Neural Underpinnings of Lexical Tone Learning
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Background

Introduction
- Second language (L2) learning is difficult when the L2 has elements absent from the native language.
- Mandarin, for example, is a tonal language while English is atonal.
- Metaphorical gestures representing pitch are effective in helping differentiate between meaning of Mandarin words (Morett and Chang, 2015).

Posterior Superior Temporal Sulcus (pSTS)
- Implicated in multimodal processing (auditory and visual; Krönke, K. M et al., 2013).

Laterality Shift
- Pitch gesture facilitates right-to-left shift in brain activity for L2 lexical tone processing in atonal language speakers (Krönke, K. M et al., 2013).

Aims

Understand the neural and cognitive mechanisms subserving pitch gesture processing in L2 learning.
Examine whether pitch gesture facilitates the right-to-left shift in brain activity during L2 lexical tone processing.
Determine whether pitch gesture’s facilitation of L2 lexical tone acquisition is due to embodiment or conceptual metaphor.

Method

Figure 1. Schematic of the four tones in Mandarin: 1- high flat; 2- rising; 3- low; 4- falling.
Figure 2. Brain with pSTS highlighted.

Figure 2. Schematic showing the study design. Note that only Phase 3 is repeated multiple times, as each of the word pairs are divided into sixteen blocks to minimize cognitive overload.

Figure 3. Images from study paradigm phases.

Figure 4. Schematic of fNIRS setup.

fNIRS

Increased activity in pSTS during pitch gesture condition because of pSTS involvement in iconic gesture processing.
Facilitation of right-to-left shift in brain activity during Mandarin lexical tone learning in pitch gesture condition.

Hypotheses

Knowledge about how the brain uses gesture to enhance L2 speech sound acquisition.
Importance of pedagogical use of pitch gesture in L2 lexical tone learning and intonation learning.

Implications

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References


Participants

Native English Speakers
Undergraduate Students
No Prior Exposure to Tonal Languages