TONAL TARGETS AND THEIR ALIGNMENT IN DAEGU KOREAN

Akira Utsugi[*], *Hyejin Jang*[**], *and Minyoung Seol*[**]

[*] JSPS postdoctoral fellow for research abroad / University of Edinburgh [**] Korea University

[*] autsugi@ling.ed.ac.uk

ABSTRACT

This study investigates tonal targets in Daegu Korean. Through our analysis of F0 and alignment, especially focusing on the turning point, we identified the different features between the rise before the accent and the fall after the accent. In the contour before the accent, we identified the turning point from the low plateau to the rise, anchored to the end of the syllable immediately preceding the accented syllable. On the other hand, in the contour after the accent, the turning point was not clear and, even if it exists, it was delayed. These results are against the theory in previous literature that the accented syllable is associated with H*+L in this dialect.

Keywords: Daegu Korean, prosody, accent, tonal target, turning point

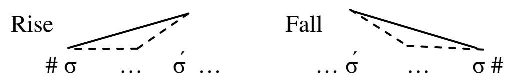
1. INTRODUCTION

This study concerns pitch in the Daegu dialect, one of the Northern Kyungsang dialects of Korean. It is widely known that this dialect has a lexical tonal system (e.g. [9], [1], [4], [7], [3]). Broadly speaking, the tonal system has two major classes (hereafter, "Class A" and "B"). Class A has a tonal peak whose location is lexically specified in any one syllable in the phonological word. Class B has flat high pitch in the initial two syllables of the phonological word. This class also has the distinction in vowel length in the first syllable, even though it has been reported that this distinction is disappearing in the younger generation [1]. Because of this distinction, some researchers further divide this class into two subclasses [9], [1]. Thus, if the phonological word consists of two syllables, there are four tonal subclasses; σ́σ (Class A), σσ́ (Class A), σ́σ́ (Class B), and σ́:σ́ (Class B) (The acute accent stands for the high pitch).

The tonal system of this dialect is often analyzed phonologically with the concept "accent" (or "accent kernel", "lexical pitch accent"), as in the analysis of Tokyo Japanese. Even though the peak in Class A is the typical "accent", some researchers include the high pitch of Class B in the accent as well (e.g. [3]). It is beyond the scope of this paper to discuss on whether the high pitch in Class B is the accent. In this paper, we expediently include the high pitch of Class B in the accent.

Our focus lies on tonal targets in the rise before the accent and the fall after the accent in this dialect. This contains the following two issues. The first issue is how many tonal targets the rise and fall has. One hypothesis is that they have only two targets, one at the edge of a phonological word or phrase and the other at the accent, and the pitch between these two targets is lineally interpolated (Figure 1, solid lines). However, it is possible to postulate another hypothesis that there are one or more additional targets somewhere in-between (Figure 1, dashed lines). The second issue is, if there are the additional targets, where those targets are aligned.

Figure 1: Expected F0 contours. Solid lines show contours with interpolation between the edge and the peak. Dashed lines show contours with additional targets between the two targets.



On these issues, there are several previous studies, which are summarized separately for the rise and fall. As for the rise, [7] impressionistically describes the rise as gradual. An empirical study of F0 contours by [3] confirms this impression. However, this study is based on limited materials which contain only three syllables before the accent. As for the fall, it has been reported that there is a turning point from the steep fall to the low plateau, supporting the existence of a low target after the pitch accent [3]. However, another experiment indirectly suggests that the falling slope becomes more gradual as the number of syllables in the phonological word increases [2].

These issues are theoretically important for two reasons. First, they are related to the issue of how the tones are specified in the surface representation in this dialect. [3] proposes that the tone associated with the accented syllable in this dialect is H*+L, based on their experiments. Our experiment on the issues above can lead to the reconsideration of their theory. Second, these issues on Daegu Korean are related to more general issues of how tonal targets are aligned with the segmental string and what the targets correspond to in phonology, which have been debated mostly in intonational studies of European languages (e.g. [6]).

2. EXPERIMENT: METHODS

2.1. Subjects

The subjects in this experiment were the following four native speakers of Daegu Korean, born in the late 1970's or in the early 1980's; JYG (male), JDW (male), JSJ (female), HYH (female).

2.2. Materials

The materials in this experiment are classified into two sets; set 1 for the rise and set 2 for the fall.

As for set 1, test words were put into the following carrier sentence.

- *Na-nun __ manhi cwuessta.*
  ('I gave many __.')

Test words in set 1 were selected from the subclass having an accent in the final syllable and were lengthened by compounding as follows: *namu* [namú] 'tree', *taynamu* [tenamú] 'bamboo', *petunamu* [pʌdɯnamú] 'willow', *mukwunghwanamu* [muguŋɦiwanamú] 'hibiscus'.

For set 2, phonological words, consisting of a two-syllable lexical word and a postpositional particle, indicating the direction, of one, two, or three syllables, were used as test words, as in the following example.

- *Na-nun* <u>*manul-ey/eyta/eytaka*</u> [mánɯɾe(daga)] *kancang ppulyessta.*
  'I put soy sauce on garlic.'

In this set, two types of carrier sentences were used. Also, in each sentence, four test words, each of a different tonal subclass, were used. However, only the results of the above material are shown in the present paper because of the limited space.

2.3. Recording and analyzing procedures

In the recordings, subjects read cards on which a test sentence was written. A set of the cards included three repetitions for each sentence and was randomized.

Segmentation of the recorded tokens was performed manually using Praat Version 4.5.14. Then F0 contours were extracted with the same software. To avoid microprosodic effects, F0 values computed in obstruents were removed.

Turning points in the part in question were detected by fitting two linear regression lines. The algorithm for this detection was based on Excel VBA macro by [8] and was modified by the authors for the semi-automatic analysis. The input to this algorithm was F0 values in certain regions as described in the next section. Turning points estimated to lie outside the region were regarded as errors. Cases in which the slope between the peak and the turning point was more gradual than the outer slope were also regarded as errors.

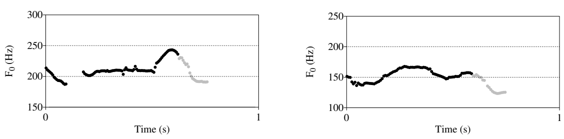
3. RESULTS AND DISCUSSION

3.1. Rise

3.1.1. F0 contours

In the rise, subjects exhibited different contours, which are classified into two types. The first type, illustrated in the left panel of Figure 2, is an elbow-shape with the peak in the final syllable. We call this 'final rise'. The second type, illustrated in the right panel of Figure 2, shows two peaks; one in word-medial position and the other in the final syllable. We call this 'dual peak'. Among the data, all of the test words of less than five syllables showed the final rise. On the other hand, the test words of five syllables showed either the final rise or the dual peak. All of HYH's five-syllable data showed a clear final rise, while all of JYG's five-syllable data showed a clear dual peak. As for two other subjects, although the typical dual peak was not found, the data sometimes showed a two-peak (dual-peak-like) pattern where the first peak is small.

Figure 2: The F0 contours of *mukunghwanamu.* Left: HYH, right: JYG. The target word is shown with black dots and the first syllable of the following word is shown with grey dots.



It is assumed that the dual peak productions are indicative of subjects producing these long compounds as two prosodic units rather than one unit. What this prosodic unit is, i.e. a prosodic word or something else such as a prosodic phrase or an intermediate phrase, is beyond the scope of this paper. In the following discussion, we only include the final rise data.

In the final rise, two significant characteristics were identified. One was a small step-like rise from the first syllable to the second syllable in the test words of more than two syllables. The other was a steep rise from the penultimate syllable to the final syllable. When the word was long enough, the contour before the turning point in the penultimate syllable showed a low plateau.

Of two characteristics above, the former has already been mentioned in the previous studies [5], [3]. On the other hand, the latter disagrees with the previous observation that the interpolation occurs between the F0 minimum in the first syllable and the peak in the final syllable [3]. It is assumed that this disagreement was caused because [3] only dealt with a three-syllable word. In three-syllable words, the contours look at first blush like interpolation. However, this interpolation-like contour is considered as a reflection of the step-like rise between the first and second syllable. The longer words in our data prove the existence of the low target immediately before the final peak.

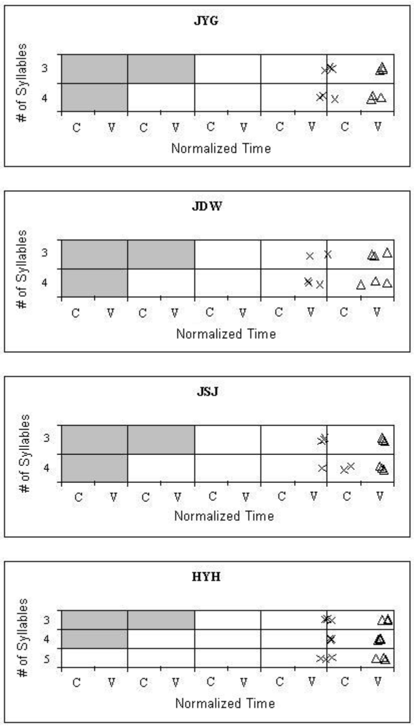
3.1.2. Analysis of turning points

The turning point around the penultimate syllable was detected by the algorithm described in 2.3. The input to the algorithm was F0 values from the beginning of the second syllable to the peak in the final syllable. The F0 values in the first syllable were not included to avoid the influence of the initial step-like rise. Thus, the two-syllable word was not included in the analysis. Also, as for the five-syllable word, only HYH's tokens, which showed the clear final rise, were analyzed.

Figure 3 shows the alignment of turning points. As can be seen from this figure, the alignment of the turning point was anchored to the end of the penultimate syllable irrespective of the number of syllables. An ANOVA (dependent variable: time (turning point – penultimate syllable end), factors: Subject and Syllable Number) excluding HYH's five-syllable word confirmed that the effect of Syllable Number was not significant ($F(1, 18) = 0.642$, $p = 0.433$). In addition, an ANOVA run on HYH's data including the three-, four-, and five-syllable words also showed no significance for Syllable Number ($F(2, 6) = 1.381$, $p = 0.321$).

These results support the existence of a low target immediately before the pitch accent.

Figure 3: The alignment of the peak and turning point in the rise on a normalized time scale. Δ and X stand for the alignment of the peak and the turning point respectively. For JYC, JDW, and JSJ's data, *taynamu* (three syllables) and *petunamu* (four syllables) are shown. For HYH's data, *mukwunghwanamu* (five syllables) is also shown.

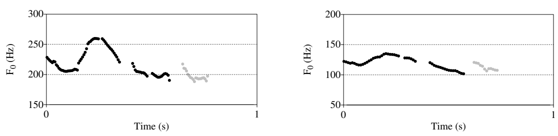


3.2. Fall

3.2.1. F0 contours

We identified two features already reported by [3]; (i) the F0 minimum in the first syllable of the phonological word, even when the word starts with the H tone phonologically, and (ii) frequent delay of a peak relative to the phonological placement of the accent. Figure 4 shows examples.

Figure 4: The F0 contour of *manwul-eytaka*. Left: HYH, right: JDW. The target word is shown with black dots and the first syllable of the following word is shown with grey dots.



Turning to our main issue of the target after the peak, the results were not straightforward. Some contours showed a likely turning point between the peak and the end of the word, as in the left panel of Figure 4. However, the others, as in the right panel, showed no clear turning point. What is more, even in the contour having the turning point, the turning point appeared fairly late, usually in the second syllable or in the third syllable from the peak.

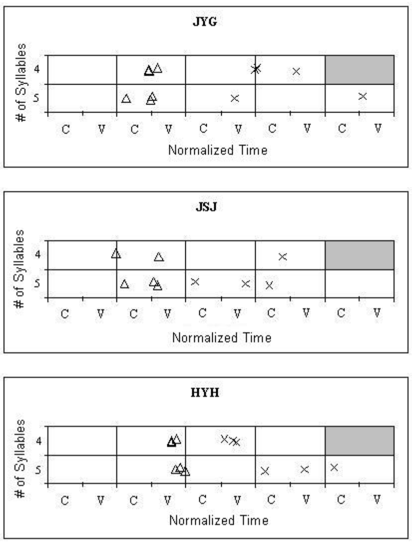
These results partly agree with [3], in that the turning point is delayed. However, another important finding, which is not mentioned by [3], is that sometimes it does not seem to appear at all even in long phonological words.

3.2.2. Analysis of turning points

The turning point in the fall was detected in the same way as in the rise. The input to the algorithm was F0 values from the peak to the end of the phonological word.

Figure 5 shows the alignment of turning points. JDW's data is not shown in this figure since all of his tokens in these test words showed errors due to no proper turning points. As can be seen from this figure, the results showed a fairly high variance in terms of the alignment of turning points.

Figure 5: The alignment of the peak and turning point in the fall on a normalized time scale. Δ and X stand for the alignment of the peak and the turning point respectively. *manwul-eyta* (four syllables) and *manwul-eytaka* (five syllables) are shown.



This high variance may be due to two reasons. First, the turning point may not be successfully detected. This further suggests that the turning point in the fall is not as distinct as that in the rise. Second, even for the points successfully detected, they may not be solidly anchored to a certain segment in terms of alignment.

In any case, the results of the fall contrast with those of the rise. It may not be possible to compare with these two accurately under the different segmental conditions. However, even when we take the segmental difference into consideration, the difference of the results described here is clear.

These results are inconsistent with [3]'s view that the pitch accent in this dialect is associated with H*+L. If this view is correct, the fall should show a clearer turning point than the rise does.

4. CONCLUSION

The results of our experiment showed that Daegu Korean has a low target before the accent, which is anchored to the end of the syllable immediately preceding the accented syllable, but does not have such a target after the accent that is comparable to that before the accent. These results were the clear contrary to [3]'s view. It is still an open question whether the fall has the low target before the end of the phonological word.

We hope that these findings will contribute to the general debate on tones and tonal targets as well as the language-specific debate on Korean.

5. ACKNOWLEDGEMENTS

This work was supported by the Field Research Fellowship, Korea Foundation (4/2006-12/2006) and JSPS Postdoctoral Fellowships for Fesearch Abroad (1/2007-1/2009).

6. REFERENCES

[1] Gim, C.-G. 1994. 60tay taykwu pangen-kwa 20tay tayku pangen sengco-uy tayco punsek. *En.ehak* 16, 23–80.

[2] Gim, C.-G. 2002. *Kwuk.e Pangen Sengcolon*. Seoul: Yeklak.

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

[4] Kenstowicz, M., Sohn, H.-S. 1997. Focus and phrasing in Northern Kyungsang Korean. *MIT Working Papers in Linguistics* 30, 25-47.

[5] Kim, N.J. 1997. *Tone, Segments, and Their Interaction in North Kyungsang Korean*. PhD dissertation, Ohio State University.

[6] Ladd, D.R. 2000. Bruce, Pierrehumbert, and the elements of intonational phonology. In: Horne, M. (ed), *Prosody: Theory and Experiment*. Dordrecht: Kluwer, 37-50.

[7] Lee, Y. 2002. Kankokugo tegu hoogen akusento-no on'inronteki kaisyaku. *Tokyo University Linguistic Papers* 21, 103-121.

[8] Nihon no chokusen ni yoru oresen kaiki (by S. Aoki). http://aoki2.si.gunma-u.ac.jp/lecture/stats-by-excel/vba/html/oresen-kaiki.html visited 12-Feb-07

[9] Rah, S. 1974. Kankokugo tegu hoogen-no akusento. *Gengo Kenkyu* 66, 1-44.