Different acoustic cues for emphasis in teaching English word stress to Hong Kong Cantonese ESL learners of different proficiencies

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Abstract
The present study examined English word stress produced by twenty-two (11 highly proficient and 11 less proficient) native adult speakers of Hong Kong Cantonese (CS) learning English as a second language (ESL), in comparison with that produced by five native English speakers (NS). All participants read four English donor words, and CS also read the corresponding Cantonese loanwords. The three acoustic cues for stress, namely pitch (F0), duration (length) and intensity (loudness) values of the vowels were obtained from all syllables. While vowel duration was found to be the dominant cue, followed by F0, in distinguishing stressed and unstressed syllables in all speakers' production, HCS may have overused F0 and LCS may have underused vowel duration.
Key words: English word stress, Cantonese loanwords, acoustic cues, speaker proficiency

Introduction
To Cantonese speakers (CS) who have been using English as a second language (ESL), English word stress could be a challenge, because Cantonese, as a tone language, makes use of pitch to distinguish lexical meanings while English, as a stress language, makes use of not only pitch (fundamental frequency, F0) but also intensity (loudness) and duration (length). With regard to Cantonese speakers' English word stress acquisition, previous studies investigated either (1) Cantonese loanwords borrowed from English (Lai, 2004; Lai, Wang, Yan, Chan, & Zhang, 2011; Silverman, 1992; and Zhang, 1986) or (2) CS's pronunciation of English words (Chan, 2007; Lai & Ng, 2014a; 2014b; and Luke, 2000).

All studies in (1) agreed that loanword syllables corresponding to stressed ones in English were assigned a high level (55) tone. Epenthetic loanword syllables were assigned a low-mid (22) tone (Lai, 2004; Zhang, 1986), but loanword syllables corresponding to unstressed ones assigned a mid (33) (Zhang, 1986) or low-mid (22) tone (Lai, 2004; Lai, et al., 2011).

With regard to (2), while Chan (2007) found that CS could effectively represent word stress by manipulating duration, intensity and F0, Lai and Ng (2014a; 2014b) identified F0, rather than duration and intensity, as the dominant cue for producing stress in HCS and LCS. Luke (2000) reported stressed syllables as being assigned an H tone and unstressed ones an M or L tone.

As revised from Lai and Ng (2014a), which compared only HCS and LCS (excluding NS) and measured parameters by segmenting syllables instead of vowels, this study examines CS's production of English word stress in English donor words and corresponding Cantonese loanwords by identifying the most dominant acoustic cue, among pitch, intensity and duration of the vowels, for HCS and LCS, when compared with NS.

Methodology

Twenty-two Cantonese ESL speakers (F=11; M=11), aged 18-24, were recruited as target participants, known as CS. All CS were born in Hong Kong and had lived there since birth. Among them, 11 were highly proficient in English (with a grade "C" in HKALE UE or a grade "5" in HKDSE English, equivalent to an IELTS score of 6.51, or above), and 11 were less proficient (with a grade "E" in HKALE UE or a grade "3" in HKDSE English, equivalent to an IELTS score of 6.02, or below) (Hong Kong Examination Authority, 2004; 2010). All CS were recruited from the Hong Kong Community College (HKCC), The Hong Kong Polytechnic University (PolyU) community. Five native speakers (F=2; M=3) of British English were recruited as controls, known as NS. They were all residents of the United Kingdom. All participants had normal hearing, speech and language ability by self-report.

All participants were instructed to read four English donor words (sauna /ˈsɔnə/, guitar /gɪˈtɑ:/, carnivals /ˈkɑ:nɪvəlz/ and vanilla /vəˈnɪlə/), and CS also the corresponding Cantonese loanwords (桑拿 /sɔŋ55 na:21/, 結他 /kit33 tʰa:55/, 嘉年華 /ka:55 min21 wa:21/ and 呔哩拿 /wɐ22 nei55 la:35/). The speech samples were recorded using AUDACITY in a quiet room with a high-quality unidirectional dynamic microphone fixed at 10 cm from each participant's mouth for consistency.

The recording of each participant was first processed using Praat (Boersma & Weenink, 2010). Each syllable in the pronounced English donor words and Cantonese loanwords was extracted and stored. The extracted syllables of both the English donor words and Cantonese loanwords were then classified into two types, (1) stressed syllables or those corresponding to stressed syllables in the English donor words,

and (2) unstressed syllables or those corresponding to unstressed syllables in the English donor words. The vowels were segmented manually by one of the authors, with ten percent repeated for intra-judge reliability measure, regarded as satisfactory with the Spearman's correlation coefficient between the duration of segmented vowels as 0.997 ($p < 0.001$). Three acoustic parameters: average fundamental frequency (F0) (in Hz), duration (in ms), and average intensity (in dB) of the vowel were measured from each sound sample.

Results

Concerning the production of the English donor words, vowel duration (instead of F0 in CS as identified previously) was found to be the dominant cue in distinguishing stressed and unstressed syllables in both NS and CS. However, HCS (with a difference of 32% between stressed and unstressed English syllables) appeared to be more similar to NS (with a difference of 51%) in relying on vowel duration when compared with LCS (with a difference of only 15%). While F0 was the next dominant cue for both NS and CS, HCS (with a difference of 20%) relied on F0 more than both NS and LCS (with a difference of 13% and 10% respectively) did.

Since Cantonese makes use of tones but not stress to contrast meanings, Cantonese loanword syllables corresponding to stressed and unstressed English syllables are supposed to differ only in F0 but not in intensity and vowel duration. Surprisingly, vowel duration was still the dominant cue, followed by F0 and intensity, in both HCS and LCS's production. Despite this, the small difference of only 2% in HCS in the use of F0 in distinguishing the (originally) stressed and unstressed syllables in the English donor words and Cantonese loanwords and the marked difference of 28% in LCS in the use of vowel duration in distinguishing them further confirm HCS's overuse of F0 and LCS's underuse of vowel duration in realising English word stress.

Conclusion

In short, unlike previous findings, vowel duration was found to be the dominant cue, followed by F0, in distinguishing stressed and unstressed syllables in all speakers' production. Also, HCS may have overused F0 and LCS may have underused vowel duration. This implies the need for different approaches in teaching English words stress, with less emphasis on F0 for HCS, and more emphasis on vowel duration for LCS.

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