The relation between neural entrainment and speech intelligibility
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1. Introduction

Objective correlates of speech understanding
- Speech entrainment is a primary cue for speech understanding [Shannon et al., 1986]
- Cortical neural activity tracks the neural entrainment of running speech [Paulus and Davis, 2010]
- Reconstruction of speech entrainment from cortical activity is possible [Ding and Simon, 2011]

Research questions
Question 1: Do the reconstruction quality of the speech envelope correlate with behaviourally measured speech understanding?
Question 2: Does the reconstruction quality of the speech envelope depend on how much attention the subject paid to the stimulus?

2. Methods

Participants
- 33 young normal hearing subjects, aged 21-29 years
- 3 young normal hearing subjects, aged 22-29 years
- 4 young normal hearing subjects, aged 21-29 years

EEG conditions
- Monotonicity measured as a function of lower SNR values
- Monotonicity measured as a function of upper SNR values
- Monotonicity measured as a function of middle SNR values

Integration window
- 0-75 ms integration window
- 0-250 ms integration window

3. Results

3.1. Experiment 1: effect of stimulus SNR
The reconstruction quality increases with stimulus SNR. For the maximal attention condition, we found no significant correlation between reconstruction quality and SNR at 33 dB above 10 Hz. Both methods were performed using a 75 ms integration window. A 33 dB increase in SNR resulted in a significant increase in reconstruction quality. The right hand figure shows a significant correlation between reconstruction quality and SNR at 100 Hz above 10 Hz. Both methods were performed using a 75 ms integration window. A 33 dB increase in SNR resulted in a significant increase in reconstruction quality.

3.2. Experiment 2: effect of watching a movie
The reconstruction quality increases with stimulus SNR. For the maximal attention condition, we found no significant correlation between reconstruction quality and SNR at 33 dB above 10 Hz. Both methods were performed using a 75 ms integration window. A 33 dB increase in SNR resulted in a significant increase in reconstruction quality. The right hand figure shows a significant correlation between reconstruction quality and SNR at 100 Hz above 10 Hz. Both methods were performed using a 75 ms integration window. A 33 dB increase in SNR resulted in a significant increase in reconstruction quality.

4. Conclusion

We found that reconstruction quality of the speech envelope increases with stimulus SNR when choosing an integration window of 0-75 ms and a post-stimulus window of 0-250 ms. Our hypothesis is that the integration window enhances the effect of attention on the level of entrainment. These results can be explained as follows: early responses (< 15 ms) are best modulated by attention compared to late responses (15-75 ms). Frequency in the right hand figure was more pronounced in the early responses than in the late responses of the neuron signal. These results can be explained as follows: early responses (< 15 ms) are best modulated by attention compared to late responses (15-75 ms). Frequency in the right hand figure was more pronounced in the early responses than in the late responses.

References

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