

# On the effect of the fricative vowels in the adaptation of English voiceless fricatives in Japanese

## 1. Introduction

Japanese shows an asymmetrical condition in the treatment of the single coda-consonant [s] and [ʃ] in loanwords from English (Kubozono et al. 2009); while it is adapted as a singleton [s] following an epenthetic vowel [su], it is adapted with a geminate consonant [ɕ:u] following the same epenthetic vowel. However, the sound [ɕ] with the epenthetic vowel [i] refuse the geminate consonant [ɕ:i] (e.g. *brass*→[buɾɛsu], *brush*→[buɾɛɕ:u], [buɾɛɕi]). This paper argues the existence of the "fricative vowels" in Japanese and their acoustic characters control the occurrence of the geminate fricative.

## 2. Perceptual experiments

Two perceptual experiments with 63 participants (2 males, 61 females) were performed to identify the main factor of the asymmetry. The conditions of stimuli are as follows: (a) IPA representation of stimuli: [os] or [oɕ], (b) the duration of [o] is 180ms, and ten patterns of duration time of the final fricative (180, 200, 220, 240, 260, 280, 300, 320, 340 and 360ms), (c) eight patterns of noise frequency range from [s] to [ɕ], (d) the condition of pole frequency transition of [ɕ] in the last 50 ms.

The summary of the results shows: (1) while every [s] sound with no formant transition was perceived as /su/, the sounds [ɕ] with no formant transition were recognized as /ɕi/ (not as /ɕu/). In contrast, every [ɕ] sound with formant transition was perceived as /ɕu/. (2) Both [s] and [ɕ] with no formant transition are hardly perceived as the geminate consonant even if they has much longer duration. However, every subject can recognize the long "ghost vowel" against the long fricatives. In contrast, [ɕ:] with formant transition are easily and categorically perceived as the geminate consonant.

## 3. Discussion

The result (2) shows that the "fricative vowels" exists in Japanese and that Japanese native speakers can recognize the syllable weights by means of the duration times of the syllables. One of the allophones of /u/ is [s]-like sound with a steady state, and one of the allophones of /i/ is [ɕ]-like sound without the radical pole frequency transition. Furthermore, the perceptual constraint inhibit the geminate consonants /Qsu/ and /Qsi/ because [ss] and [ɕɕ] do not have the formant transition as the perceptual cue of germination (the italic style shows the "fricative vowels"). On the other hand, when once Japanese sound system adopts an epenthetic vowel /u/ in English /ʃ/, Japanese sound [ɕ] inevitably has the formant transition that is the sign of consonant-vowel boundary. As the perception of Sokuon requires the duration of geminate consonants which means the time span from the onset point of the consonant to the consonant-vowel boundary, [ɕ:] with formant transition generated by the following vowel /u/ can have the perceptual cue of geminates.

## Reference

Kubozono, Haruo., Ito, Junko., & Mester, Armin (2009). Consonant Gemination in Japanese Loanword Phonology. In *Current Issues in Unity and Diversity of Languages. Collection of Papers Selected from the 18th International Congress of Linguists*, pp. 953–973. Dongam Publishing Co.

Examples of the acoustic features of the perceptual experiments

