Sleep-mediated Learning of Distorted Speech

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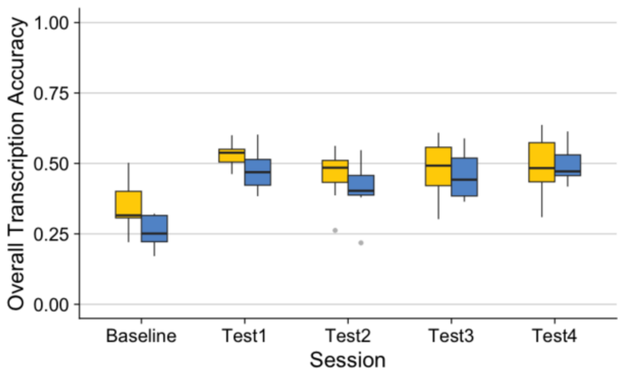
Introduction

- The process of learning speech is part of what's known as perceptual learning, or our ability to interpret our sensory experiences.
- This process must be highly adaptable to adjust to and interpret new stimuli like a new speaker or degraded speech, similar to the signals transmitted through Cochlear Implants (CI). Noise-Vocoded (distorted) speech is a form of electronically degraded speech, and is similar to CI speech signals
- Auditory training has been shown to help learn and adapt to this novel type of speech signal through exposure and practice, allowing for the generalization of heard inputs into identifiable speech sounds.[2]
- Memory consolidation is known to generalize the novel signal in order to more accurately interpret the degraded speech. Memory consolidation occurs most often and efficiently during periods of sleep, where it is known specifically as sleep consolidation.[3]
- Previous research has suggested that sleep consolidation in particular stabilizes speech learning, but due to methodological limitations it remains unknown if sleep itself stabilizes performance or if it's a result of mere lack of auditory interference.[1]

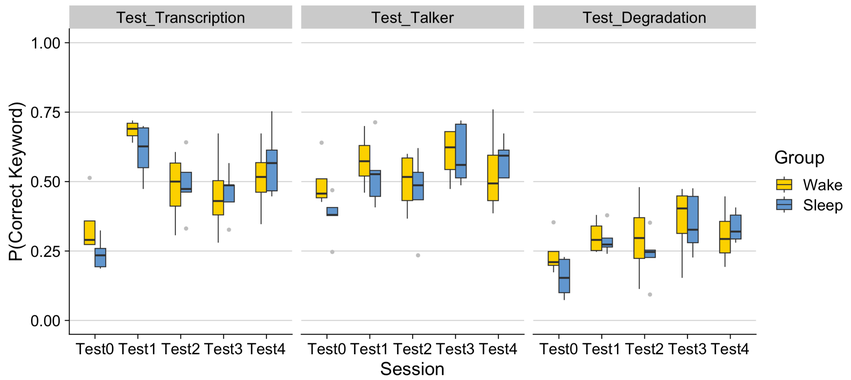
Question: Does sleep-mediated memory consolidation predict improvements in adaptation to acoustically degraded speech?
Hypothesis: Listeners in the sleep condition will see increased accuracy in the auditory transcriptions initially conversely, participants the wake condition would miss this benefit of consolidation, but similarly improve after their own sleep periods.

Results & Discussion

Transcription Performance Across Test Sessions



Transcription Performance Across Each Sub-test



- Initial improvement is clear after training (between baseline/Test0 and Test1), with relative stabilization across conditions for later tests
- Pilot data shows differences between performance on each sub-test, with degradation as the most difficult
- Similar averages overall, but more clear shifts in performance across testing sessions when examining sub-tests

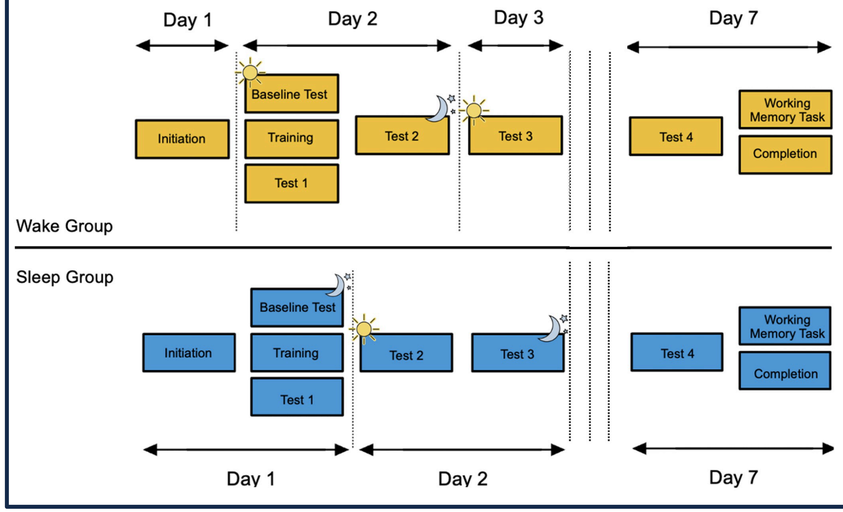
Methods

Participants

- Participants were assigned to a wake (n = 7) or sleep (n = 7) group and completed remote training and testing on noise-vocoded speech across a 1-week period.
- Participants were monolingual American English with no reported deficits in speech, language, or hearing, and passed a hearing screening
- During the experiment, participants wore wristband actigraphs, recording daily sleep and wake cycles through movement sensitivity and ambient light, and they completed daily sleep logs

Stimuli & Procedure

- **Training**: consists of 3 talkers, 150 unique sentences (50/talker), 6-channel distortion, feedback in the form of correct transcription
- **Tests**: include 90 unique sentences, with 30 per sub-test; all trials consist of hearing a sentence and transcribing what was heard, scored via X/5 correct keywords
  - **Sentence test**: transcription of new and learned sentences
  - **Degradation test**: transcription of 4-channel sentences
  - **Talker recognition test:** transcription of three new and learned talkers



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