Perception of allophonic contrast of Japanese high vowel /u/ by Japanese Tokyo dialect speaking listeners

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Overview: It is commonly observed that non-native sounds are difficult to distinguish (e.g. Japanese listeners have a hard time discriminating English /l/ and /r/. (Yamada and Tohkura, 1992; among others) In addition, it was recently suggested that native sounds with weak phonological relation are also imperceptible. For example, sounds in allophonic relations are indistinguishable by native speakers (Boomershie *et al.*, 2008), and perceptibility of two phones that neutralize in a certain environment is shown to merge when perceived by native listeners (Hume and Johnson, 2003). Hume and Johnson, following the evidence from perceptual merge of Mandarin tones, suggests that perceptual contrast of speech sounds decreases as phonological contrast weakens. The phonological contrast can be shown with four levels (Hume and Jonson, 2003): 1) fully contrastive (e.g. English /l/ and /r/), 2) partially contrastive (e.g. Mandarin tone 214 and 35), 3) allophonic contrast (e.g. English ɾ/t/t^h/ʔ), 4) non-occurring (e.g. Japanese /l/ and /r/). This paper provides evidence that 1) native listeners can distinguish allophonic contrast, but not as accurately as phonemic contrast, and 2) allophones in complementary distribution are more perceptible than those in free variation, through an investigation of Tokyo dialect speakers' perception of vowel allophones.

Background: Japanese high vowels must devoice in devoicing context in Tokyo dialect: [+obs] [-voice] _ [+obs] [-voice] (e.g. /asuka/ 'southern region of Nara prefecture' → [asɯ̥ka]). Therefore, full high vowels and devoiced high vowels show allophonic contrast of complementary distribution in-between voiceless obstruents in this dialect. High vowels in non-devoicing context, on the other hand, are optionally devoiced; so they show allophonic contrasts of free variation (e.g. /azusa/ → [azɯsa] or [azɯ̥sa] 'a person's name'. Following the phonological contrast scale of Hume and Johnson's, the study predicts that allophonic contrast between devoiced vowel and full high vowel is less perceptible than phonetic contrast between one-mora vowel (e.g. /u/) and two-mora vowels (e.g. /uu/). If allophonic contrast is equally imperceptible, perceptibility of the high vowel is the same regardless of the devoicing condition; however, if distributional information is important, allophones in complementary distribution, i.e. those in devoicing context, should be more perceptible. My experiment shows that Japanese listeners are more accurate in discriminating phonemically contrastive sounds, and also that allophones in complementary distribution are more perceptible than those in free variation.

Experiment: The experiment tested whether Japanese listeners are able to discriminate allophones of the Japanese high vowel /u/. The stimuli were pairs of Japanese non-words that contained a pair of sounds that differ in voicing of the vowel ([ɯ̥]-[ɯ]). Pairs of words which contained sounds that

differ in length were also prepared as control ([ɯɯɯ]-[ɯ]). The experimental task was AX discrimination with a filler word in between the paired words (e.g. A-filler-X). Japanese Tokyo dialect speaking listeners judged if the first and the last words were the same.

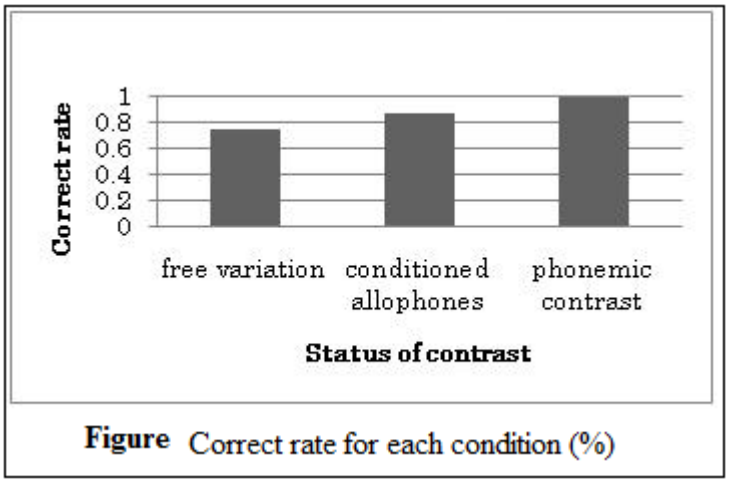

Figure Correct rate for each condition (%)

The figure shows the results based on 5 participants. Statistical analysis was not conducted because of the small population. As the figure indicates, allophonic contrast in general was heard less accurately than phonemic contrast. It is also shown that allophones in complementary distribution are more perceptible than those in free variation.

Conclusion: This report shows that Japanese listeners are less accurate in discriminating allophonic contrasting pairs than in discriminating phonemic contrasting pairs. In addition, allophones in complementary distribution are shown to be more perceptible than those in free variation. The results support the hypothesis that perceptual contrast reflects phonological contrast.

References:

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