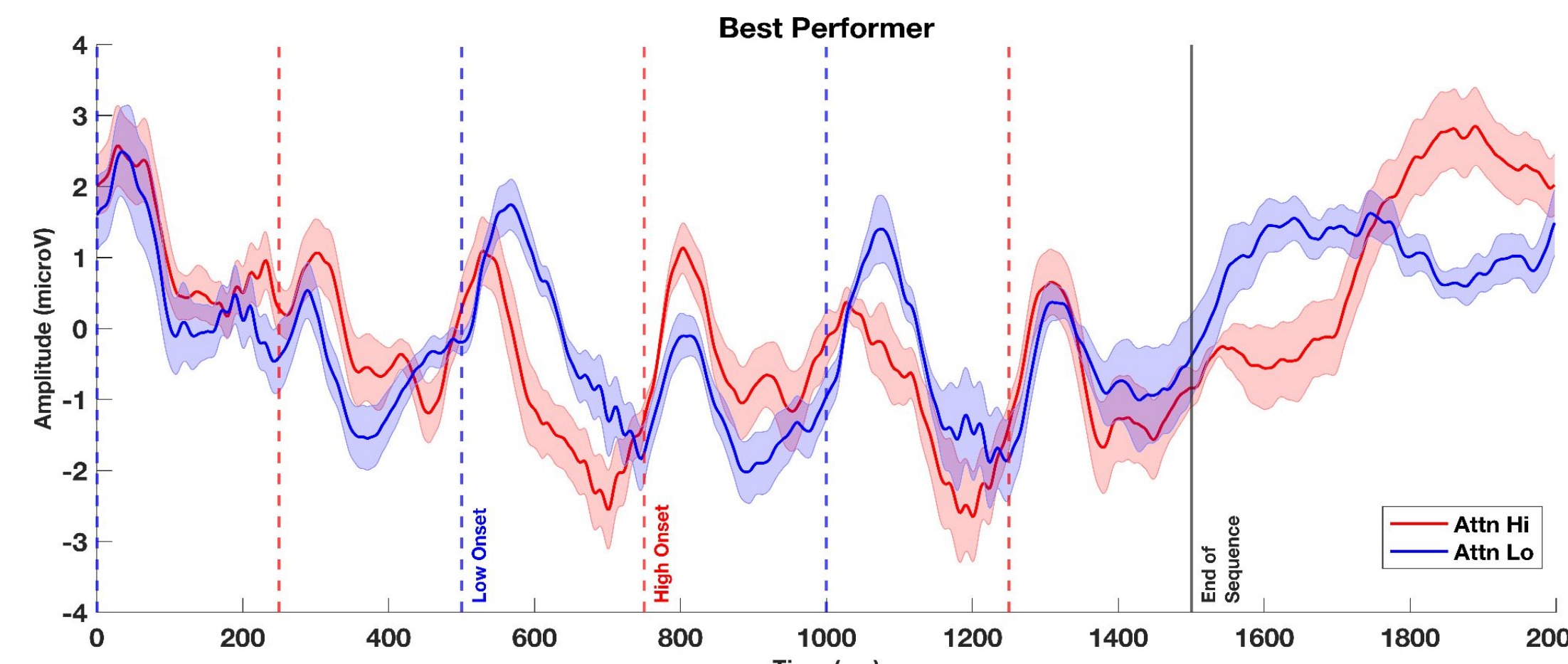
- Every other note enhanced (low or high, depending on attended stream)
- Each note onset evokes cortical activity but the cortical responses overlap



- Comparing best and worst performer

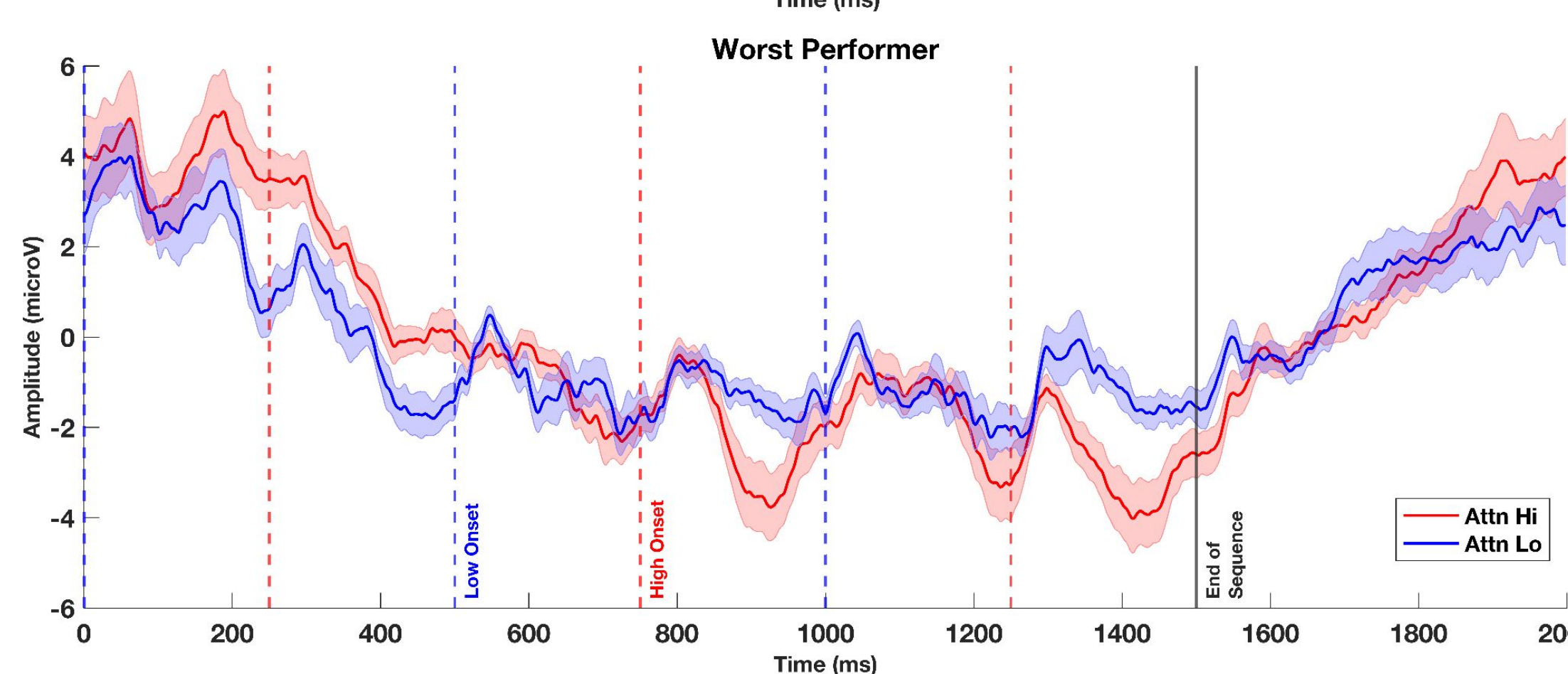
Best performer

- d' high: 3.99
- d' low: 3.61
- Phase shift: 2.34 rad (134 deg)



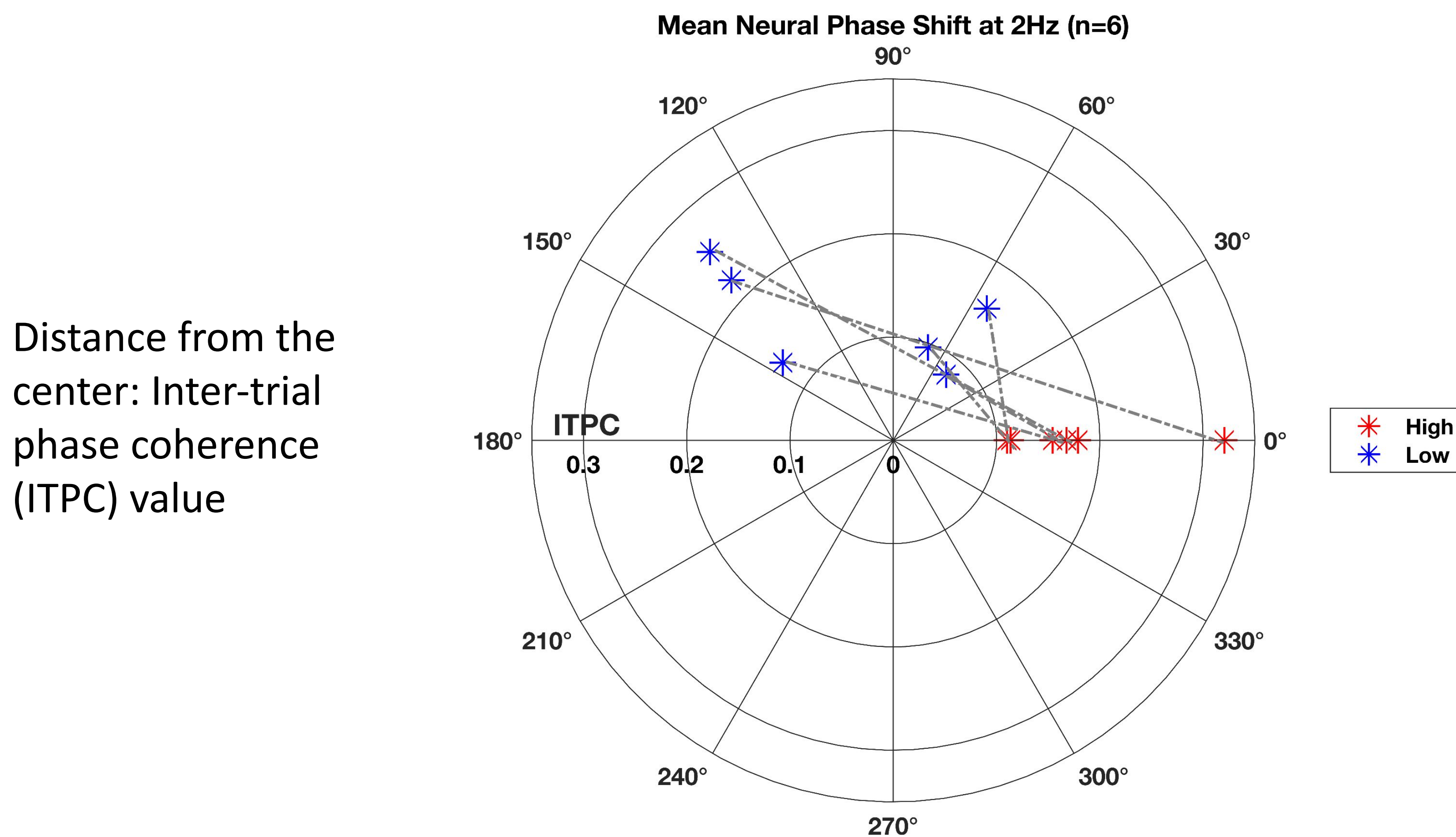
Worst performer

- d' high: 2.61
- d' low: 1.61
- Phase shift: 0.89 rad (51 deg)



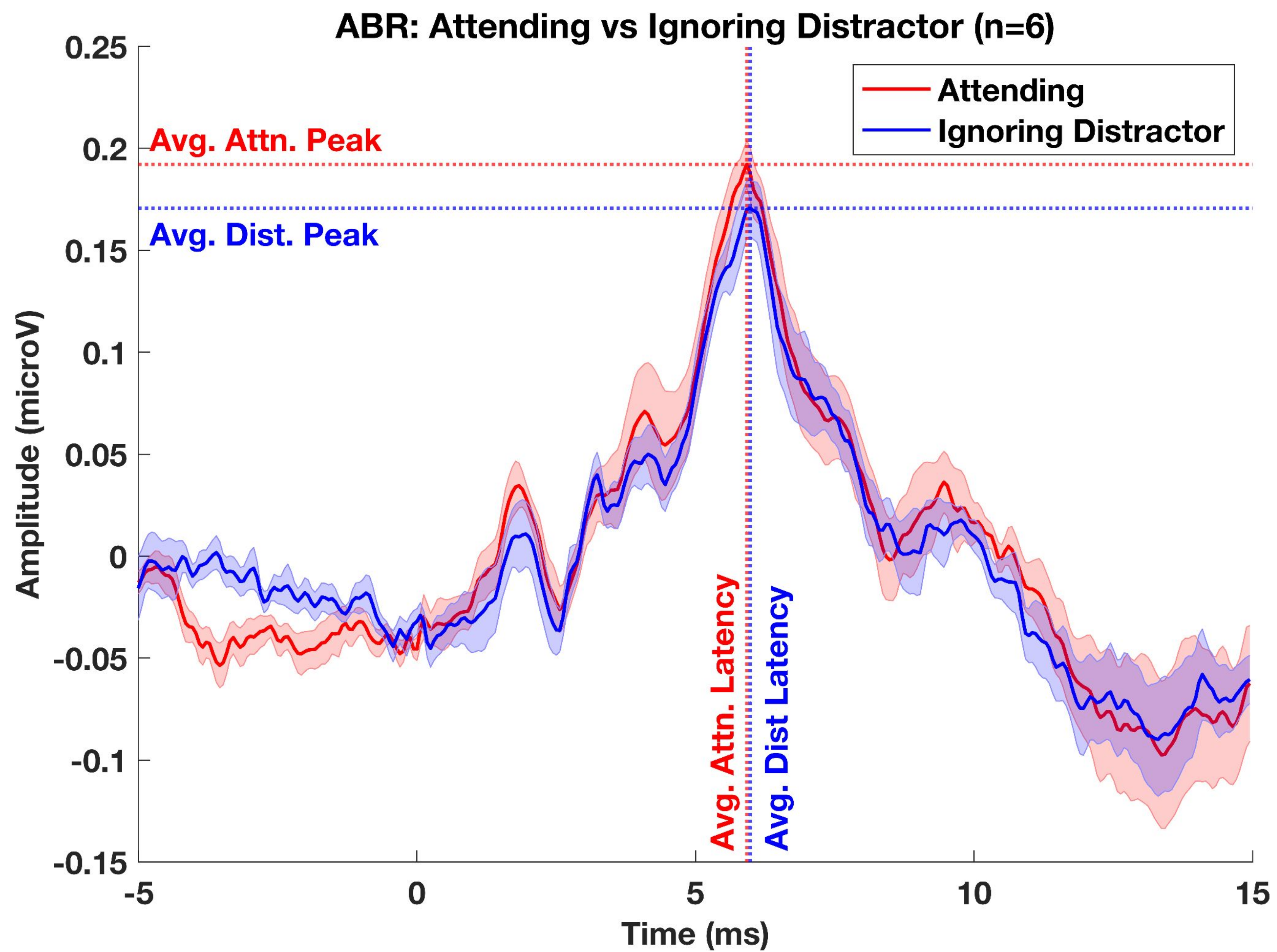
6. Attention modulates neural phase

- Past results: good listeners show 180 degree phase separation between conditions⁸⁻¹⁰
- Our preliminary results affirm this



7. Robust auditory brainstem responses

- Little evidence for differences in ABRs due to attention (but need more data)



8. Summary and Next Steps

Summary

- Stimuli successfully evoke both robust cortical and subcortical responses
- Attention modulates cortical responses (clear even with small N)
- Inconclusive results for ABR so far, but little evidence of attention effects

Next Steps

- Gather a full cohort of subjects (will recruit 70 subjects)
- Perform Bayes factor analysis
- Analyze individual differences (i.e., musician vs. non-musicians)

References

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