

L tone downtrends in Korean across utterance types

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Abstract

Research on global pitch trends has shown that statements and different types of questions in Dutch all display distinct patterns, and suggests that these may be influenced by the presence of accentual prominence on wh-words and whether syntactic cues to interrogativity are present [11]. This implies that there would be different pitch trends in a language such as Korean which lacks accentual prominence and which does not necessarily have an interrogative syntax in unmarked yes-no questions. We test this implication by comparing the results in [11] with similar statements and question types in Korean, concentrating in this paper on the scaling of L tones. Further, we differentiate between the pitch trends towards the end of the utterances and those in the rest of the utterance, so as to investigate the contribution of final lowering to the shape of global trends. Results reveal similar downtrends in Korean, providing evidence against the explanation that syntactic and lexical cues to interrogativity directly influence these downtrends.

1. Introduction

The investigation of global pitch trends in Dutch [11] shows that each utterance type has distinct upper and lower trends. The emergence of the trends is explained with respect to the lexico-syntactic correlates of interrogativity or accentual prominence. Such an interpretation reflects the view that the patterns may be language dependent and that the use of prosodic cues is closely related to, or limited by, the presence of other functional cues. That is, it presupposes different pitch trends in languages which lack syntactic marking of interrogativity, on the one hand, and pitch accents on the other.

In addition, whereas the regression method in [11] has the advantages of providing the two trend lines, which can serve to calculate pitch span and pitch register [2], the regression lines include different types of downtrends, such as downstep, declination and final lowering, all together. Consequently, it is not clear how they interact to create overall trends.

In this paper, the assumption that global pitch trends may be language dependent will be examined by comparing the lower pitch trends of [11] with those of Korean which is typologically very distinct from Dutch. Further, we shall investigate how each of the aforementioned pitch downtrends affect the shaping of the lower trend line.

2. Background

2.1. Downtrends: definition

In this paper different types of downtrends will be discussed separately under the following definitions below based on [2].

(a) **Downstep** the phonological stepwise lowering of pitch which sets a new register within which subsequent tones are scaled

(b) **Declination** the quasi-phonetic, gradual, time-dependent downward sloping of fundamental frequency

(c) **Final lowering** an additional lowering of pitch at the end of the utterance

In Korean, the occurrence of downstep has not yet been identified, even though a phonetically similar phenomenon has been observed [5]. For that reason, the discussions of downtrends in the following sections will be limited to the other two trends.

2.2. Global pitch trends in Dutch

The upper and lower trend lines in [11] were obtained by calculating the regression of the F0 contour. In performing the regression, the utterance final rise is not considered, since including it would certainly result in a rising regression line. The linear ('all point') regression of F0 (without the final rise) was used to divide the displayed pitch span into two; above and below the regression line, respectively. Regression is applied yet again onto the separated data sets to achieve upper and lower regression lines.

The resulting regressions of the four sentence types, i.e., statement, yes/no question, wh-question and declarative question, are reproduced in Figure 1. The pitch of both the declaratives and wh-questions shows a downtrend. However, wh-questions are distinguished by a narrower pitch span and steeper slopes of the upper and lower regressions as well as higher utterance initial pitch.

On the other hand, yes/no and declarative questions are characterized by rising top lines. In the case of yes-no question, while the lower regression falls at a similar rate as in declaratives, the upper rises, displaying a funnel like global trend pattern that becomes wider towards the end of the utterance. Declarative questions present similar top line trends but with slightly inclining baselines.

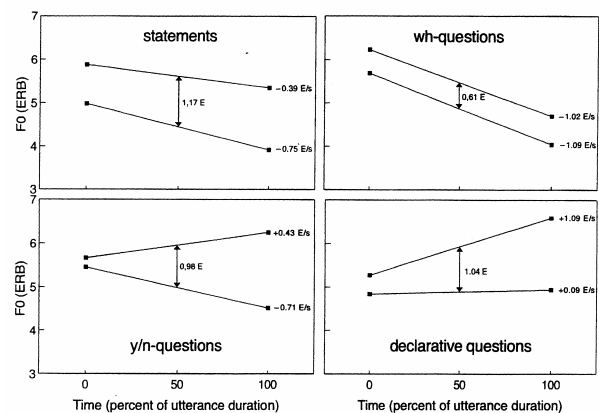


Figure 1: Global pitch trends in different utterance types in Dutch (reproduced from [11])

[11] views the uptrend, or inclination, as a major prosodic correlate of interrogativity that, at the same time, interacts closely with other question cues, such as subject-verb inversion and the presence of a wh-word. That is, the uptrend of both the regression lines in declarative questions has been attributed to the absence of syntactic cues which typically signal interrogativity in other types of questions. Likewise, high initial pitch level and steep slope in wh-questions was ascribed to accentuation, drawing attention to the utterance initial wh-word.

2.3. Korean language

The language investigated is the variety of Korean spoken in the Seoul area which is also known as Standard Korean. Some regional variants of Korean have lexical tone, with up to three contrasting tones. However, Seoul Korean (like the majority of dialects) has only post-lexical tones. Furthermore, it has no stress or accent. It has two tonally defined prosodic units, the Accentual Phrase (AP) and the Intonational Phrase (IP) [3][4]. The AP is demarcated by its tonal pattern TH(L)...LH, where T represents either L or H according to the presence or absence of the segmental feature [stiff vocal cords]. The tones are mapped to individual TBUs (Tone Bearing Units) by a series of rules, which allocates a tone to every syllable (TBU). However, it has been argued [6] that most syllables are, in fact, left underspecified, other than the two AP initial syllables and the two IP final syllables (i.e., the penultimate and final TBUs of an IP).

The IP is characterised by the IP boundary tones on the last syllable of an IP, which is lengthened about 1.8 times when compared to the phrase initial syllable [8]. So far, nine different tonal complexes are identified; L%, H%, LH%, HL%, LHL%, HLH%, HLHL%, LHLH%, LHLHL%. The tonal constituents of the complexes are taken to be upstepped [4].

Interrogativity can be manifested in terms of morphology (question verbal ending at the end of an utterance) combined with intonation (typically with rising or high ending pitch). However, it is often achieved in terms of intonation alone, especially in casual speech, where question and declarative endings are identical in form. The ending /-jo/, for instance, is used both in statements and questions alike, and /mi.jaŋ.i.je.jo/ can be either a declarative, '(it) is Miyoung (a female proper name)', or a question, 'Is (it) Miyoung?', depending on the intonation, i.e., whether it is a rise-fall (declarative) or a rise-fall-rise (interrogative).

In wh-questions, wh-words are in situ. That is, /mi.jaŋ.i.nwn. ts^hul.s'u.rwl. tso.a.hɛ.jo/ ('Miyoung'+thematic particle /i/+subject particle /nwn/ 'Chulsu' (male proper name)+object particle /rwl/ 'like') 'Miyoung likes Chulsu' is converted to the corresponding wh-question, /mi.jaŋ.i.nwn. nu.gu.rwl. tso.a.hɛ.jo/ 'Whom does Miyoung like?' by substituting 'Chulsu' with /nu.gu/ 'who'. Therefore, wh-questions have an identical word order to statements, that is, the wh-word does not have to be initial, as it does in Dutch.

3. Experiment: L tone trends in Korean

3.1. Description of the experiment

The Korean distinction between statements and yes-no question corresponds to the distinction between statements

and declarative questions in Dutch, in that interrogativity is signaled solely in terms of intonation. In Korean, wh-questions may have the wh-word later in the utterance. If the pitch trends of these three Korean utterance types show identical characteristics to the Dutch ones, we may conclude that the global pitch trends in [11] are independent of linguistic typology.

Downtrends were investigated by measuring the F0 values of L tone syllables in AP initial and IP penultimate positions, which are not underspecified in [6] (see 2.3). The tones on the IP/utterance final syllable (i.e., IP boundary tones) were not considered for two reasons. Including the upstepped tones (2.3) may mask utterance type specific pitch trends, and IP boundary tones differed across the utterance types (H% in yes-no question, L% in declaratives and LH% in wh-questions). They were all preceded by an L tone on the IP penultimate syllable, which was included in the investigation. The mean values of the F0 measurements were calculated and displayed as a function of time.

Final lowering was examined by comparing the scaling of the two L tones in the IP final APs. In languages like English or German, it is believed that final lowering is applied to the last pitch accent [7]. However, as Korean lacks pitch accent, the two rightmost low tones before the IP boundary were investigated instead. In addition, an extra category was introduced for the study, namely, a non utterance final IP (e.g. as produced in lists). A non final phrase should lack final lowering and, hence, serve as a reference when comparing the varying degrees of final lowering in different utterance types.

3.1.1. Speakers

Speakers were two Standard Korean speakers, one male (LCJ) and one female (KJI), in their 30's with university level education. They were both born and brought up in Seoul and currently live in the outskirts of the city.

3.1.2. Design of recording material and recording

Two sets of dialogues were created to include the three utterance types, statements, yes-no question, wh-questions, and non-final phrases. The statement and yes/no question data contain identical segmental strings. However, the wh-question is not related to them, neither segmentally nor semantically, and contains the wh-word in the second AP.

The APs in IP final position were controlled not only in terms of segments, but also in the number of syllables. They all contained five syllables, so that the two target L tone syllables, the phrase initial and the fourth (IP penultimate) syllables, are equidistant across utterance types.

Voiceless consonants were avoided in target phrases and when possible sonorants were used. Other parts of the recording material were not strictly controlled, as constructing utterances solely with voiced sounds would undermine their naturalness.

Two sets of dialogues containing eight sentences were recorded in a role play. They were quasi-randomly separated with three other dialogues which served as distracters. This procedure was repeated 50 times. The recordings were first made on to audio cassette tapes and later digitalised in 16bit at the sampling rate of 44100 Hz.

3.1.3. Analysed utterances

Following are the target sentences embedded in dialogues for recording. The analysed utterances, or, in the case of non-final

phrases, part of the utterance, are in bold face.

1) Wh-question: **Where did elder sister Miyoung go?**

mi.jaŋ.i.-aŋ.ni **ʌ.di.-ga.sʰ.ʌ.-jo**
 ‘Miyoung’-VOC. PART. ‘elder sister’ ‘where’-‘went’-ENDING

2) Declarative & Yes/no question: **This is used for Tanchong as well / Is this used for Tanchong as well?**

i.ga.tʰ.o **tan.tsʰaŋ-e** **sa.joŋ.dwe.-nuŋ**
 ‘this’-‘too’ Tanchong-LOC. ‘is used’-ADJ.ENDING

mu.njaŋ.i.je.-jo
 ‘pattern’-‘is’-ENDING

3) Non-finality: And this **is called ‘water lily’ pattern**, and it is a pattern based on (the shape of) water lilies.

kw.ri.go **i.ga-n** **jaŋ.mu.n-i.ra.go**
 ‘and’ ‘this’-SUB. ‘water-lily pattern’-‘is called’

jaŋ.n-wul **ki.bo.n-w.ro.-ha-n** **mu.njaŋ.i.je.jo**
 ‘water-lily’-OBJ. ‘base’-‘as’-‘do’-ADJ.ENDING ‘pattern’-‘is’-ENDING

3.1.4. Prosodic analysis and measurements

From the 50 repetitions 20 utterances were taken for further analysis. They were selected quasi-randomly considering phrasing and irregularities in pitch, particularly around target L tone syllables and phrases. That is, when there are irregularities, rather than manually correcting them, the utterance was discarded in favour of others. They were analysed based on [3][4] where tonally defined prosodic units of two distinct levels, Accentual Phrase and Intonational Phrase, are assumed (see 2.3).

Using Praat [1], utterances were labeled to mark syllable and phrase boundaries as well as the types of boundary. Extracted pitch was smoothed at 10Hz bandwidth and the measurements were made at the lowest F0 point of the target syllables.

3.2. Results

3.2.1. General downtrend of L tones

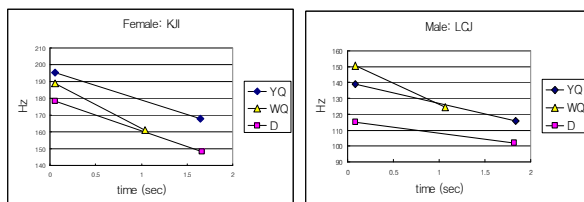


Figure 2: Global downtrend of L tones (utterance initial and penultimate syllables) in declaratives, yes-no questions and wh-questions in Korean.

In Figure 2, the global downtrend is represented with the solid lines that connect two F0 measurements. These values are the means of the 20 measurements in utterance initial and penultimate syllables of each utterance type. Both the speakers produced simple yes-no question (diamonds) higher

than the corresponding declaratives (squares). Yet both the utterance types display a similar rate of downtrend. The falling slope of wh-questions (triangles) is steeper than in the other data sets. However, interestingly enough, while LCJ’s wh-questions start higher than the other utterance types, as in Dutch [11], KJI’s initial pitch begins at a level between the declaratives and the interrogatives.

3.2.2. Declination

To examine the effect of declination and final lowering separately, the mean measurements of all the L tone syllables in yes-no questions and declaratives are plotted in Figure 3. Wh-question data are not included in the charts below. The target utterances contain a smaller number of syllables and APs (see 3.1), which prevents a fair comparison of potentially different declination trends.

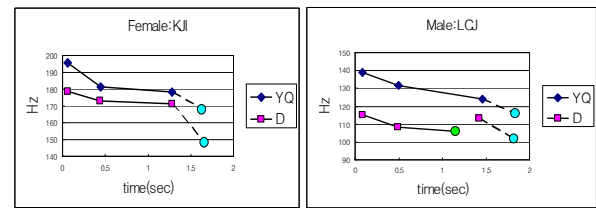


Figure 3: Mean F0 values of L tone syllables in the statement and yes/no question data. Phrase initial L tones are represented with diamonds and squares, and L tones in penultimate syllables with circles.

The plots in Figure 3 show that pitch was reset at the beginning of the last AP in LCJ’s declaratives, and hence the declination and global downtrend in his statement data should be regarded separately. Nevertheless, the low tones before the reset show identical characteristics as those in KJI’s declaratives and the L tone declination in declaratives is shallower than in interrogatives in the speech data of the two participants. It should also be noted that the downtrend is not constant. After a large initial lowering the pitch level is kept very steady until just before the final fall.

3.2.3. Final lowering

It has been argued for Japanese that final lowering is present in declaratives, but absent in interrogatives [10]. For Korean, interrogatives also undergo final lowering, but merely to a lesser degree than declaratives. That is, the final L tone values of yes-no questions (indicated with the rightmost circles in Figure 3; upper lines) are lower than would be accounted for by the effect of declination alone.

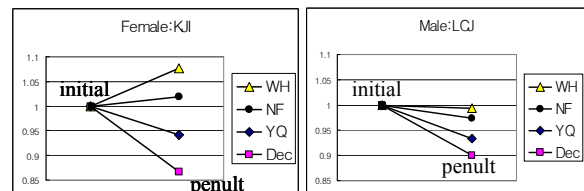


Figure 4: Varying degrees of final lowering across IP/utterance types. The scaling of L tones on initial and penultimate syllables of IP final APs in four different categories.

Figure 4 shows the relative pitch height of the IP penultimate syllable as a percentage of its preceding AP initial syllable, which is represented with a dark square at level '1', in all four IP categories. This reflects varying degrees of final lowering across data types. If we assume that the tones do not undergo final lowering in the last APs in non utterance-final IPs (henceforth, NF), but only declination, a lower ratio than NF should be ascribed to final lowering. Paired T-tests show that, while LCJ's NF supports the assumption ($t=3.601$, $p<0.05$), KJI's NF, as well as LCJ's WQ, may not have any declination, either.

A very distinct pattern is observed; the highest are wh-questions, followed by utterance medial IP (NF), then yes-no questions and declaratives. A one-way ANOVA reveals that there is a significant effect of utterance types (for KJI $F(3,76)=90.992$, $p<0.001$ and for LCJ $F(3,76)=37.296$, $p<0.001$). Each utterance type is significantly different from the others ($p<0.05$) except LCJ's NF and WQ. The pattern clearly reflects the utterance types. Whereas it was expected that declaratives would have the lowest relative value, it is interesting that wh-questions should show the highest one. For the female speaker the utterance penultimate L tone has a higher F0 than the preceding AP initial, despite the fact that the wh-word constitutes a morphological cue to interrogativity.

3.3. Discussion

3.3.1. General downtrends of L tones

The global downtrends (of L tones) in Figure 2 show very similar tendencies to the lower regression lines of Dutch utterances in [11] reproduced in Figure 1; very steep downslope in wh-questions, shallower yes-no question that are almost parallel to declaratives but with a higher pitch level. It should be remembered that the declarative-interrogative distinction in Korean corresponds structurally to the Dutch declarative-declarative question, and that the latter shows slight inclination. However, the downslope of L tones in Korean yes-no questions corresponds more closely to the Dutch yes-no question than to the declarative questions.

The initial pitch of the wh-question data varies across the two speakers; the highest initial value in LCJ's data sets and the second highest (after yes/no questions) in KJI's. The lower starting pitch in KJI's data may be ascribed to the pattern in her final lowering. Her wh-question did not display any sign of final lowering. On the contrary, the L tone level was raised at the end of the utterance, which might give the impression of higher overall pitch. It is, however, very unlikely that the presence of the wh-word could have caused this higher scaling of the L tone. Even though the question word lies in the second half of the utterance, it is at the beginning of the second AP. The measured penultimate syllable which displays high pitch is a part of the verbal ending and not in the wh-word.

3.3.2. Declination and final lowering

The results in Figure 4 and 5 show that the L tone downtrend in Korean displays a step-like pattern that is largely influenced by final lowering which, in turn, shows a very distinct pattern which is influenced by the utterance type. That is, shallower declination in declaratives may be ascribed to a greater degree of final lowering, as steeper and deeper final lowering would leave less room for declination. This assumes a high degree of preplanning. This would predict that

wh-questions are characterised by even more sharply descending L tone declination, as they either lack final lowering, or display raised pitch at the end of the utterance. The global downtrend pattern in Figure 2 (as well as the declination in yes/no question data in Figure 4) support this prediction, as wh-questions have the steepest downslope of all the data types.

4. General conclusion

The global pitch trends of the L tone in Korean are in accordance with the findings of [11] despite the linguistic and typological differences across the languages. However, we have provided counter-evidence as to why this occurs. The high initial pitch and steep global pitch trend in wh-questions can be attributed neither to prominence on the wh-word nor to accentuation, as Korean wh-questions do not start with wh-words and the language lacks pitch accents. Contrary to [11], the uptrend in Dutch declarative questions cannot be simply ascribed to the lack of syntactic marking, since structurally equivalent Korean yes-no questions display downtrends. The distinct pitch trends in different utterance types should be understood as characteristics that are more language independent than assumed in [11].

The L tone downtrend in Korean is distinguished by a large initial lowering and a following steady pitch level which, in turn, is followed by an abrupt lowering just before the end of the utterance. Final lowering clearly reflects information on utterance types, and interacts closely with declination to create global pitch trends.

5. References

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