Perception and Production in Pitch Accent System of Korean

ABSTRACT
This research investigates dialectal variations of 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 [1, 2]. In Mandarin Chinese and French, French listeners are sensitive to tonal variations, but cannot categorize tonal variation as Mandarin Chinese do [3].

Similarly within a language, speakers with dialectal non-lexical properties fail to distinguish another 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 SYSTEM 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 phonologically 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 [5, 6]. 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. Thus, there are accent minimal pairs (eg. kaci: HL ‘kind’, LH ‘eggplant’, HH ‘branch’[10]). The lexical pitch accent categories in North KS Korean can be distinguished largely by the location of a high tone in a word [1, 9,10], though there are also contrasts in the presence or absence of a second, initial high.

Most previous research on KS lexical patterns were focused on distinguishing lexical pitch accent patterns by speakers’ intuition, and few experimental studies distinguishing lexical pitch accent categories. Jun et al. [6] 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 is spoken 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] provides some implication that a large portion of the variation in mimicry strategies is not because of external factors such as foreign language experience, but more to internal factors. 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. yang.mo: 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 was 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 a minimal pair contrasting in accent on the first
syllable (HL) and accent on the second (LH) for an
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 to
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 for identification task of HL-LH accent
pattern is at stimulus 5 for both continua, and a
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 a second KS speaker

Such categorical correspondences were apparent in
each of the KS participants, with minor variations.
Figure 2 presents results for a second 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
LH-HH and HH-LH accent pattern are almost
consistent for the categorical boundaries. The
continuum of LH-HH and HH-LH can be
considered that the effect of register is bigger than
other accent pattern continuums.

Figure 3 plots one of the CL participants’
data. Here, there are no categorical boundaries
evident in either identification or mimicry
responses. Identifications tended to be near 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 clear categorizes,
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 one 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 matalinguistically 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 gradually track F0 continua in mimicry tasks.

6. REFERENCES