

Effects of Sustained Auditory Selective Attention on Cortical and Subcortical **Representations of Sound**

1. INTRODUCTION



- Ascending Auditory Pathway⁶ • Auditory selective attention is our ability to focus on specific
- sounds while ignoring competing sounds
- Attention modulates *cortical* representations of sound¹
- Whether modulation occurs in *subcortical* structures is unclear²⁻⁵

Objectives:

- Show that attention modulates event-related potentials (ERPs), an index of *cortical* activity
- Determine if top-down attention modulates auditory brainstem **responses (ABRs)**, which are *subcortical* representations of sound

2. STIMULI AND TASK DESIGN



High band notes: 73.42Hz, 82.41Hz, 92.5Hz; tone-pip carrier frequency 4500 Hz Low band notes: 43.65Hz, 49Hz, 55Hz; tone-pip carrier frequency 3500 Hz Stimuli Design:

- Streams separated in space & pitch, requiring top-down attention ⁸⁻¹⁰
- Each individual tone-pip within a pseudo-note elicits one <u>ABR¹¹⁻¹²</u>
- <u>Pseudo-note onset elicits strong cortical response⁸⁻¹⁰</u>

Selective Listening Task:

- Melodies presented dichotically at 65 dB SPL
- High carrier/pitch: right ear; Low carrier/pitch: left ear
- One-back task: Respond when previous 3-note sequence is a repeat

References

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Not all subjects produced clear ERPs to low notes (7 omitted above right)

5. ATTENTION MODULATES NEURAL PHASE

- A fast Fourier transform was applied to each trial to calculate the inter-trial phase coherence (ITPC) and average neural phase at 1.5 Hz
- ITPC quantifies consistency of phase of neural oscillations (0-no phase constancy, 1-perfect phase alignment)
- Average neural phase indicates timing of neural oscillations relative to stimuli



In agreement with previous studies⁸⁻¹⁰, better behavioral performers tended to have average neural phase shifts closer to 180 degrees

6. TONE PIPS IN PSUEDO-TONE EVOKED ROBUST ABRs



Each ABR trial weighed by inverse variance of whole 6-note trial Attention may be modulating the post-wave V peak, in agreement with a companion study in the lab; will need more subjects to confirm

7. SUMMARY AND NEXT STEPS

- Attention modulated cortical activity as quantified by N1-P1 peak difference Better behavioral performers had neural phase shifts closer to 180 degrees not typically examined, though this will be better characterized with more data Will continue data collection (planning to recruit 34 subjects)
- ABRs results inconclusive: attention may be modulating a later component that is

Acknowledgements

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