

Non-rising questions in North Kyeongsang Korean

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Abstract

This paper investigates interrogative intonation in North Kyeongsang Korean, a pitch accent language making use of final particles. A production study shows that yes/no questions do not have rising intonation, in contrast to impressionistic observations in the literature. Moreover, a perception study shows that the perceptual distinction between yes/no questions and statements is fairly sharp, despite relatively small acoustic differences between them. High pitch is strongly associated with the percept of yes/no questions, which supports the Strong Universalist Hypothesis [7]. Finally, no consistent effect is found between the presence/absence of question particles and intonational realization.

1. Introduction

This paper investigates intonation patterns of sentence types in North Kyeongsang Korean (NK Korean hereafter), which is a pitch accent language spoken in south-eastern regions of the Korean Peninsula. It has been said in the literature that yes/no questions have rising intonation whereas statements and WH questions have falling intonation in NK Korean [12]. However, this impressionistic observation has yet to be instrumentally supported. In this paper, therefore, intonation patterns of statements and questions are described based on production and perception experiments.

One of the major topics in the studies of intonation has been the distinction between statements and questions. In the literature, one of the most commonly observed intonational patterns for questions is sentence-final rising. Bolinger [1] reported that over 70% of languages in the world share rising intonation for questions. According to Ladd [7]’s Strong Universalist Hypothesis (SUH), questions tend to have high or rising intonation whereas statements tend to have low or falling intonation. However, counterexamples to this hypothesis have been reported. For example, Ladd [7] himself noticed that questions do not necessarily rise at the end in varieties of Rumanian and Hungarian, and intonational patterns depend on focus conditions. In Bengali [6], Greek [4] and Basque [3], statements and yes/no questions may not be distinguishable in terms of utterance-final intonation. In Neapolitan Italian [2], a major distinction between statements and yes/no questions lies in the timing of accent-lending falling and rising, respectively, relative to the accented vowel. Rialland [11] observed that low-pitched questions are not rare in many African languages. Gussenhoven [5] argues, therefore, that universal meanings of intonation are attributed to the phonetic implementation, embedded in biological codes, whereas the language-specific meaning is “located in the intonational morphology and phonology.”

Realizations of interrogative intonation are also affected by lexical information. In Mandarin Chinese, for instance,

yes/no questions may not be clearly distinguishable from statements if the utterance final syllable is lexically L-toned [14, 15]. In Thai, an intonational H tone emerges for questions, only when the sentence-final particle is lexically toneless [10]. Van Heuven and Haan [13] argued that for Dutch, the more lexical information is available, the weaker the intonational marking of questions becomes.

Studying the interrogative intonation patterns in NK Korean will contribute to the understanding of universality and language-specificity of interrogative intonation. According to Lee [8], the intonational contours of NK Korean yes/no questions and statements overlap to a large extent in four-word utterances, in which distinctions between the two sentence types are not so clear. Moreover, since NK Korean makes use of sentence-final particles, the presence of question particles may deemphasize the strength of intonational question marking, leading to weaker intonational distinctions between sentence types.

In this paper, I show that yes/no questions are not “rising,” in contrast to observations in the literature, but they are still higher in pitch than statements. Moreover, the distinction between statements and yes/no questions is perceptually salient. Finally, I argue that intonational realizations are independent of the presence or absence of disambiguating lexical interrogative particles.

2. Production experiment

In order to identify general pitch contours of each sentence type, a set of sentences were recorded, and a set of pitch targets were measured. Based on the measurements, mean pitch contours were drawn by interpolating the mean values of the pitch targets over time.

2.1. Method

2.1.1. Materials

Test sentences were composed of three words, Subject/Adverb-Object-Verb. There were three sentence types: statements, yes/no questions and WH questions. The sentence types were indicated with punctuations on subjects’ scripts. There were two kinds of sentence-final particles: neutral particle *-yo* and question particles *-na* or *-no*. When the sentence particle was *-yo*, intended sentence types were indicated only with punctuation, but if the sentence-final particle is *-na* or *-no*, this particle is an unambiguous indicator of yes/no questions and WH questions. Examples are given below.

a. Lexically ambiguous

Onul	me	nala-yo
today	what/something	deliver-NeutPart
‘I deliver something/ Do you deliver anything?’		
What do you deliver?’		

b. Lexically unambiguous

Onul me nalass-na/no
today what/something delivered-QPart
‘Did you deliver anything?/ What did you deliver?’

The example in (a) can be interpreted in three ways: as a statement, a yes/no question or a WH question. Distinctions among these three sentence types depend on intonational patterns. If the neutral particle *-yo* is replaced with *-na/no* as in (b), the sentence is unambiguously a question.

Statements and yes/no questions were focused on either the second or the third word. Focus was used to control the number of pitch accents in a sentence. When the third word in a three-word sentence is focused, each word in a sentence has a separate pitch accent, but when the second word is focused, the last word is deaccented. For WH questions, a WH word appears only on the object position, i.e. the second word. Therefore, WH questions always have focus on the second word.

Experiment sentences embedded in dialogues were printed on flash cards and presented in a random order.

2.1.2. Procedures

Eight native speakers of NK Korean participated in the recordings: four female and four male speakers in their late 50’s or early 60’s. Two male speakers were later excluded from the analysis due to their unnatural intonation or disfluencies. Each speaker read all the dialogues, repeating them five times.

2.1.3. Pitch target measurements

Seven pitch targets as shown in Figure 1 were measured in Praat: the F0 and timing of three accentual peaks, three post-peak valleys, and the right edge. When the third word was deaccented due to focus on the second word, *Peak3* was not measured.

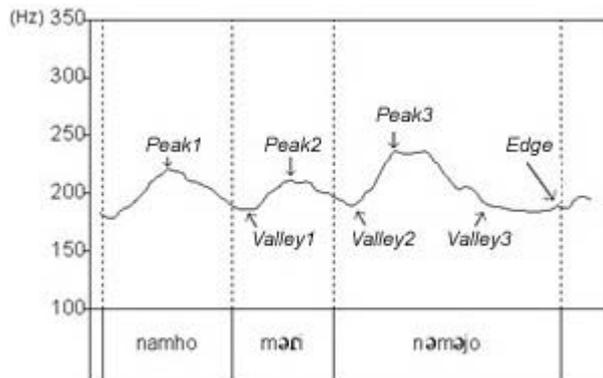


Figure 1: Pitch targets measured

2.2. Results

2.2.1. Statement versus yes/no questions

Mean pitch contours for the female and male speakers are shown in Fig. 2, where focus falls on the last word and particle types are pooled. In contrast to Suh [12]’s claim that Kyeongsang Korean yes/no questions are rising, the mean F0

contours in Figure 2 show that yes/no questions are not literally rising. In Figure 2, we can see that both female and male speakers produced falling intonation for statements and non-rising intonation for yes/no questions. Female speakers’ yes/no questions end in sustained pitch at the right edge. The mean F0 difference between the last two targets for the female speakers is only 0.2 semitones. Since such a small difference would not be perceived as a rise, it would be perceived as a mid-plateau. Male speakers display falling pitch for yes/no questions as well as statements. The distinction lies in the extent to which the pitch drops.

Two-sample t-tests run on F0 measurements for the female speakers show that sentence types are significantly different in some dependent variables: normalized *Peak3* [$t_{105}=3.47, p<.001$], *Valley3* [$t_{102}=-9.32, p<.0001$] and *Edge* [$t_{70}=-9.04, p<.0001$]. The timing variables of *Peak3* and *Edge* also show significant differences according to sentence types ($p=.0001$ and $<.0001$ respectively). Similar results were obtained for the male speakers.

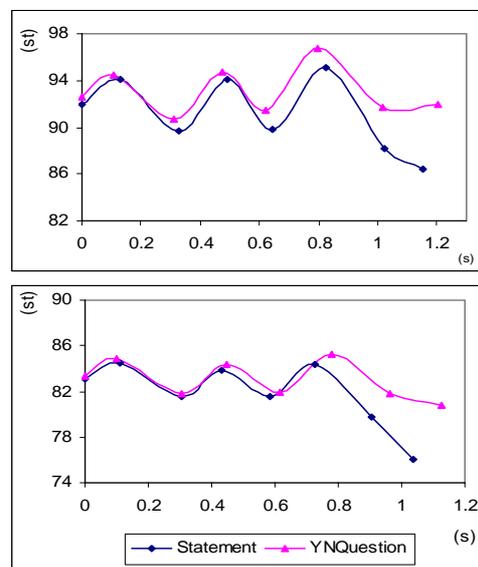


Figure 2: Mean pitch contours of statement and yes/no question: female (top) and male speakers (bottom)

2.2.2. Statement vs. yes/no question vs. WH question

Mean pitch contours for the three sentence types are shown in Figure 3, where sentences are focused on the second word, and particle types are pooled. Yes/no questions display sustained pitch as was seen above, but WH questions have falling pitch similar to that of statements.

In the female speakers, F0 variables such as normalized *Peak3*, *Valley3* and *Edge* were significantly different between WH questions and statements ($p<.001$), and between yes/no questions and WH questions ($p<.05$). In male speakers, however, those F0 values were significantly different enough to distinguish only between yes/no and WH questions ($p<.0001$), but not between statement and WH question ($p>.05$).

I argue that WH questions have a falling intonation like statements, but they can optionally exhibit sustained pitch like yes/no questions. I claim that the optional pitch raising places

WH questions in between statements and yes/no questions in the female speakers (Fig.3 top). Indeed, WH questions with higher pitch were observed more often in female speakers.

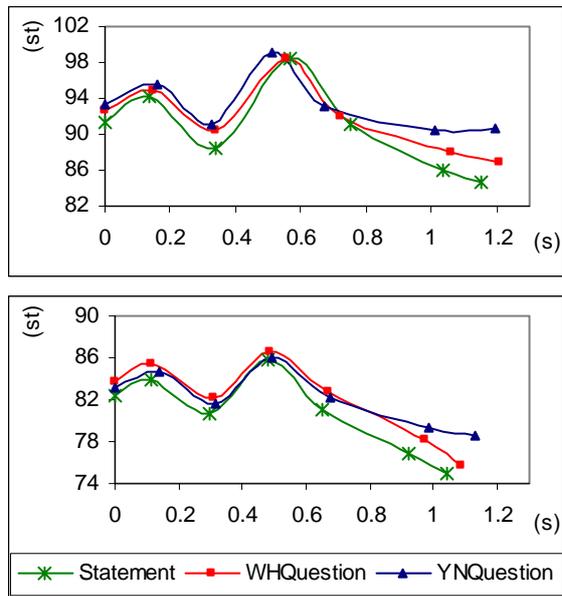


Figure 3: Mean pitch contours for three sentence types: female (top) and male speakers (bottom)

3. Perception experiment

Distinctions between statements and yes/no questions may seem obvious from section 2. However, the sentence types may not be so easy to distinguish when in isolation, since pitch is generally falling at the right edge for both sentence types. In this section, I examine whether native listeners can systematically distinguish questions from statements solely by intonation, by carrying out a sentence type identification test.

3.1. Method

A set of stimuli was selected from the recordings. Stimuli were balanced for two sentence types (statement and yes/no questions), two focus conditions (early and late focus), and six speakers (four female and two male). All the stimulus sentences contained neutral particles so that they were potentially ambiguous with respect to sentence types.

Twenty-five listeners participated in this test. The participants listened to each utterance and judged whether it was a statement or a question. The test was a forced-choice task. Based on their responses, question-response ratios (Qratio) were calculated, i.e. the actual number of “question” responses over the total number of responses. Nominal logistic models were plotted for individual responses as well.

3.2. Results

In Figure 4, Qratios of individual stimuli are plotted against *Edge F0* (semitone) separately for all female speakers. In these figure, *Edge F0* is strongly correlated with sentence type perception such that low pitch is associated with statements, and high pitch with yes/no questions. Moreover, the data are clustered into two clouds, one on the lower left

and the other on the upper right. Such a clear separation along the *Edge F0* suggests that perception of yes/no questions and statements may be discrete in this language. Similar patterns were found for the male speakers.

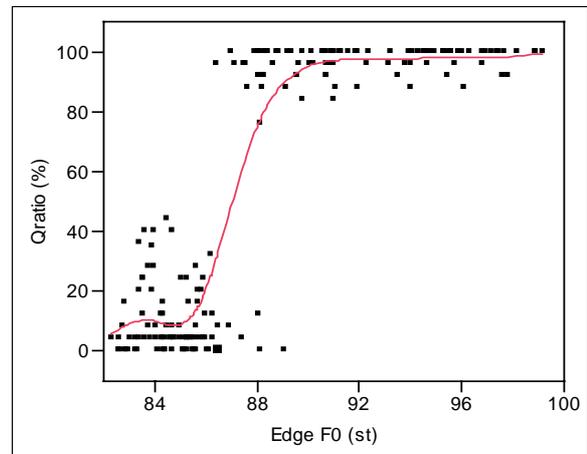


Figure 4: *Qratio*(y-axis) against *Edge F0* (x-axis) for all female speakers with a smoothing Spline fit ($\lambda= 0.1$ standardized)

The smoothing spline fit on Figure 4 supports that the sentence type perception may be categorical ($R^2=85.28\%$). The two clouds in Figure 4 overlap on the X-axis, around 88 semitones, which is due to pitch range variability. Scatterplots with *Qratio* against *Edge F0* for individual speakers (stimuli) showed clearer separations with no overlaps.

The results suggest two things. First, yes/no questions are strongly associated with high pitch. Second, native listeners are able to distinguish between statements and yes/no questions by relying on intonational cues only, even though the two sentence types have similar intonational configurations. That is, native listeners are sensitive enough to small acoustic differences to identify sentence types.

4. Effect of particles on intonation

NK Korean sentence types, otherwise lexically ambiguous, can be disambiguated by the use of lexical question particles. As argued in van Heuven and Haan [13] and Pittayaporn [10], intonational question marking may be negatively correlated with lexical interrogative marking. Maybe the presence of lexical interrogative particles voids the need to mark the distinction intonationally in NK Korean. Moreover, the relatively weak intonational marking of NK Korean yes/no questions may be related to an interaction with lexical question particles. To resolve this issue, questions with disambiguating interrogative particles were compared to those with neutral particles.

As illustrated in Figure 5, where yes/no questions are split into two particle groups, mean intonational contours do not look different between the two groups. An ANOVA test run with the dependent variable *Edge F0* and a fixed factor *Particle* confirms this observation: *Edge F0* was not significantly different with respect to the type of sentence-final particle [$F(1,56)=0.48, p>.5$ and $F(1,126)=0.37, p>.5$ for female yes/no and WH questions respectively]. That is, no systematic effect was found in my study between sentence-final particles and intonational realizations of questions.

Relatively small acoustic differences between NK Korean statements and yes/no questions have little to do with the presence or absence of disambiguating question particles but they are rather language-specific properties of NK Korean intonational modalities.

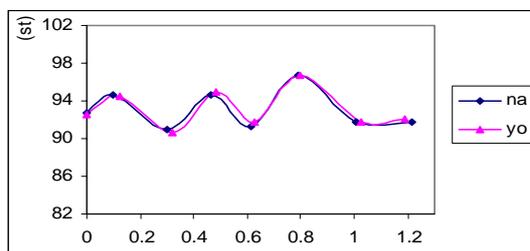


Figure 5: Mean F0 contours of yes/no questions, question particle -na vs. neutral particle -yo (female)

5. Discussion

The acoustic analysis showed that yes/no questions have higher pitch than statements, and the identification test revealed that high pitch is strongly associated with the percept of questions. These findings suggest that the SUH is supported in NK Korean.

Yes/no question contours deviate from statement contours to a larger extent toward the end of the utterance. As the differences are smallest at the beginning, and largest at the right edge, the pitch at the right edge may be the strongest cue for marking yes/no questions in this language. As shown in Figure 4, Edge F0 alone can separate yes/no questions and statements quite sharply, which also supports the argument that the pitch at the right edge is the strongest intonational cue of questions in NK Korean. In her identification test with manipulated stimuli, Lee [8] reported that only the sentence-final pitch was positively correlated with the percept of yes/no questions while other cues including peak heights did not show any systematic effect. However, as van Heuven and Haan [13] have shown for Dutch, global cues such as general declination slope or pitch range evolutions along the declination may also play a role in cuing interrogativity. Further study is required to determine whether interrogative intonation is realized locally with the sentence-final pitch, for instance, or globally with distinct general trends.

There may be gender and age effects on intonational realizations. This study showed that WH questions are not systematically different from statements in terms of intonation. However, female speakers optionally have sustained pitch for WH questions. Though not discussed here, younger speakers seem to have clearly rising intonation for both yes/no questions and WH questions, as opposed to older speakers. Details will be discussed in Lee [9].

6. Conclusions

Two experiments carried out in this study show that NK Korean statements and WH questions are falling as observed in the literature. However, NK Korean yes/no questions are not rising in contrast to the observation in the literature. Nevertheless, yes/no questions are still differentiated from statements acoustically: yes/no questions have systematically higher pitch than statements. Perceptual distinctions between

yes/no questions and statements were quite sharp, which suggests that sentence type intonations may be discrete in this language. The most important acoustic cue for marking questions seems to be sentence-final pitch, since the deviation between yes/no questions and statements is largest at the end of an utterance. In other words, higher edge F0 is one of the strongest predictors of yes/no questions. Time-dependent global evolutions of pitch contours may play a role in cuing sentence types as well as local deviations in pitch at the end of an utterance. This remaining issue will be investigated in Lee [9].

7. References

- [1] Bolinger, D., 1978. Intonation across languages. In Greenberg, J. (ed.), *Universals of Human Language*, Vol. II: Phonology. Stanford University Press, 471-524.
- [2] D'Imperio, M.; House, D., 1997. Perception of questions and statements in Neapolitan Italian. In *Proceedings ESCA Tutorial and Research Workshop on Intonation: Theory, Models and Applications*. Athens, Greece.
- [3] Elordieta, G., 1997. Accent, tone, and intonation in Lekeitio Basque. In Fernando Martínez-Gil and Alfonso Morales-Front (eds.), *Issues in the Phonology and Morphology of the Major Iberian Languages*. Washington D.C.: Georgetown University Press.
- [4] Grice, M.; Arvaniti, A.; Ladd, D. R., 2000. On the place of phrase accents in intonational phonology. *Phonology* 17, 145-185.
- [5] Gussenhoven, C., 2002. Intonation and interpretation: phonetics and phonology. *Speech Prosody 2002: Proceedings of the First International Conference on Speech Prosody*, 47-57.
- [6] Hayes, B.; Lahiri, A., 1991. Bengali intonational phonology. *Natural Language and Linguistic Theory* 9, 47-96.
- [7] Ladd, D. R., 1981. On Intonational Universals. In T. Myers et al. (eds.), *The Cognitive Representation of Speech*. Amsterdam: North Holland Publishing.
- [8] Lee, H., 2006. Intonational distinctions between sentence types in North Kyungsang Korean. *JASA* 120(5), 3087.
- [9] Lee, H., forthcoming. *Experimental studies on tones and intonation of North Kyeongsang Korean*. Ph.D. Dissertation, Cornell University.
- [10] Pittayaporn, P., 2005. Prosody of final particles in Thai: The interactions between lexical tones and boundary tones. Ms.
- [11] Rialland, A., 2006. Question prosody: an African perspective. http://ed268.univparis3.fr/lpp/publications/2006_Rialland_Question_prosody.pdf.
- [12] Suh, C. M., 1987. *Kwuke Uymwunmwun Yenkwu* (A study on the interrogative sentences in Korean). Tower Press: Seoul, Korea.
- [13] van Heuven, V. J.; Haan, J., 2000. Phonetic Correlates of Statement versus Question Intonation in Dutch. In Botinis, Antonis (ed.), *Intonation: Analysis, Modelling and Technology*. Kluwer Academic Publishers: Dordrecht, the Netherlands.
- [14] Yuan, J.; Shih, C.; Kochanski, G. P., 2002. Confusability of Chinese Intonation. *Proceedings of Speech Prosody 2004*. Nara, Japan
- [15] Yuan, J., 2004. *Intonation in Mandarin Chinese: Acoustics, Perception, and Computational Modeling*. Ph.D. Dissertation, Cornell University.