The effects of vowel length and place of articulation of the following stop on formant frequencies in Thai vowels

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This study examined the effects of vowel length and place of articulation of the following stop on duration and formant frequencies in Thai vowels. Vowel length is phonemically contrastive in Thai as in languages such as Japanese.

In a recent study on Japanese vowels, there was a significant effect of vowel length on vowel quality such that long vowels generally occupied a more peripheral portion of the vowel space than did the short vowels [6]. We sought to determine if the same pattern could also be observed in Thai. Another phonetic variable known to affect vowel quality is the place of articulation of the following consonant [8]. In English, F1 displacement due to this factor is quite small whereas F2 is substantially displaced in the context of alveolar consonants.

Twenty-two native speakers of Thai (5 male, 17 female) living in Sydney, Australia, participated in this study. CVC words (where the 2nd C is /p t k/) containing /a/ or /a:/ written in Thai scripts were read three times in isolation in randomized orders.

The EMU speech database system was used for marking the onset/offset of the speech segments of interest. The first two formant center frequencies (F1, F2) of the target vowels were automatically tracked in a signal processing package ESPS/Waves.

Two-way ANOVAs with Length (short, long) and Place (bilabial, alveolar, velar) were carried out separately for male and female data to examine if these factors influence duration and F1/F2 values.

A significant durational difference was found between /a/ and /a:/ with the ratio of 2.1 for both male (142.3 vs. 299.6 ms) and female (161.5 vs. 338.3 ms). This is consistent with previous studies [1-5]. An effect of the following stop place on vowel duration was found only in female data, but the effect was less than 10 ms (cf. [7]).

For formant frequencies of the male group, significant effects were observed for F1 (Place, Place x Length): /a:/ had higher F1 (more open articulation) than /a/ did, but this depended on the following stop. For the female group, significant Length effects were observed for F1 and F2: /a:/ had higher F1 and lower F2 (more retracted tongue position) compared to /a/.

These preliminary results suggest that Thai speakers produce a reliable length distinction between /a/ and /a:/, that vowel length affects mainly F1, and that the effect of place of articulation on F1 and F2 is very small.

(400 words)

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