Perceptual cues to English lexical stress: Comparison between native speakers and Mandarin second language learners

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Abstract
The present study investigates the role of F0, duration, and vowel quality in English lexical stress perception by second language learners with a tonal L1. Mandarin speakers learning English as a second language (advanced learners, n=25; beginning learners n=25) were compared to a control group of native English speakers (n=25). Re-synthesized disyllabic nonce words (dada) were presented in a stress localization task. Stimulatively manipulating five different F0 ratios (ratio of maximum fundamental frequency values of first and second vowel) and five different duration ratios (ratio of duration values of first and second vowel), stimuli were synthesized based on acoustic measurements from a previous study (Y. Lai and J. Sereno, J. Acoust. Soc. Am. 121, 3071 (2007)). Both full-vowel and reduced-vowel stimuli were used. The results indicated that full vowels most often attracted stress across all three listener groups. More interesting, beginning second language listeners relied mainly on duration cues to determine the stressed syllables and advanced listeners focused more on F0 cues, while native listeners made use of both cues. The findings will be discussed in terms of the similarities and differences between the prosodic systems of Mandarin and English.

Introduction - acoustic realization

- **Max F0 and duration**: Learners are more similar to native speakers in initial stressed words. In final stressed words, learners use duration cues to a lesser extent but rely heavily on F0.
- **F2**: Native speakers reduce unstressed vowels regardless of stress location and vowel (front and back), learners show similar patterns in syllable 2 but not in syllable 1 position. (Lai and Sereno, 2007)

Methodology

- **Stimulus construction**: Max F0 and duration
- **Spectral composition**: Native speakers sensitive to both max F0 and duration
- **Advanced learners**: sensitive to max F0 and duration, with a stronger effect for max F0 cue
- **Beginning learners**: sensitive to duration differences, insensitive to max F0 differences

Results

- **Profiency, max F0, and duration**: Native speakers sensitive to both max F0 and duration
- **Advanced learners**: sensitive to max F0 and duration, with a stronger effect for max F0 cue
- **Beginning learners**: sensitive to duration differences, insensitive to max F0 differences

Conclusion

- **Importance of perceptual cues for English stress**:
  - native English listeners use duration and then F0 as cues to stress
  - advanced Mandarin L2 learners of English rely mainly on F0 cues
  - beginning Mandarin L2 learners of English rely mainly on duration cues

When comparing stress realization, care should be taken to distinguish stress location:
- In the acoustic study, stress correlates vary across first and second syllable stress position
- In perception, cues to stress also vary across first and second syllable stress position; the same magnitude of acoustic difference has different perceptual consequences depending on prosodic position (initial or final)

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