

INDIVIDUAL DIFFERENCES IN VOWEL EPENTHESIS AMONG KOREAN LEARNERS OF ENGLISH

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ABSTRACT

The aim of this study was to investigate individual differences in vowel epenthesis among Korean L2 speakers of English, and its relationship to other measures of segmental and suprasegmental processing. Thirty-two subjects completed a battery of production and perception tasks: spoken target words that were likely to have epenthetic vowels, read sentences, epenthetic vowel perception, identification of vowels and consonants, and stress deafness perception. The results demonstrate that Korean L2 speakers have problems with vowel epenthesis in production and perception. However, production and perception epenthesis are not correlated with each other, suggesting that they rely on different mechanisms. Overall, epenthesis was most strongly correlated with vowel production and perception, suggesting that epenthesis is more linked to segmental processes and representations.

Keywords: phonetics, vowel epenthesis, speech production and perception

1. INTRODUCTION

Korean learners of English often insert vowels within English consonant clusters that do not occur in Korean (e.g., /bd/ in *abduction*), thereby breaking these clusters into CVC sequences. Most research on vowel epenthesis has adopted a phonological approach, focusing on examples of epenthesis in production [4, 11]. However, recent research has demonstrated that epenthesis also has effects on perception [2, 3]. For example, Dupoux, et al. [3] asked Japanese and French speakers to discriminate between non words such as /ebzo/ (no epenthetic vowel within consonant clusters) and /ebuzo/ (full epenthetic vowel within consonant clusters). The results showed that Japanese speakers were poorer at discriminating this difference; Japanese speakers perceptually inserted an /u/ vowel into /ebzo/ such that it sounded similar to /ebuzo/.

The present study investigated Korean learners of English with a wide range of English proficiency to see whether the frequency of vowel epenthesis in production and perception are related among individuals, and whether these measures are more related to the perception and production of segments (vowels and consonants), prosody, or is relatively independent from these processes.

2. METHOD

2.1. Participants

Thirty-two Korean learners of English completed the experiment. Their age range was 20 to 30 years (median = 24 years and 5 months). They reported that they had started to learn English from 7 to 17 years old (median = 11 years and 5 months), and had lived in English-speaking countries from 2 months to 6 years (median = 10 months). None of the subjects reported any hearing disorders.

2.2. Production tasks

Thirty-two target words (including compound words) were selected based on consonant combinations that Kabak and Idsardi [10] reported were difficult for Korean learners of English (e.g., *abduction*, *factory*, *vegetables*). The words were illustrated with pictures so speakers would not be influenced by orthography. Speakers also read 31 BKB sentences [1] that were presented orthographically. All subjects recorded both sets of materials twice.

The production tasks were analyzed in terms of the frequency of epenthesis errors (i.e., insertion of vowel-like voicing in positions where native English speakers do not typically insert vowels). The sentence productions were also acoustically compared to the same materials spoken by native English speakers, both in terms of segment durations and vowel duration, using the ACCDIST method [5, 6, 7]; speech rate of the sentence recordings were also analyzed.

2.3. Epenthetic vowel perception

On each trial, listeners heard three speech recordings and had to choose which one sounded different. The stimuli were real examples of epenthesis by Korean speakers of English, and edited versions in which the epenthesis was removed. For example, they could hear *abduction* /æbdʌkʃən/ - *abduction* /æbudʌkʃən/ - *abduction* /æbdʌkʃən/; the correct response would be the middle stimulus that had the epenthesis preserved. There were 78 experimental trials, as well as a short practice prior to the main experiment.

2.4. Identification of consonants and vowels

Each trial consisted of VCV or CVC words (e.g., /aba/, /but/). For consonant identification, 17 VCV words were repeated 4 times randomly. For vowel identification, 14 CVC words were randomly repeated 4 times. On each trial, subjects clicked the word that they had heard on a computer monitor.

2.5. Stress deafness perception

Listeners heard three two-syllable words on each trial and had to choose which one had a different stress pattern. The stimuli were six pairs of words that could be spoken with contrastive stress patterns (e.g., *contract* /kʌntrakt/ - *contract* /kʌn'trakt/), which were recorded by three different talkers. On each trial they heard the words spoken by 3 different speakers, two of which had the same stress pattern and one that was different (e.g., *contract* /kʌntrakt/ - *contract* /kʌn'trakt/ - *contract* /kʌntrakt/). Subjects completed 78 experimental trials, and subjects completed a short practice beforehand.

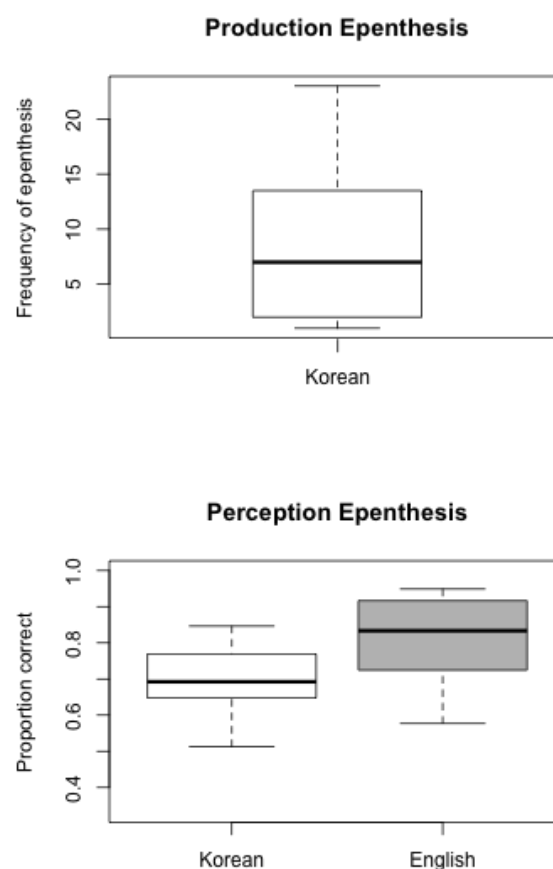
3. RESULTS

Figure 1 displays the frequency of epenthesis in production (i.e., number of times Korean L2 speakers inserted an epenthetic vowel, summed over all sentences and words). There was high variability in the frequency of epenthesis among Korean learners of English, with some speakers having no incidents of epenthesis and some having more than 20 over the set of recordings (66 words and 62 sentences). The median number of epenthesis incidents was 6, indicating that, although epenthesis occurs regularly, it is not extremely frequent.

Figure 1 also displays the results of the perception epenthesis experiment for Korean and English speakers. Korean learners of English were

correct between 50 and 80% of trials (median = 70%), and English speakers were correct between 60 and 90% (median = 80%). Although there was some overlap between the ranges of scores, the difference between Korean and English speakers was significant, $t = -2.79$, $df = 16$, $p < .05$, suggesting that Korean learners of English had more difficulties in detecting an epenthetic vowel than English native speakers.

Figure 1: Production and perception epenthesis among Korean learners of English and native English speakers. Boxplots display the quartile ranges of scores.

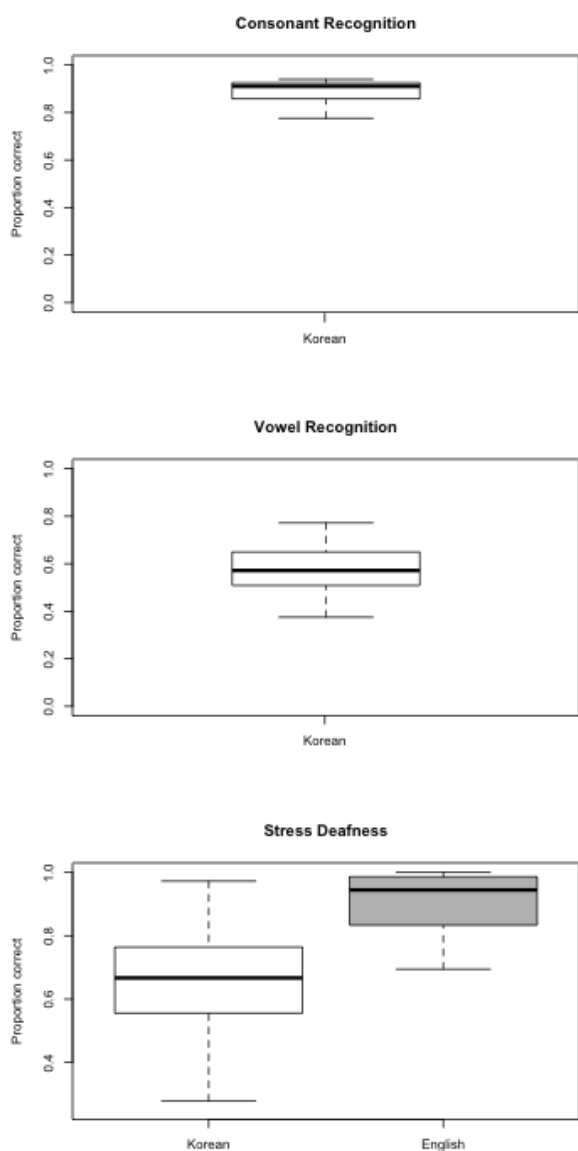


Although our results demonstrate that Korean learners of English have difficulty with epenthesis in both perception and production, the individual differences correlation between measures for Koreans was not significant, $r = -0.28$, $p > .05$. This suggests that the difficulties in production and perception may have different causes.

The segmental identification results for Korean learners of English (Figure 2) demonstrated that they were correct for consonants between 80 and 95% (median = 85%) of trials, and they were

correct for vowels between 50 and 70% (median = 60%). The results thus demonstrate that English consonants were generally not very difficult for these individuals, but all of these Korean learners of English had substantial difficulties for vowels.

Figure 2: Results for consonant and vowel recognition by Korean learners of English, and stress deafness perception by native speakers of Korean and English.



The results of the stress deafness test showed that Korean learners of English varied from 50 to 80% correct (median = 70%), and English speakers were between 70 and 100 (median = 90%). A paired t-test demonstrated that there was a significant difference between the results of Korean and English native speakers, $t = -6.39$, $df = 28$, $p < .01$. English native speakers were much

better than Korean learners of English at identifying contrastive stress.

The correlations between measures (Table 1) suggest that, in general, the amount of epenthesis in production and perception is most related to vowel perception and production; the production measure used here was a spectral comparison with native English productions (see Method). This pattern is particularly strong for production epenthesis, where the correlation with both vowel measures are high. Correlations with consonants was comparatively weak, perhaps because the Korean speakers had relatively little difficulty with identifying English consonants.

Table 1: Individual-differences correlations among Korean speakers of English.

	Perception Epenthesis	Production Epenthesis
Vowel identification	$r = 0.39^*$	$r = -0.62^*$
Consonant identification	$r = 0.24$	$r = -0.09$
Stress Deafness	$r = 0.37^*$	$r = -0.31$
Sentence production: segment duration similarity	$r = 0.19$	$r = -0.34$
Sentence production: vowel spectra similarity	$r = 0.16$	$r = -0.51^*$
Sentence production: speech rate	$r = 0.19$	$r = -0.57^*$

* $p < 0.05$

There were only moderate correlations between epenthesis and measures of prosody perception and production. Stress deafness was significantly related to perception epenthesis, but did not reach the significance level for production. The production of relative segment durations in sentences (comparisons to productions of native English speakers, see Method) was not significantly related to epenthesis. Speech rate in sentences was inversely correlated with production epenthesis, with slower speakers producing more epenthesis. In this case, it is likely that slower speech rates indicate that the speaker is less proficient in English production and thus they also produced more epenthesis; it is unlikely that the slow rates themselves directly caused more epenthesis.

4. DISCUSSION

The results demonstrated three main findings. First, the results confirm the previous studies that Korean learners of English have problems with vowel epenthesis. The results showed that English native speakers were more accurate than were Korean L2 speakers. Second, epenthesis in production and perception are not correlated with each other among Korean individuals, even though these individuals had a wide range of variability in vowel epenthesis in both production and perception. Third, compared to other measures, epenthesis is most correlated with vowel production and perception than with prosodic abilities or consonant identification.

The lack of correlations between epenthetic vowel production and perception is surprising. Dupoux et al. (1999) have argued that vowel epenthesis arises from phonotactic constraints, and one would expect that such constraints would affect both perception and production epenthesis. This may be explained by Kabak and Idardi's [9] claims that difficulties with phonotactic constraints are realized and repaired by L2 speakers differently in speech production and perception. The present study investigated vowel epenthesis only, but it is possible that there were other changes in production (e.g., consonant assimilation or deletion) that more related to perceptual epenthesis, which may blur correlations between speech production and perception.

It appears that epenthesis among Korean learners of English is more related to acquiring the English vowel system than it is to measures of segmental timing or prosody. This strongly suggests that epenthesis is related to segmental processes and representations. However, one problem with this interpretation is that speakers of many languages have difficulty learning English vowels [8], whereas epenthesis difficulty appears to be restricted to a smaller number of language groups. It may be that L1 phonotactic constraints and poorly specified English vowel categories may combine to produce epenthesis errors, rather than epenthesis being caused by a single factor.

5. REFERENCES

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