AN ANALYSIS OF KOREAN INTONATION IN DECLARATIVE AND PROPOSITIVE SENTENCE TYPES

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ABSTRACT It has been claimed that morpho-syntactically equivalent declarative and propositive sentence types are not distinguishable intonationally in Korean. This paper investigates whether this is so, by analysing, within in the Autosegmental-Metrical model, short declarative and propositive sentences, produced by 4 native Seoul Korean speakers. It is shown that the two types are in fact distinguishable by a combination of boundary tones, the duration of the sentence-final syllable, and accentual phrasing.

INTRODUCTION

One of the most essential and important issues in the phonological study of intonation is how the different main sentence types like statement, suggestion, and question are distinguished. The four major sentence types, declarative, propositive, imperative, and interrogative, cannot be distinguished morpho-syntactically in many cases of conversational speech in Korean. It has been claimed that the declarative, propositive, and imperative sentence types can only be distinguished with contextual rather than phonetic cues, and furthermore that the three sentence types have the same 'falling' intonation (e.g. Chang 1996; Park 1991; Sohn 1994 etc.). This paper, therefore, looks at whether the two sentence types, declarative and propositive, are intonationally distinguishable, and if they are, how they are different. It also examines how intonational tones are realised over units of different length, and the 'Accentual Phrase' (Beckman & Pierrehumbert 1986; Pierrehumbert & Beckman 1988; and Jun 1993) which is crucial for the analysis of the current study.

PROCEDURE

Speakers Four native Seoul speakers in their mid twenties to mid thirties participated in an experiment (two females, speakers 1 and 3, and two males, speakers 2 and 4). All four speakers had been in Australia 3 to 9 years and claim to speak Korean for more than 60 percent of their daily lives.

Corpus Eight sentences were designed so that each sentence could be interpreted and said in declarative and propositive modes. That is, each sentence can be interpreted and said as either sentence type without changing its morpho-syntactic form. Each sentence consists of one noun followed by one verb (Korean is verb-final), both noun and verb having different numbers of syllables. Nouns have two to three syllables, and verbs have one to four syllables. The reason why the sentences were designed to contain different numbers of syllables was to investigate possible F0 pattern changes, especially on the sentence-final syllable, and intonational phrasing (accentual phrasing). The sentences used are listed in Table 1.

Table 1. Corpus. A, B, C, D = sentences with 1, 2, 3, and 4 syllable verbs respectively

	Sentences	Meanings in Two Sentence Types
A	namu pɛ tree chop	'(I'm) cutting down the tree' (Dec.) '(Why don't you) cut down the tree?' (Prop.)
B	uju mək-j-ə milk eat-caus.-INF.	'(I'm) feeding (the baby) some milk' (Dec) '(Why don't you) feed (the baby) some milk? (Prop.)
	toŋmun-til manna alumnus-pl. meet	'(I'm) meeting some alumni' (Dec.) '(Why don't you) meet some alumni?' (Prop.)
	namu pɛ-jo tree chop-polite	'(I'm cutting down the tree' (Dec.) '(Why don't you) cut down the tree (Prop.)
C	uju mək-j-e-jo milk eat-caus.-INF-polite	'(I'm) feeding (the baby) some milk' (Dec.) '(Why don't you) feed (the baby) some milk? (Prop.)
	toŋmun-til manna-jo alumnus-pl. meet-polite	'(I'm) meeting some alumni' (Dec.) '(Why don't you) meet some alumni?' (Prop.)

	uju mantil-ə milk make-INF	'(I'm) making some milk' (Dec.) '(Why don't you) make some milk?' (Prop.)
D	uju mantil-ə-jo milk make-INF-polite	'(I'm) making some milk' (Dec.) '(Why don't you) make some milk?' (Prop.)

Elicitation and Recording The speakers were all recorded in the studio of the A.N.U. phonetics laboratory. Each type of sentence was produced as an answer to a question (declarative) or as a suggestion to an addressee (propositive), and each sentence was repeated five times (80 tokens per speaker, 2 sentence types x 8 sentences x 5 times) using randomised cards. The utterances were digitised at 10 KHz, and further analysed with CSL. Each sentence was segmented using a wideband spectrogram and an audio wave, then F0 values were sampled as a function of the segmental structure. F0 values of each sentence were, first, sampled at peaks and dips, then from each segment, except for those segments that included the peaks and dips (1 point per segment). However, when it was required, for instance, when a segment had both peak and dip, the segment had two or three points of F0 values measured. This frequently occurred in the sentence-final syllable as a boundary tone. A sample F0 trace with a segmented wideband spectrogram is shown in Figure 1.

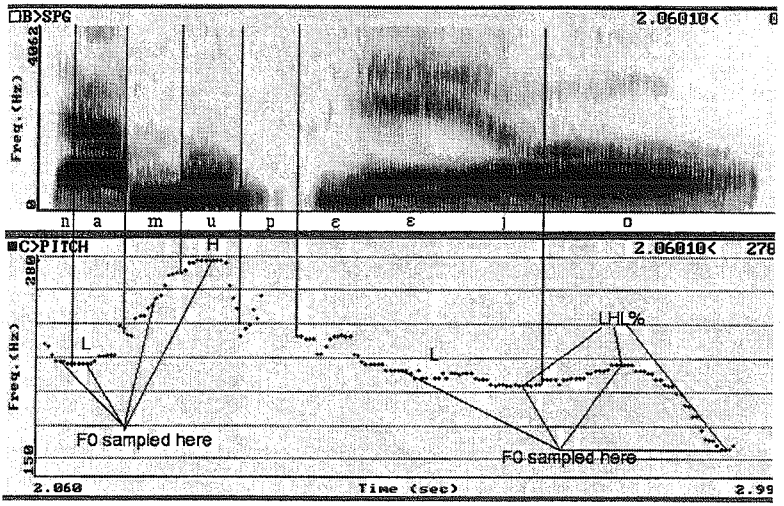

Figure 1. A sample utterance sentence ('namu pɛjo', uttered in propositive by speaker 3) showing where F0 was measured. Top panel shows a segmented wideband spectrogram, bottom is a F0 trace (there is not acoustic discontinuity marking the onset of 'o', so the onset was taken to be the point where F_2 becomes stable)

RESULTS AND DISCUSSION

It was found that, contrary to the received views mentioned above, declarative and propositive sentence types were in fact distinguished intonationally. This was done by a combination of boundary tones, the duration of the sentence-final syllable and accentual phrasing.

The graphs in Figure 2 show the average F0 values of verbs with 2 syllables and 4 syllables, uttered by four speakers. Apart from the verbal phrase, one more syllable was plotted before the verb to show the F0 pattern before the verb (this is marked as Prev. syl. in Figure 2). However, unlike the measurements previously discussed, these graphs were plotted with a sampling rate of 1 point per syllable, except for the sentence-final syllable (original measurements were made with a sampling rate of 1 point per segment or more when there was more than one peak or dip in a segment). For example, in Figure 2.D, the first measured point is the F0 mean value of the syllable, '***-ju***', located before the four syllable verb, 'man-til-ə-jo', in the sentence 'u-***ju*** man-til-ə-jo'. The second measured

point is the lowest F0 mean value in the syllable, 'man-', the third point is the highest F0 mean value in '-tił-', the fourth point is the F0 mean value in '-ə-', and the remaining four points are from the sentence-final syllable, '-jo'.

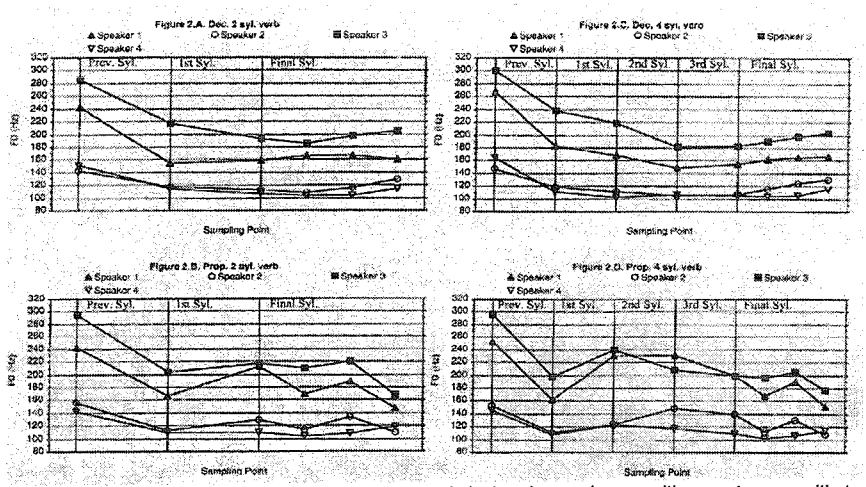

Figure 2. Mean F0 profiles for 4 Korean speakers' declarative and propositive sentences with two syllable verbs and four syllable verbs

Boundary Tones The experiment showed that, perhaps not surprisingly, there was not a simple correlation between sentence type and a single boundary tone type. Five different boundary tones, H%, L%, HL%, LH%, and LHL%, were observed in declarative, and four different boundary tones, LHL%, HLHL%, LH%, and HLH%, were observed in propositive. However, the distinction between the two sentence types was generally mirrored, at least for three speakers, in differences between boundary tone types. Their distribution is given in Table 2, which shows the percentage of the different types of boundary tone used by all speakers in both sentence types. Part of the heterogeneity in these results can be accounted for by one large between-speaker difference: speaker 4 evidently did not clearly distinguish the two types. If speaker 4 is discounted, there is a minimal overlap in boundary tone types: only LHL is shared between the two sentence types, and then only asymmetrically.

Table 2. Percent incidence of boundary tone types in declarative and propositive sentences for each speaker

	Declarative					Propositive			
	H	L	HL	LH	LHL	LHL	HLHL	LH	HLH
Sp. 1	20	20	30	30	0	62.5	37.5	0	0
Sp. 2	32.5	0	0	67.5	0	50	50	0	0
Sp. 3	27.5	0	0	55	17.5	75	25	0	0
Sp. 4	7.5	5	2.5	72.5	12.5	0	0	87.5	12.5

The data in Table 2 show a strong tendency towards (L)H% in declarative. As can be seen, among the four speakers, three uttered more than 80% of tokens with (L)H%, and one speaker uttered 50% with (L)H%. In the case of speaker 2, he uttered all 80 tokens with (L)H%. The only exception to this is speaker 1's 50% for (H)L%. These results are well reflected in Figure 2.A. The speakers 2, 3, and 4 show 'rising' F0 patterns, while speaker 1 shows slight 'falling'.

These results thus appear to contradict the received views that declarative has a 'falling' intonation at the end of the sentence. The unmarked value appears to be (L)H%. It is possible that the non- (L)H% boundary tones represent marked types, in possibly the same way as a rising boundary tone for wh-questions in English is marked as opposed to the ummarked fall. The two intonational F0 patterns, 'rising' and 'falling', certainly convey different meanings. When a declarative sentence ends with a (L)H% F0 pattern, it sounds more friendly than the HL% pattern, and (L)H% seems to invite the addressee's interaction. On the other hand, when a declarative sentence ends with 'Falling' F0

pattern, it sounds as if the speaker is showing a blunt or unfriendly attitude towards the addressee. Obviously, further research is required to determine whether one can identify marked vs. unmarked values here.

An unmarked boundary tone can also be recognised for propositive: (H)LHL. In the case of propositive, LHL% was most frequently realised in speakers 1, 2, and 3. Of the propositive sentences, 62.5% were uttered with LHL% for speaker 1, 50% for speaker 2, and 75% for speaker 3. These results are also well reflected in Figure 2.D, where a propositive sentence type produced by the three speakers show LHL%.

HLHL% pattern was most frequently found in two syllable verbs (refer to Figure 2.B). For speaker 1, 15 sentences were uttered with HLHL% and all 15 tokens were found in two syllable verbs, for speaker 2, 15 tokens were found in two syllables verbs out of 20 tokens with HLHL%, and for speaker 3, 10 tokens were found in two syllable verbs out of 10 tokens with HLHL%.

It may be that the first H in *H*LHL% is a part of the AP tone rather than the boundary tone. There could be two possibilities: that the H tone is delayed from the previous syllable, or the first H tone in the AP tonal pattern, L*H*LH, is not fully undershot for some reason. Thus, it is assumed that the underlying form of the boundary tone is LHL%. To confirm this, further research with more controlled data is required.

Given the two unmarked patterns of (L)H% and (H)LHL% it is clear that speaker 4 is not producing a separate boundary tone for propositive, but shows a boundary tone identical with declarative in propositive in more than 80% of tokens (he uttered 80% of tokens with LH% in declarative). It will be shown that, even though the speaker shows the identical boundary tone in both sentence types, he still distinguishes the two types by accentual phrasing and the duration of the sentence-final syllable.

Duration of Sentence-Final Syllable Throughout the experiment, it was found that the duration of the sentence-final syllable also played an important role in distinguishing declarative and propositive. All four speakers produced propositive sentence types with much longer duration of the sentence-final syllable compared to declarative. The following table shows the means and standard deviations of the duration of the sentence-final syllables in four verbs with different numbers of syllables in the two sentence types.

Table 3. Means and standard deviations (italics) for duration (csec.) of sentence-final syllable in declarative and propositive sentence types

	Declarative							
	1 Syllable		2 Syllable		3 Syllable		4 Syllable	
Sp. 1	24.28	*1.15*	19.24	*3.15*	19.06	*1.32*	21.03	*1.5*
Sp. 2	35.63	*3.02*	30.75	*3.28*	27.47	*3.85*	25.28	*0.42*
Sp. 3	33.73	*4.72*	29.46	*5.0*	24.94	*5.15*	21.96	*2.74*
Sp. 4	26.31	*3.23*	16.82	*2.56*	17.39	*5.02*	14.42	*1.7*

	Propositive							
Sp. 1	64.08	*2.58*	50.08	*2.28*	48.03	*3.05*	46.03	*2.33*
Sp. 2	49.75	*2.3*	47.42	*7.18*	43.72	*4.41*	39.35	*2.73*
Sp. 3	52.88	*3.4*	41.76	*3.68*	37.33	*6.12*	32.14	*0.91*
Sp. 4	46.36	*2.19*	32.36	*2.81*	29.61	*2.51*	29.73	*3.04*

As can be seen in Table 3, speaker 1 shows at least 25 csec. (in 4 syllable verbs), longer duration in propositive than declarative, 14.07 csec. (in 4 syllable verbs) for speaker 2, 10.18 csec.(in 4 syllable verbs) for speaker 3, and 12.22 csec. (in 3 syllable verbs) for speaker 4. That is, all four speakers produced propositive at least 10 csec. longer than declarative in the sentence-final syllables.

It is important to note that the relationship between the duration of the final syllable and its tone is not totally intrinsic. Thus, in the case of speaker 4 who shows the same boundary tone in the two sentence types, the duration of the sentence-final syllables and accentual phrasing play crucial roles in distinguishing declarative and propositive.

The Accentual Phrase The Accentual Phrase (AP) is one of the two prosodic levels which are marked by intonation. This analysis was suggested by Pierrehumbert, who also introduced the framework adopted in this paper, and Beckman (Pierrhumbert 1980; Beckman & Pierrehumbert 1986; Pierrehumbert & Beckman 1988) to explain the contrast between accent and lack of accent in

Japanese. Later, this term was adapted to Korean by Jun (1996). According to Jun (1998), AP in Korean is a tonally demarcated unit which can contain more than one lexical item. It only has phrasal tones that are not specific to its component words but which are the property of the phrase. Since Korean does not have a lexical pitch accent (Jun 1996; 1998), there are only two levels of phrasing, AP and Intonational Phrase (IP), which are marked by intonation. That is, the AP in Korean is a lower level of phrase than the IP, but is higher than the phonological word. Thus, an IP can have at least one AP, and an AP can have at least one phonological word. According to the Strict Layer Hypothesis (Selkirk 1984), since IP is a higher unit than AP, an AP-final tone could be overridden by an IP boundary tone when the AP is the IP-final AP.

The underlying tonal pattern of AP in Korean is either LHLH or HHLH depending on a laryngeal feature, [stiff vocal cords] (Halle & Stevens 1971) of the AP initial segment (Jun 1996). However, only the former, LHLH, will be discussed in this paper. The first tone, L, is associated with the first syllable of the AP, and the final tone, H, is associated with the final syllable of the AP. The third tone, L, is associated with the penultimate syllable if there are three or more syllables in an AP. Then, the second tone, H, is reportedly associated with the second syllable of AP, but also could be associated with the third syllable (Jun 1996). An example of schematic tonal association presented in Figure 3 in the next section.

According to Jun (1996: 1998), the tonal pattern of an AP in Korean is very sensitive to the number of syllables that the AP has. That is, if an AP has 3 or fewer syllables, the tonal pattern of the AP would lose one or two tones due to phonetic undershoot. For instance, if an AP has only two syllables, the tones between the first L and the final H will be undershot, resulting in LH. If an AP has three syllables, either the second or the third tone can be undershot, resulting in LLH or LHH. On the other hand, if an AP has four or more syllables, all four tones will be realised on the surface. When there are more than four syllables in an AP, phonetic interpolation occurs from the third syllable to the anti-penult. As mentioned above, when an AP is IP-final, the AP final tone, H, is pre-empted by the IP-final boundary tone. That is, if an IP has a HL% boundary tone, the final H of the IP-final AP would not be realised, but replaced to HL%. Thus, the surface tonal pattern of the AP would be LHL HL% ('%' after 'H' or 'L' means boundary tone) unless there is any phonetic undershoot.

Differences in Accentual Phrasing Through the experiment conducted for this paper, it was found that the accentual phrasing, besides the boundary tones, played a crucial role in distinguishing the declarative and propositive sentence types. In the former, the whole sentence was produced in one AP by all four speakers. That is, all the four speakers produced all the tokens of declarative in one AP: [Noun + Verb]$_{AP}$. On the other hand, all the tokens of propositive sentence type were produced with two APs, [Noun] $_{AP}$ + [Verb] $_{AP}$. It seems the underlying accentual phrasing of propositive is to have a separate AP for a verbal phrase. The same result was observed in an associated experiment with a longer sentence consisting of [Noun (or Postpositional Phrase)] $_{AP}$ + [Noun + Verb] $_{AP}$ in declarative, and [Noun (or Postpositional Phrase) + Noun] $_{AP}$ + [Verb] $_{AP}$ or [Noun (or Postpositional Phrase)]$_{AP}$ + [Noun] $_{AP}$ + [Verb] $_{AP}$ in propositive.

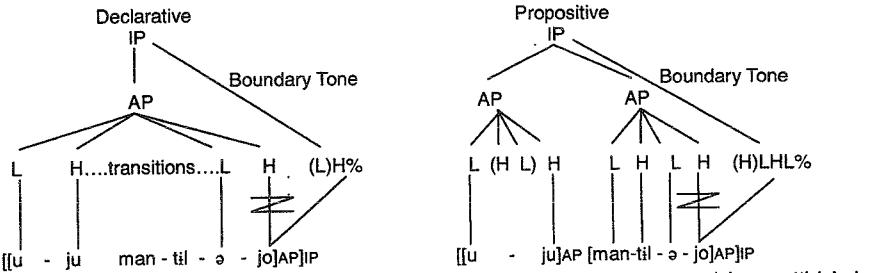

Figure 3. Sample tonal associations and accentual phrasing of a sentence, 'uju mantiləjo', in declarative and propositive (tones in brackets show that the tones are undershot)

As mentioned in the previous section, an AP has its own underlying tonal pattern, thus having a different number of APs in the same sentence could result in a great difference in tonal pattern of the whole sentence. For instance, in a sentence with a four syllable verb as in Figure 3, 'u-ju man-til-ə-jo',

(also refer to Figure 2.C and D) the surface tonal pattern of the sentence could be [LHL H%]$_{AP}$ in declarative, and [LH]$_{AP}$ [LHL LHL%]$_{AP}$ in propositive. Therefore, the number of syllables that an AP has and the number of APs in a sentence are two of the most important phonetic cues in distinguishing sentence types, not only as APs themselves, but also as their tonal patterns.

However, some sentences, which have four or fewer syllables, show identical surface tonal patterns regardless of the sentence type. This is mainly due to the phonetic undershoot. As mentioned above, some tones can be undershot when there are fewer than four syllables in an AP. This phonetic undershoot mainly occurs in propositive because the sentence type has two separate APs, and each AP has fewer than four syllables when the whole sentence has four or fewer syllables. For example, speaker 4, whose boundary tone in propositive is similar to that of declarative unlike the other three speakers, often shows identical surface tonal pattern in the two sentence types. In one sentence, 'namu pejo' (refer to Figure 2.A and B), he shows {LH LH%} in declarative and {LH} {LH%} in propositive. Though the surface tonal pattern of the two sentence types are identical, LH LH%, these two types in this case can still be distinguished by accentual phrasing, as discussed in this section, and the duration of the sentence-final syllable.

CONCLUSION

The aim of this study was to find out if, contrary to the received view, the difference between declarative and propositive sentence types in Korean is signalled intonationally. It has shown that the two sentence types are in fact distinguishable by prosodic and phonetic features such as boundary tones, the duration of the sentence-final syllable and accentual phrasing. This finding therefore challenges claims that the two types can only be distinguished by contextual cues. Among the prosodic and phonetic features, it was found that accentual phrasing was the most consistent feature distinguishing the two sentence types, one AP, [noun + Verb]$_{AP}$, for declarative and two APs, [noun]$_{AP}$ + [verb]$_{AP}$, for propositive. Though there was no correlation between a single sentence type and a single boundary tone, a strong tendency to (L)H% for declarative and (H)LHL% for propositive was observed. The duration of the sentence-final syllable also played an important role in distinguishing the two types by having at least 10 csec. longer duration in propositive sentences than in declarative. One additional interesting finding was that speakers can use different strategies in distinguishing the two sentence types.

To what extent these features serve to cue the difference between the two types must now be investigated. As a native listener, I thought the distinction between propositve and declarative types was always clear. However, informal tests with other native listeners showed that this was not always the case, and formal perceptual tests are planned to determine the relative strengths of the cues.

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