

**The roles of duration, F0, F1, and jaw displacement  
in the realization of accent for English vs. Japanese speakers**

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As a pitch-accent language, it is generally believed that in Japanese the primary phonetic correlate of word accent is a sudden drop in pitch (Kubozono, 1993). English accent (stress) is, by contrast, realized not only by pitch (F0) but also duration and amplitude (intensity) (cf. Beckman, 1986). In addition, in stress-timed English, stressed and unstressed syllables tend to alternate according to the principle of rhythmic alternation (Selkirk, 1984), which is reflected, for example, in alternating high-low pitch (Shattuck-Hufnagel et al., 1994) or strong-weak jaw opening (Erickson, 2004).

However, it has not been examined in detail to what extent English speakers and Japanese speakers depend on any of the three phonetic elements (duration, intensity, pitch) in realizing their English or Japanese accent.

In this study, ten native speakers of American English and 30 Japanese EFL learners read two English sentences that contain the same vowels that are stressed or unstressed depending on the context. Acoustic analyses were done on the duration, intensity, F0, and F1 of the target vowels in the following test sentences. (The words/syllables that include target vowels are written in italics.)

(1) *I saw five bright highlights* in the *sky* tonight.

(2) *Pam had a chance* to *chat and nap*.

The results show that the mean duration of the target diphthong in (1) and low vowel in (2) ranged from 69.9 ms (“a”) to 219.5 ms (/ai/ in “five”) for NS, whereas JS showed less variation from 112.9 to 215.1 ms and also “a” in (2) is longer than the vowel in “chat” and as long as those in “and” and “nap”. However, the maximum intensity of the target vowels produced by JS show similar zigzag patterns (high-low intensity) to that of NS. It is also noticed that F0 in semitone varied more widely for JS than for NS; for JS, four pairs of neighboring words in (2) show significant pitch (in semitone) differences in their vowels ( $p < 0.001$ ). This suggests JS rely more on pitch alternations to express utterance rhythm, a possible carry over from their native pitch-accent language. As for F1, in both test sentences NS, compared to JS, show clear alternating patterns of low and high F1, possibly reflecting alternations in jaw displacement.

Video recordings of four Americans and four Japanese learners show that for stressed low vowels, NS lower their jaws to a greater degree than JS. These results suggest F1/ jaw displacement may be reliable correlates to rhythmic alternation of English stress.