

# TRANSFER EFFECTS IN THE PRODUCTION OF ENGLISH VOWELS BY JAPANESE LEARNERS

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## ABSTRACT

The present study examines transfer effect in learning English pronunciation by Japanese learners of English. They are known to have pronunciation difficulty accommodating non-native target sounds, and the production of L2 (target language) sounds depends on, in part, how they have established phonetic criteria for L2 non-native contrasts. Acoustic analysis was made on vowels in Japanese, American English, and interlanguage. The results of the analysis indicate that they appear to use the acoustic space of L1 vowels in the production of L2 vowels and there are differences in transfer effects among English vowels. This implies that Japanese learners, depending on their level of proficiency, are affected by negative transfer effects from L2 pronunciation strategy. Although there are several hypotheses on cross-language production, the present study provides an evidence to support the model of perceptual discrimination on a range of L1 assimilation.

## 1. INTRODUCTION

Much has been done on teaching English as a second language to Japanese learners of English, and many attempts have been made to improve oral proficiency of Japanese learners of English. Through such attempts, major problems which they face have been pointed out in many articles of English pronunciation. Such problems arise from how the learner's first language (L1) affects the learning segmental and prosodic features of English. They range from learning minimal pairs of sounds which do not exist in L1 to learning rhythmic and intonational features of the second language (L2). Several theoretical considerations have been presented to explain the problems in learning such features of English. One of them is transfer effect in which learners tend to make mistakes by incorporating some features of L1 in learning L2 pronunciation. Although the terms "transfer" and "interference" are closely related with behaviorist theories of L2 learning, the influence from learner's L1 can not be adequately explained in terms of habit formation. In the present study, the transfer effects in learning L2 pronunciation will be examined in learning English vowels by Japanese learners.

## 2. VOWELS

Vowels in both languages differ in quality and quantity, and their acoustic characteristics have been affected by various phonetic factors. As is known, the production of vowels is controlled by vertical and horizontal movements of tongue and lip apertures. Some of the differences between the two languages can be said as follows:

- (1) The distinction between tense and lax vowels in English does not exist in Japanese.
- (2) The vowels in English are contextually more sensitive than in Japanese and are subject to reduction in unstressed syllable.
- (3) The back vowels are often characterized as rounded vowels in English, but the vowel /u/ in Japanese is phonetically realized as unrounded vowel [u].

### 2.1. Japanese Vowels

It is generally known that vowels vary allophonically across segmental and suprasegmental contexts. For Japanese vowels, one of the most well-known phenomena is that high vowels such as /i, u/ are often devoiced when they come in between voiceless consonants or between a voiceless consonant and a word boundary. Kondo (1997) discusses the voiceless vowels in detail, and presents several conditions under which the vowels are devoiced. Acoustic characteristics of Japanese vowels have been studied in some detail, and, as shown in several studies, there are four degrees of F1 values /i/ - /u/ - /e/ - /o, a/, and there are also four degrees of F2 values /i/ - /u/ - /e/ - /o, a/. The F1 values are known to be inversely related with vowel height differences and the F2 values are known to be correlated to the difference in back - front distinction.

In the present study, seven Japanese undergraduate students took part in the experiment, and recorded five words three times for Japanese vowels. Measurements of formants of Japanese vowels were made for 21 tokens for each vowel by Multi-Speech program. The results can be shown in Table 1.

JPN Vowels	F1(Hz)	F2(Hz)
/a/	690(45)	1,314(71)
/i/	340(69)	2,349(412)
/u/	361(75)	1,338(426)
/e/	441(67)	1,754(536)
/o/	487(87)	1,063(166)

Table 1. Formant Frequency of Japanese Vowels (s.d. in parenthesis)

In plotting these frequencies in the vowel space with F1 vertical scale and F2 horizontal scale, the vowels /a/, /e/, /o/, and /u/ form a diamond shape, with /e/ and /o/ equal in height, and /u/ and /a/ equal in backness. Vowel /i/ is slightly lower in F1 value but considerably higher in F2 than any other vowels, giving the set of five vowels a pulled and skewed distribution towards the high front vowel. Based

on this distribution, it can be said that some vowels are rather close to other vowels as in /u/ and /o/, while other vowels are separated from empty regions of the vowel space as in /i/ and /e/. Furthermore, there are three degrees of F1 values /i, u/, /e, o/ and /a/, and four degrees of F2 values /i/, /e/, /a, u/ and /o/. These divisions by degrees is rather different from those in Keating and Huffman (1984).

## 2.2. English Vowels

Acoustic characteristics of American English (AE) vowels have been well-documented in many literature. Harshman, et al.(1977) examined the formant frequencies of /i, ɪ, eɪ, ε, æ, α, ə, ɔ, ʊ, u/, and pointed out that such vowel features as [high] and [back] can be acoustically defined. Furthermore, it can be seen that there are four degrees of F1 values, and three degrees of F2 values. In the present study, two female speakers of AE took part in the experiment and recorded five English words three times for each AE vowel /i, ɪ, ε, æ, α, ə, ɔ, ʊ, u/, a total of 30 tokens for each vowel. The speech analysis system of Kay's Multi-Speech was used to analyze the formant frequencies of the words, and the results can be shown in Table 2.

AE Vowel	F1(Hz)	F2(Hz)
/i/	293(37)	2,984(144)
/ɪ/	526(42)	2,321(190)
/ε/	692(81)	2,380(66)
/æ/	975(119)	2,144(63)
/α/	935(107)	1,498(38)
/ə/	716(12)	1,608(216)
/ɔ/	609(54)	1,042(79)
/ʊ/	572(47)	1,335(163)
/u/	403(61)	1,561(191)

Table 2. Formant Frequency of AE Vowels (s.d. in parenthesis)

In plotting F1 and F2 frequencies in the acoustic space, AE vowels are evenly distributed, except the F2 value of /i/, and form a round shape with eight vowels. It can be seen that lax vowels /ɪ, ε, α, ə/ are rather centrally distributed, and more inwardly placed in the acoustic space. Furthermore, /u, ʊ/ which are generally defined as back vowels are not so placed in backness as in /ɔ/, and /α, ə/ are placed in mid-central region of the acoustic space. Vowel /i/ is distinctly separated from /ɪ/ in F2 frequency.

## 2.3. AE Vowels by Japanese Learners

Seven undergraduate students of Japanese learners of English who were mentioned in section 2.1 read and recorded three

English words containing each AE vowel of /i, ɪ, ε, æ, α, ə, ɔ, ʊ, u/. Acoustic analysis was made by Kay's Multi-Speech program and the measurements were made for F1 and F2 frequencies for each vowel, with a total of 189 words (9 vowels x 3 times x 7 speakers). Table 3 shows the mean values for nine AE vowels.

Vowels	F1(Hz)	F2(Hz)
/i/	320(67)	2,592(274)
/ɪ/	336(64)	2,511(349)
/ε/	509(107)	1,988(545)
/æ/	739(169)	1,463(333)
/α/	675(151)	1,257(214)
/ə/	742(199)	1,124(164)
/ɔ/	580(117)	1,071(164)
/ʊ/	429(92)	1,727(217)
/u/	413(103)	1,672(208)

Table 3. Formant Frequency of AE Vowels Produced by Japanese Learners (s.d. in parenthesis)

In plotting F1 and F2 frequencies in the acoustic space, it can be pointed out that Japanese ESL learners have the following characteristics: The mean vowel values in the interlanguage show a skewed distribution towards the high front part /i/ of the space, whose general pattern is similar to that of Japanese vowels. Three vowels /æ, α, ə/ are not distinctly separated from each other and are pronounced in the acoustic space of Japanese vowel /a/. Furthermore, it can be seen that the distinction between tense and lax vowels /i - ɪ, ʊ - u/ was not made.

## 3. DISCUSSION

Based on the acoustic analysis in the preceding sections, it can be said that Japanese learners of English produce a pattern of nine English vowels which is similar to that of Japanese vowels, skewed towards the high front vowel. This indicates that Japanese learners tend to produce English vowels /i, ɪ/ with an acoustic space of Japanese /i/, English /æ, α, ə/ with Japanese vowel /a/, and English vowels /ʊ - u/ with Japanese vowel /u/. Furthermore, it can be pointed that Japanese learners did not make a distinction between tense and lax vowels as in /i, ɪ/ and /ʊ - u/. Although these characteristics largely depend on the level of oral proficiency of the learners, they can be considered as typical ones in learning English vowels.

In learning L2 pronunciation, there are several hypotheses as to why L2 learners might not perceive and produce L2 phones accurately. Flege (1987) proposed the model of perceptual equivalence in which perceptual closeness between L1 and L2 phones is related to the degree

of acquisition. The other is a model of perceptual discriminability on a range of L1 assimilation, proposed by Best (1995). This implies that acquisition of L2 phones depends on the discriminability, and L2 learners tend to use L1 phones when non-native L2 phones are perceptually assimilated to certain L1 phones.

In examining the results of the present study of AE vowel production, it can be found that Japanese learners of English use the native model when they produce AE vowels. This shows that they tend to "identify" non-native L2 vowels with their perceptually close L1 phones, and they use such L1 phones in producing non-native phones. The present study appears to support the model of perceptual discrimination on a range of L1 assimilation.

#### 4. CONCLUSION

From the results of the preceding sections, it can be said that AE vowels produced by Japanese learners of English are influenced by L1 vowels, and that they tend to use L1 pattern of vowels based on their perceptual assimilation in producing L2 vowels. This can be considered that the L1 pattern of vowels negatively affects the production of L2 phones. In order to improve L2 pronunciation, Japanese learners of English need to be give specific description of L1 and L2 phones and need to be give strategies based on such description.

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