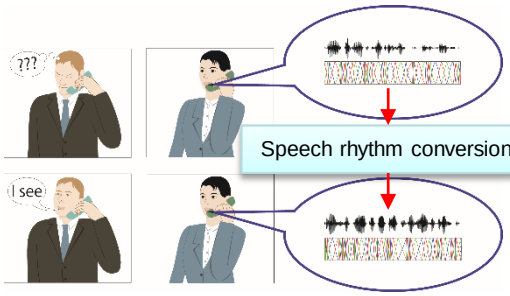
22 Does this sound like a native?

- Neural mechanisms of speech rhythm perception -

Abstract

Most native Japanese speakers have difficulty speaking English and therefore cannot communicate well in English with native English speakers. We have proposed a method 'Speak like a native' that can convert the speech rhythm of English sentences spoken by native Japanese speakers into stress-timed rhythm by a native English speaker. However, few studies have investigated the neural mechanisms of speech rhythm. In this study, we performed a functional magnetic resonance imaging (fMRI) scans when native English speakers listened to English sentences spoken by a Japanese native speaker (Japanese rhythm) and the converted speech (English rhythm). Results showed that supplementary motor area (SMA) was activated more by Japanese (less natural) rhythm than by English (natural) rhythm.

Speech rhythm conversion 'Speak like a native'



Speech rhythm of Japanese native speakers

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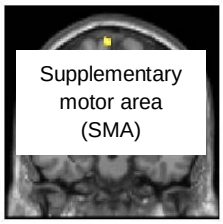
Speech rhythm of English native speakers

※NTD[1] is used for extracting speech rhythm from speech signals

- Extract speech rhythm for both speakers
- Conversion by replacing the rhythm between them

Functional brain imaging

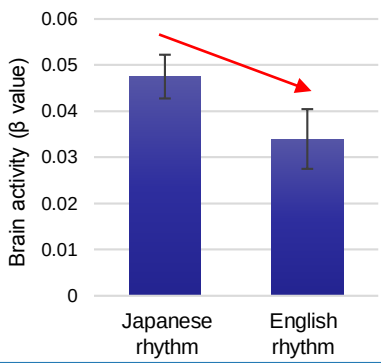
We measured brain activity when native English speakers listened to English sentences with Japanese and English rhythms.



Results

- We found that SMA was more activated by Japanese rhythm more than English rhythm.
- SMA is involved in articulatory planning in time. This indicates that SMA is involved in detection and modification of unnatural speech rhythm during speech perception.

- Brain activity in SMA decreased during listening to the rhythm-converted speech.
- This showed an importance of speech rhythm during speech perception.



Reference

[1] S. Hiroya, "Non-negative temporal decomposition of speech parameters by multiplicative update rules," *IEEE Transactions on Audio, Speech, and Language Processing*, Vol. 21, No. 10, pp. 2108-2117, 2013.

[2] S. Hiroya, K. Jasmin, S. Evans, S. Krishnan, M. Ostarek, D. Boebinger, S.K. Scott, "Effects of speaking rhythm naturalness on the neural basis of speech perception," *Society for Neuroscience Abstracts*, 2015.

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