Perception and Production in Pitch Accent System of Korean

Jungsun Kim and Ken de Jong

Indiana University
E-mail:jk16@indiana.edu, kdejong@indiana.edu

ABSTRACT

This research investigates dialectal variations of the pitch accent system in Korean. Specifically, this paper is focused on how speakers of a non-lexical pitch accent dialect are influenced by a lexical pitch accent dialect. Three experiments have participants from two dialectal regions produce pitch accent minimal pairs, and imitate and identify continua spanning pitch accent categories. Results show general correlation between productions and imitations and identifications in Kyungsang Korean speakers, and clear cases of divergence in Cholla speakers. Identification patterns suggest a variety of categorization schemes in these speakers, while their imitation results consistently indicate a lack of robust categorization.

1. INTRODUCTION

This research investigates the relationship between perception and production of lexical pitch accent contrasts in Korean. Regarding lexical and non-lexical prosodic properties, previous research has focused on the perception of tone, stress, or pitch accent across languages including investigations into how a language with a suprasegmental lexical contrast is perceived by speakers of a language without such contrasts. For example, French speakers do not distinguish between stress contrasts, whereas Spanish speakers do [2, 3]. In Mandarin Chinese and French, French listeners are sensitive to tonal variations, but cannot categorize tonal variation as Mandarin Chinese do [4].

Similarly within a language, speakers with dialectal non-lexical properties fail to distinguish lexical properties in another dialect. In a cross-dialectal study of Japanese, the effect of Tokyo Japanese pitch accent by native speakers with non-lexical pitch accent from two accentless areas in Japan was examined [12]. In Korean, there have been several cross-dialectal studies of pitch, but none focused on the effect of lexical properties of pitch accent across the dialects. The experiment in this research was focused on understanding speech perception and production of two dialects which differ in the presence of lexical contrasts in the location of pitch accent.

2. PITCH ACCENT IN KOREAN

Korean dialects can be categorized into lexical pitch accent dialects and non-lexical pitch accent dialects. This paper is focused on the North Kyungsang [KS] and South Cholla [CL] area in Korea. South CL Korean is a non-lexical pitch accent dialect spoken in the southern part of the southwest area of Korea, and the assignment of pitch accent is prosodically dependent. If the phrase starts without a laryngeal feature, the tone pattern is LHL, whereas if the phrase starts with laryngeal feature, the tone pattern is HHL [6, 7]. North KS Korean is a lexical pitch accent dialect spoken in the northern part of the southeast area of Korea. In it, the presence of a pitch accent is determined at the level of the phonological word, while the location of the pitch accent in a word is lexically determined [1, 9, 10]. Most previous research on KS lexical patterns was focused on distinguishing lexical pitch accent patterns by speakers' intuition, and few experimental studies distinguishing lexical pitch accent categories. Jun et al. [5] have demonstrated lexical pitch accent categories based on the distinction of word-initial low f0 and peak f0 in productions of six North KS speakers. The current experimental study examines also perceptual identifications of these categories, and also pursues the question of whether speakers of other dialects distinguish the KS tonal contrasts. In addition, the current study seeks to compare productions of the categories with identifications of the categories, by employing a mimicry task that requires both perception and production.

Correlations between these tasks open a window into the general relationship between speech perception and production.

3. MIMICRY

To account for the relationship between lexical and non-lexical pitch accent patterns, the mimicry method was used. Besides being a useful experimental paradigm in its own right, mimicry may also play a crucial role in the acquisition of the sound system of a native dialect or native language. By mimicking the sounds, infants learn to map between the auditory patterns and motor system. Previous studies of mimicry in infants show very early sensitivity to the dialect produced locally by adult speakers of each language [11]. Mimicry has also been used to investigate individual variation within one language related to degree of categorization evident in individual speech processing [13, 15]. Viechnicki [15] indicates further that internal factors, rather than external factors such as foreign language experience, can be responsible for much of the variation in mimicry strategies. As an example, comparing to monolinguals, the number of production categories was increased for bilinguals [14]. For English speakers, non-English vowels tend to be mimicked less clearly than English vowels [8]. This paper aims to investigate the relation between lexical and non-lexical properties in the mimicry method. We expect that speakers of a dialect without lexical categories will not have categorized mimicry responses, while those of a dialect with lexical categories will.

4. EXPERIMENT

4.1 Materials and Stimuli

Two syllable nouns were used to create the stimuli for speech perception and production experiments. The stimuli consist of three minimal pairs in the KS dialect, as in (1).

(1) Minimal pairs of 3 lexical accent patterns
 a. moI: HL vs. LH ‘feed’, ‘conspiracy’
 b. morE: HL vs. HH ‘sand’, ‘tomorrow’ [9]
 c. yangmo: LH vs. HH ‘wool’, ‘adoptive mother’

For production and mimicry tasks, base tokens of each lexical item were recorded within a carrier sentence by one North KS speaker using Praat 4.4, and resynthesized with 9 different F0 patterns. Patterns varied in equal steps from the original pattern to the F0 pattern in the other member of the minimal pair. Thus, for each minimal pair, there were two continua, one from each base.

4.2 Participants

Participants are 6 North KS speakers (3 females and 3 males) from Daegu which is the central city in the North KS area and 5 South CL speakers (5 females) from Kwangju which is the central city in South CL area. None of subjects reported any hearing problems, and all were compensated for their participation.

4.3 Procedures

The procedure includes a production task, an identification task, and a mimicry task. For production task, a set of 20 sentences including target words was recorded 3 times in random order. For the identification task, each stimulus was presented to the subjects 8 times in random order, and listeners were asked to press one of two buttons labeled with the two members of the minimal pair. The mimicry task also included an identification task. Each stimulus was presented 5 times to the subjects in random order, and the talkers were instructed to repeat into the microphone immediately what they heard, and then, to chose one of two words by clicking a button on a screen.

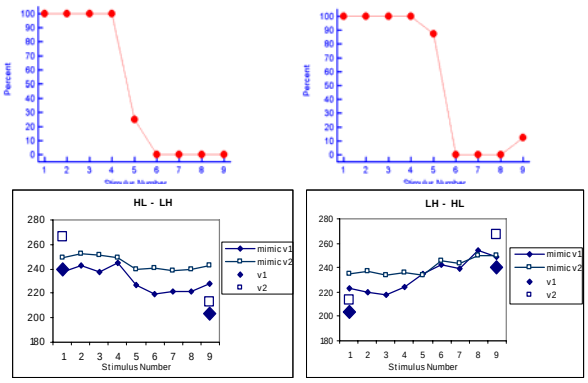
4.4 Results

4.4.1 Identification and Mimicry Response

The general pattern of results is that identification boundaries for the KS participants corresponded to locations of shifts in the mimicry responses. On the other hand, the presence of categorical boundaries and clustering in the mimicry responses are not consistent for the CL speakers.

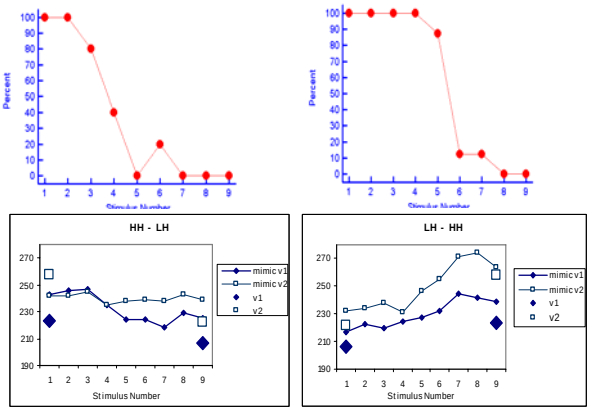
Figure 1 shows results of the identification task, production task and mimicry task with the minimal pair contrasting in accent on the first syllable (HL) and accent on the second (LH) for a KS participant.

Figure 1: Response patterns to HL-LH continua by one North Kyungsang speaker. Top panels plot proportion of base responses to resynthesized stimuli; bottom panels plot F0 patterns for mimicry responses to the same stimuli as the panels above them. Average F0 results for the production task are given at the margins of the lower plots.



In Figure 1, the top panels plot identification responses and the bottom panels plot mimicry and production responses. The mimicry responses below are to stimuli identified directly above them. The natural production responses were presented at both edges of the stimulus numbers. Comparing the result of identification and mimicry responses, the categorical boundaries above correspond to the location of shifts from a flat F0 pattern to a rising pattern in the mimicry data. The categorical boundary from the identification task of HL-LH accent pattern is at stimulus 5 for both continua, and a shift in the mimicry response is apparent between stimulus 4 and 5 in both continua. The flat and high F0 response in the left half of the left panel corresponds to identification as HL, and the rising pattern in the left half of the right panel corresponds to identification as LH.

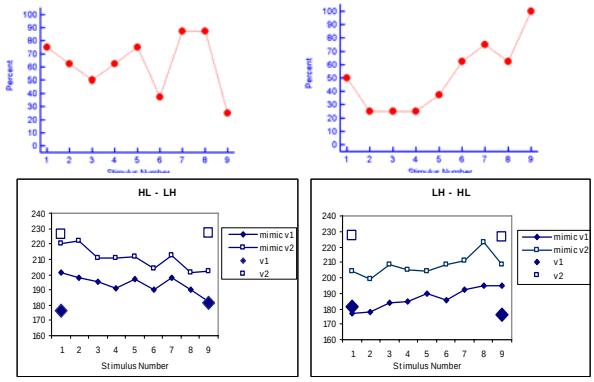
Figure 2: As in Figure 1, for one KS speaker



Such categorical correspondences were apparent in each of the KS participants, with minor variations. Figure 2 presents results for HH-LH and LH-HH continua by one KS participant. Here, again, the correspondence of identification boundaries and mimicry shifts are apparent, though the location of the shift differs in the two continua, suggesting some residual non-pitch difference from the LH and HL bases is influencing categorization. Also, an increased register of the F0 pattern in the HL (accent 1) cases is more apparent in the mimicry responses. However, the identification and mimicry clustering correspond well. The identification and mimicry responses of HH-LH and LH-HH continua are similar to those for LH-HL continua, though the boundaries are not quite as apparent, and the mimicry responses tend to exhibit shifts in register, rather than changes from rising to flat patterns.

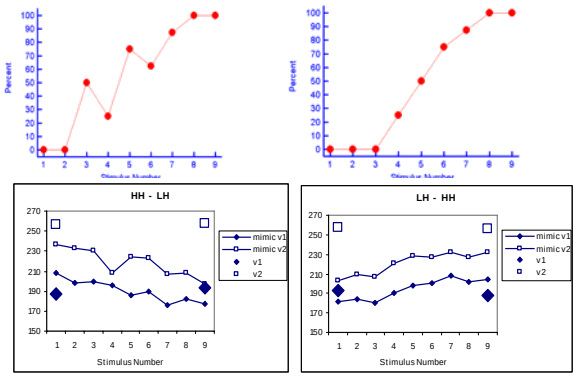
Turning to the Cholla speakers, figure 3 plots one of the CL participants' data. Here, there are no categorical boundaries evident in either identification or mimicry responses. Production data did not differentiate the two end point categories. Identifications tended to fluctuate around 50% across the board, and mimicry tended to gradiently track the stimuli across the whole 9 step-continua.

Figure 3: As in Figure 1, for one CL speaker



Other patterns also occurred in the CL speakers. Figure 4, plots data for a CL speaker whose identifications are systematically affected by the F0 changes. This subject clearly categorizes the stimuli according to the endpoints of the continuum, though not as cleanly as the KS speakers, and has the labels reversed. Mimicry responses also differ from the KS speakers in that they gradiently track the stimuli.

Figure 4: As in Figure 1, for a second CL speaker



4.4.2 Production and Mimicry Response

One other aspect of the data is of interest, the relationship between the production averages and the mimicry patterns. Figures 1-4 illustrate the general pattern, and that is that the gradient tracking of the stimuli apparent in Figures 3 and 4 reside within the overall range of the production patterns shown at the margins of each figure. That is, there is no difference between the productions of the minimal pair forms, all of them exhibit a large and pervasive rising F0 pattern, as is expected from previous descriptions of the accentual phrase marking tones [7]. The gradient tracking by the CL talkers, then, constitutes pitch range expansion of this single intonational pattern. By contrast, Figures 1 and 2 (and the KS talkers in general) exhibit a large difference in the pitch level, even for these accent 1 – accent 2 contrasts. Thus, the mimicry responses sometimes reflect categorized shifts in register, as in Figure 2, and sometimes show different tone patterns as in Figure 1. Taken together, the results indicate that the lexically categorized F0 pattern in KS often corresponds to a metalinguistically varied gradient pattern in CL.

5. CONCLUSION

Considering lexical and non-lexical pitch accent systems in Korean, this study finds evidence for 'categorical production' in one dialect and fuzzy or non-categorization in another. North Kyungsang speakers have sharp category boundaries for F0 continua, whereas South Cholla speakers have no or less sharp category boundaries, and identification labels are inconsistent. North Kyungsang speakers show categorization in both perception and mimicry, but South Cholla speakers do not show it in mimicry. Mimicry, then, reflects the robustness of lexical representation. Speakers in the dialectal locus of pitch accent contrasts are less likely to accurately track F0 continua in mimicry tasks, while speakers further from this dialect region might differentially identify pitch accent pairs, but are more likely to gradiently track F0 continua in mimicry tasks.

6. REFERENCES

[1] Chung, Y. H. 1991. *Lexical tone of North Kyungsang Korean*. Ph. D. dissertation. The Ohio State University.

[2] Dupoux, E., Pallier, C., Sebastian, N., Mehler, J. 1997. A destressing "deafness" in French? *Journal of Memory and Language*, 36, 406-421.

[3] Dupoux E., Peperkamp, S., Sebastián-Gallés, N. 2001. A robust method to study stress "deafness". *J. Acoust. Soc. Am*. 110, 1606-1618.

[4] Hallé, P. A., Chang, Y. C., Best, C. T. 2004. Identification and discrimination of Mandarin Chinese tones by Mandarin Chinese vs. French listeners. *Journal of phonetics*, 32, 395-421.

[5] Jun, J. H., Kim, J. S., Lee, H. Y., Jun, S. A. 2006. The prosodic structure and pitch accent of Northern Kyungsang Korean. *Journal of East Asian Linguist*, 15, 289-317.

[6] Jun, S. A. 1993. *Phonetics and phonology of Korean prosody*. Ph. D. dissertation. The Ohio State University.

[7] Jun, S. A. 1998. The accentual phrase in the Korean prosodic hierarchy. *Phonology*, 15, 189-226.

[8] Kent, R. 1979. Imitation of synthesized English and non-English vowels by children and adults. *Journal of Psycholinguistic Research*, 8, 43-60.

[9] Kim, G. R. 1988. *The pitch accent system of the Taegu dialect of Korean with emphasis on tone sandhi at the phrasal level*. Ph. D. dissertation. University of Hawaii.

[10] Kim, N. J. 1997. *Tone, segments, and their interaction in North Kyungsang Korean: A correspondence theoretic account*. Ph. D. dissertation. The Ohio State University.

[11] Kuhl, P. K., Meltzoff, A. N. 1996. Infant vocalizations in response to speech: Vocal imitation and developmental change. *J. Acoust. Soc. Am*. 100, 2425-2438.

[12] Otake, T., Cutler, A. 1999. Perception of suprasegmental structure in a non-native dialect. *Journal of Phonetics*, 27, 229-253.

[13] Pierrehumbert, J. B., Steele, S. A. 1989. Categories of tonal alignment in English. *Phonetica*, 46, 181-196.

[14] Schouten, M. E. H. 1977. Imitation of synthetic vowels by bilinguals. *Journal of Phonetics*, 5, 273-283.

[15] Viechnicki, P. D. 2002. Composition and granularity of vowel production targets. Ph. D. dissertation. University of Chicago.