

The effect of accent on speech recognition in a competing-talker background: Neural oscillations and the N400

Jieun Song, Paul Iverson

Speech, Hearing and Phonetic Sciences, University College London

jieun.song@ucl.ac.uk, p.iverson@ucl.ac.uk

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1. Introduction

In everyday listening situations, listeners often need to attend to speech that is masked by the speech from other talkers. When the distracting speech is intelligible, masking occurs at linguistic/informational levels as well as at acoustic levels. For example, background noise is found to be more detrimental to the recognition of the target speech when it is produced in a native language than in a foreign language [4]. Listening in these circumstances places demands on attention and cognitive control, and raises the overall cognitive load.

Speech recognition is also influenced by the accent of the talker and the listener, especially in the presence of background noise [1,3,5]. Given that foreign accents are often less intelligible, one could expect that smaller interference occurs when the competing speech is spoken with a foreign accent, and that attending to the target speech is relatively easier when it is spoken with an accent that matches the accent of the listener.

The aim of the present study was to investigate the effects of talker-listener accent differences on speech recognition in a competing-talker background. To this end, we examined how neural oscillations are entrained to amplitude envelopes of attended and unattended speech signals in EEG recordings, by measuring phase-locking between the two signals in the 4-8Hz range as shown in Peelle et al. [2]. In addition, we measured the N400 to investigate word recognition processes.

2. Method

Native speakers of Southern British English with normal hearing participated in the experiment. English sentences recorded by a native speaker of Southern British English and a native speaker of Korean were simultaneously presented to each ear. In each block, the subjects were instructed to attend to one of the talkers. The sentences also differed in the predictability of the final word; there were anomalous sentences, low-cloze probability sentences and high-cloze probability sentences.

3. Results & Discussion

The preliminary results from our phase coherence analysis showed some indication of greater neural entrainment to attended speech than to unattended speech, but the effect of accent was not clear with the current number of subjects.

The preliminary results from the N400 analysis found a smaller N400 effect overall compared to single-talker conditions, suggesting that under the greater cognitive load caused by competing-talker background noise, listeners likely reduce the depth and duration of lexical processing. In addition, there was a smaller N400 effect for the Korean accent than for the native accent in the target speech condition, as displayed in Figure 1 and 2. It seems that listeners are more strongly affected by cognitive load when processing a foreign accent. No effect of sentence context was found for the unattended speech in both accent conditions, demonstrating that attention to a speech stream modulates lexical processing at the level measured by N400.

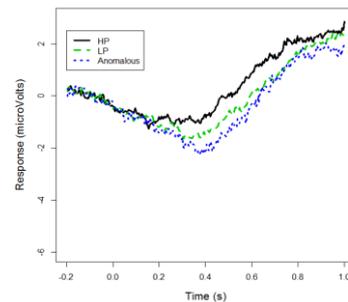


Figure 1: Grand average ERPs to final words spoken with the native accent in the three conditions of sentence context averaged at three midline electrodes (HP: high-cloze probability sentences, LP: low-cloze probability sentences)

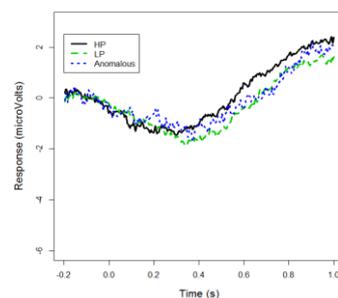


Figure 2: Grand average ERPs to final words spoken with the non-native accent in the three conditions of sentence context averaged at three midline electrodes (HP: high-cloze probability sentences, LP: low-cloze probability sentences)

4. References

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