

EFFECT OF PITCH ON JAPANESE WORD-INITIAL STOP PRODUCTION BY KOREAN SPEAKERS

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ABSTRACT

This study investigated the relationship between the production of Japanese stops by Korean speakers and word pitch pattern. Both Korean and Japanese languages have stops, but they have different phonetic characteristics: Japanese has voiced and voiceless stops whereas Korean has three stops (aspirated, tense and lax), but no contrast in voicing. Korean stops are also associated with the pitch of the following vowel, and the pitch may be used in perception to differentiate stops as well as VOT in some accents; i.e. the pitch following aspirated and tense stops is higher than the pitch following lax stops.

The study found that voicing mistakes in Japanese stop production by Korean speakers was associated with word pitch pattern. The results also indicated that Korean speakers used pitch patterns associated with Korean stops in L2 Japanese production.

Keywords: Korean stops, Japanese stops, pitch, voicing, acquisition

1. INTRODUCTION

Japanese and Korean share many similarities, including syntactic structure and vocabulary. However, the way that pitch is manifested in the two languages is different. Pitch has a distinctive function that distinguishes words in Japanese, but in Korean it is normally used for prosodic purposes and expressed as tone at the phrase-level [3]. Therefore, typically pitch is not considered to distinguish words in Korean, but some recent studies have reported that some Korean accents, including the Seoul accent, have recently started to use pitch to distinguish words (see below).

Another difference between the two languages is the distribution of stops. Japanese has two way contrast in stops, i.e. voiced or voiceless, at three different places differentiated by voice onset time (VOT). Korean, in contrast, has three way contrast in stops, namely aspirated, tense and lax (normal) stops. The Korean stops are also differentiated by VOT, but all three types are phonologically

categorized as voiceless: aspirated stops have the longest VOT, lax stops the next longest and tense stops have the shortest VOT [5].

Transcription of Japanese sounds in Korean orthography has been mostly standardized. Japanese voiceless stops are transcribed as aspirated, voiced stops are transcribed as lax, and voiceless geminate stops are transcribed as tense. That means that Korean speakers who learn Japanese in Korea are likely to interpret Japanese voiceless stops as aspirated, lax and tense equivalents of the respective Korean stops. However, this transcription system is inaccurate because it maps Korean ‘voiceless’ lax stops onto ‘voiced’ stops in Japanese. Also, it maps Korean tense stops onto geminate stops in Japanese, even though their closure durations are different.

Another difference between Japanese and Korean stops is related to pitch. In Korean the pitch of vowels following stops differs depending on the type of stop (see Section 2), but in Japanese pitch is lexically distinctive and is not affected by type of consonant.

The acquisition of Japanese stop voicing is difficult for Korean speakers. A study showed that the majority of mistakes in Japanese writing by Korean learners concerned the distinction of stop voicing, i.e. voiced or voiceless, accounting for nearly 70% of all mistakes [9]. VOT of Korean stops and associated vowel pitch have been studied extensively, and Korean speakers’ acquisition of Japanese stops has also been examined in many studies. However, the relationship between Korean stop VOT and subsequent pitch difference has not been tested in L2 Japanese stop acquisition. It is important to examine the relationship between Korean speakers’ interpretation of Japanese stop voicing and Japanese word pitch pattern.

In this study we analyzed mistakes in Japanese stop production by Korean speakers and also examine how these mistakes are related to Japanese word pitch pattern. We focused on the standard varieties of both languages, namely Tokyo Japanese and Seoul Korean.

2. BACKGROUND

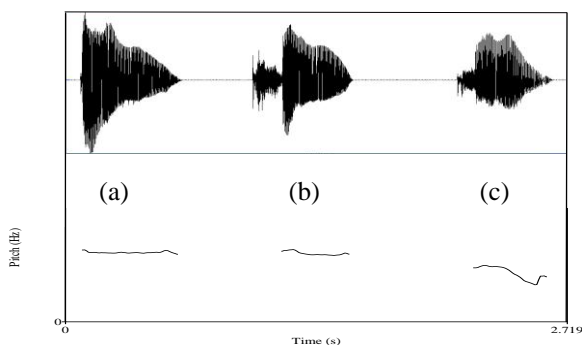
2.1. Voice onset time

As explained in Section 1, Korean stops have contrasting VOT: aspirated stops > lax stops > tense stops (see Fig. 1). A study reported that Korean subjects perceived stop stimuli with long VOT as aspirated stops and stop stimuli with short VOT as tense stops [1]. However, some studies have reported that actual voice onset durations of the three types of stops vary greatly and that some lax stops have longer VOT than aspirated stops [5], and that younger speakers tend not to differentiate VOT values of lenis and aspirated stops [12]. Therefore, VOT alone is not a reliable way to discriminate Korean stops.

2.2. Pitch of vowel following different stops

Japanese uses pitch accent to differentiate words. In contrast, in Korean pitch is a property of phrase accent, and accent is not a distinctive feature of words. However, several studies have found that the pitch of a syllable in Korean is determined by the onset of an accentual phrase [6, 10, 11]: the syllable pitch is Low when the onset is a lax stop, nasal or there is no onset consonant, and the pitch is High when the onset is an aspirated or a tense consonant (Fig. 1).

Figure 1: Pitch contours of 3 Korean words produced by a native female speaker from Seoul: the words start with (a) a tense /t/ (*tal* ‘daughter’), (b) an aspirated stop /tʰ/ (*tʰal* ‘mask’), and (c) a lax stop /l/ (*dal* ‘moon’).



Lexical pitch is also affected by the combination of stops in a word because different stops influence the pitch of the following vowel. Ko [7] studied word pitch pattern of one and two syllable Korean words with tense and lax stops, and found that word pitch pattern was generally falling. In two syllable words the pitch of words fell when the onset consonants of the first and second syllables were the same, i.e. ‘lax-lax’ or

‘tense-tense’. Word pitch only rose when the consonant of the first syllable was lax and the consonant of the second syllable was tense. The study did not specifically test pitch with aspirated stops, but the results indicate that Korean word pitch is strongly affected by inherent pitch associated with combinations of syllable onset consonants. In contrast, the pitch pattern of words in Japanese is not affected by the type of consonant because pitch is determined lexically.

2.3. Perception of Japanese stops by Koreans

In Japanese the majority of words are non-accented and pitch rises from the first to the second syllable [8]. In Korean, the phrase pitch normally rises when the onset consonant of the first syllable is a lax stop, which is the default choice to transcribe a Japanese voiced stop. Therefore, when Korean speakers produce a Japanese word with rising intonation, such as a non-accented word, it is natural for them to produce the first consonant of the word as a voiced stop. Equally, when they produce a Japanese word with falling intonation, the onset consonant of the word is more likely to be a voiceless stop [7].

A study found that Korean speakers tended to perceive an initial consonant as an aspirated stop when the pitch pattern of a word was HL, but they started to hear a lax stop when the pitch of the initial syllable was lowered [1]. Jung [4] showed that Korean speakers tended to hear voiceless stops when the pitch was High and voiced stops when the pitch was Low; i.e. Korean speakers transfer phonetic features associated with Korean stops to their perception of Japanese voiced and voiceless stops. Fukushima [2] studied non-accented words and found that Korean subjects substituted voiced stops for voiceless ones twice as often as substituting voiceless for voiced ones. She concluded that Korean speakers have difficulty acquiring word initial voiced stops because Japanese voiced stops are perceived as Korean lax stops, which are voiceless in word initial position.

3. EXPERIMENT

An experiment was carried out to investigate first language (Korean) interference on second language (Japanese) stop production, and how this was related to word pitch pattern. Firstly, Korean speakers’ production of Japanese stops was examined to determine if they could differentiate voicing of Japanese stops. Secondly, their

production was examined in terms of mistakes in word pitch patterns. The hardest Japanese consonant for Koreans to acquire is a voiced stop at word initial position [2], so word initial Japanese stops were tested in relation to word pitch pattern.

3.1. Subjects

Nine Seoul Korean speakers, all undergraduate students at a Japanese university, participated in the experiment. Four (2 male and 2 female) were beginner speakers of Japanese who had studied Japanese for 6-12 months at the time of recording and the other 5 (all female) were fluent speakers of Japanese and had studied Japanese for 4-7 years.

3.2. Test words and procedure

Fifteen pairs of Japanese words (1) were chosen. They all start with either a voiced or voiceless stop of 2 to 4 morae and are contrasted by pitch: either with the accent on the 1st syllable, i.e. HL(L)(L) or non-accented, i.e. LH(H)(H). Another 13 pairs of words were also included, starting with either a non-stop consonant (/m, n, s, dz, or h/) or a vowel, and 21 distractors were also included. No words starting with /p/ were included because all such words are loanwords that the subjects might have known through knowledge of other foreign languages.

(1) /b:/	/ban/	/budoo/	/buNka/
/t:/	/taiko/	/taisjoo/	/taiseki/
/d:/	/dooka/	/dooki/	/doosi/
/k:/	/kama/	/kaN/	/kasi/
/g:/	/geNzai/	/geNgo/	/geNkaN/

All fifteen of the above word pairs have two meanings contrasted by accent location, e.g. /^ˈbaN/ vs. /baN/ (non-accented), /^ˈbudoo/ vs. /budoo/ (non-accented).

The test words were randomized and presented in Japanese orthography, Kanji and Hiragana. The pronunciation of all Kanji characters was written in Hiragana directly above each character. The meaning of the test words was provided in Korean orthography beside each word. At the same time, the test words were also vocally provided through headsets with a native Japanese speaker's recorded model pronunciation and pitch. When the subjects heard a word through the headsets they repeated it in the carrier sentence "Korewa test word to yomu" ('This is pronounced test word').

The recording was made in a quiet room using a SONY unidirectional condenser microphone,

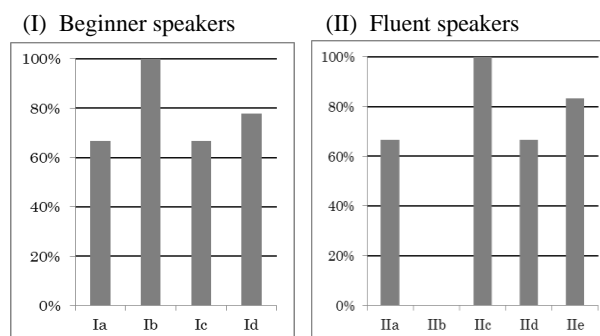
recorded directly to a PC, and digitized at a sampling rate of 44.1KHz. Recorded data were analyzed using Praat. The voicing of stops and the pitch pattern of the recorded words were judged by two native Japanese speakers; when auditory judgment was difficult to make, the judgment was based on acoustic analysis.

4. RESULTS AND DISCUSSION

4.1. Mistakes in voicing

Figure 2 shows the rates of voicing mistakes by the beginner and fluent speakers. Both groups produced the majority (71.6%) of word-initial voiced stops as voiceless. There were individual differences in mistake rates, varying from 0% to 100%, but there was no clear difference between the two speaker groups. However, there was no instance of wrongly produced voiced stops for voiceless stops.

Figure 2: The rate of wrongly produced voiceless stops for word-initial voiced stops by two groups of Korean speakers of two Japanese ability levels: (I) beginner speakers, and (II) fluent speakers.



4.2. Voicing and pitch

Mistakes in word pitch pattern were analyzed in relation to mistakes in voicing of stops (Table 1). Beginner speakers produced slightly fewer mistakes than the fluent speakers for both LH and HL pitch patterns. The top row of Table 1 shows the number and rate of non-accented words of LH pitch pattern wrongly produced with an HL pitch pattern. The bottom row shows the number and rate of HL pitch pattern words wrongly produced with an LH pitch pattern.

Table 2 shows the number of samples produced with wrong pitch patterns. The subjects most frequently mistook LH word pitch patterns for HL patterns when the initial sound of a word was a voiced stop (16%). The most frequent mistaking of HL pitch patterns for LH patterns occurred when the initial sound of a word was a voiceless stop

(32.4%). The type of word-initial consonant was based on the actual production by the subjects.

Table 1: The number of mistakes in word pitch pattern by Korean of two different Japanese levels.

	Beginners	Fluent speakers
LH → HL	23/112 (20.5%)	34/140 (24.3%)
HL → LH	5/112 (4.5%)	15/140 (10.7%)

Table 2: Production mistakes of word pitch patterns by Korean subjects, analyzed by the type of word-initial consonant.

Word-initial sound pitch pattern	Voiceless stops	Voiced stops	Non-plosives & vowels
HL → LH pitch pattern	10/111 (9.1%)	4/25 (16.0%)	5/117 (4.3%)
LH → HL pitch pattern	36/111 (32.4%)	1/24 (4.2%)	19/117 (16.2%)

The results support the hypothesis that when Korean speakers substitute a Korean aspirated or tense stop for a Japanese word-initial voiceless stop, the pitch of the word-initial syllable is raised due to the inherent characteristics of Korean aspirated and tense stops. This occurs irrespective of the lexical pitch pattern. As a result, the pitch pattern of a word is realized as HL. The results also showed that when a word was produced with a non-accented LH pattern, the word-initial consonant was produced as voiced. This occurred because in Korean when the pitch pattern is LH the likely candidate for a word-initial consonant is a lax stop, which is normally used to transcribe Japanese voiced stops.

Another question is why beginner speakers did marginally better in the experiment. It is possible that the fluent speakers in our experiment studied Japanese in Korea, whereas the beginner speakers started learning Japanese in Japan using Japanese as the medium language. Therefore, there may have been an effect of the standardized transcription of Japanese sounds in Korean orthography in the textbooks used in Korea (see Section 1). Further study is needed to clarify this point.

5. CONCLUSIONS

The study found that the mistake in Japanese stop production by Korean speakers was associated with mistakes in pitch patterns. The Korean speakers tended to produce voiced stops when the lexical pitch pattern was LH, whereas they produced voiceless stops when the pattern was HL.

The results indicate that Korean speakers also use pitch patterns associated with Korean stops in L2 Japanese production.

6. ACKNOWLEDEMENTS

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