

Sentence-Final Intonation Contours: Formal Description *

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ABSTRACT

As the segmental phonetic output is derived from its underlying form, the phonetic surface of intonation could also be derived from its underlying tone melody. In order to show clearly the phonological processes (in fact, we need more than just phonological processes) involved in the generation of intonational surface, we need to formalize the description of those processes. This paper firstly examines different types of sentence-final intonation contour in Korean, and then attempt to formalize the intonational behavior of those contours. In this attempt, we will investigate what kinds of linguistic information participate in deciding the shapes of the contours and what kinds of tonological processes the underlying tone melody undergoes before it takes the surface shape. In this analysis of intonation contours, we focus on the linguistic structure rather than the acoustic property, adopting just two tones L and H as phonological tones, with four phonetic pitches.

1. Introduction

An intonation contour (IC) is the tune of an intonational phrase (IP)¹, and its shape in Korean depends on several factors such as the position of its IP in a sentence, the function it performs², and its phonetic environment. Depending on its position in a sentence, IP can be divided into two kinds -- sentence-final IP (SFIP) and nonfinal IP (NFIP). The sentence-final intonation contour (SFIC), the contour of SFIP, carries more

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¹ A span of the sentence over which a particular pitch pattern extends is treated as a tone group (Ladefoged 1982), intonation-group (Cruttenden 1986) or intonational phrase (Selkirk 1984).

² An IC may help eliminate ambiguity (Leech 1974: 78), express the speaker's affective state (Jakobson & Waugh 1979: 45, Ward & Hirschberg 1985), mark focus (Ladd 1980: 153, Jackendoff 1972: 258-65), and so on.

linguistically meaningful information, and has more diverse shapes, than the nonfinal intonation contour (NFIC), the contour of NFIP (Park 1990). This paper investigates what factors determine the different realizations of SFIC, and attempt to formalize the processes that are involved in producing the surface contours from the underlying basic tone melody.

"Intonation" here is taken up in its restricted sense as pitch contour without considering length in general, and the scope of this study is limited to everyday conversation speech of the standard dialect of Korean. I will focus on linguistic structure, not on acoustic detail. For representing intonation contours, a two-tone analysis (H and L) is adopted with four phonetic pitch levels accompanying it.

2. Basic Tone Melody and Tone Mapping

In Korean the most outstanding prominence falls on the phrase-final syllable, and this accent is realized as a pitch peak (Koo 1986). That is, each IP has a pitch peak on its final syllable. This again means that the pitch accent in Korean falls on the IP-final syllable. Context-neutrally, the pitch peak occurs only once in an IP.

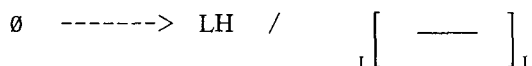
(1) Accent Assignment

- a. V -----> V* / _____ C0]_I (IP-final vowel is accented.)
- b. H -----> H* / [L _____
 I

(The first H after an IP-initial L gets accented context-neutrally.)

It was further observed in Park (1990) that the Korean tone melody is in general realized as LH for NFIPs and LH plus something for SFIPs, and suggested LHL as the basic tone melody (BTM) in Korean. However, that BTM was set up without much plausible account, and thus seems a little arbitrary. Since SFIPs may have contours like LH, LHL, and LHLH, and the tones following that initial LH in SFIP can be assigned by the information about sentence types, discourse functions, and so on (see section 3), it would be better to take LH, which is shared by both NFICs and SFICs, as the BTM. If we take LHL as the BTM, the final L deletion is extra to get the normal contour for nonfinal phrases, which carry LH in general, and might be overlapped with the processes we must somehow undergo to get different kinds of SFICs.

(2) Basic Tone Melody Assignment

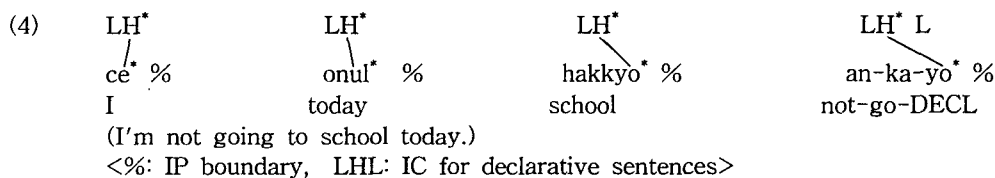


Once we have the BTM, how can we associate each tone of the melody with the text? Here we may employ a tone mapping rule as follows:

(3) Tone Mapping Rule (Tentative)

- a. The accented tone is initially associated with the accented syllable.
- b. Associate the remaining tones with the syllables of the text on a one-to-one basis.

At first by (3a) we can link the tone to the text as follows:

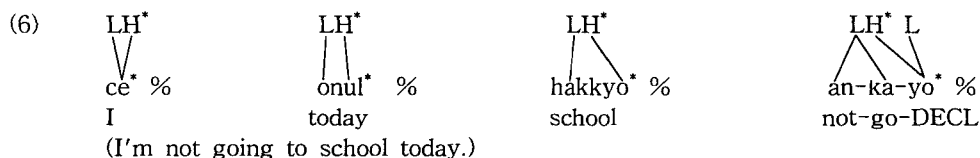


When we apply (3b), however, we will be at a loss as to which syllable each L tone of the first and last IPs should be linked to. Here, Goldsmith's (1976) Well-Formedness Condition works.

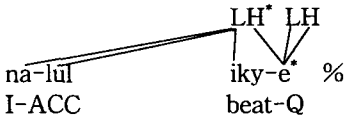


(5) Well-Formedness Condition

- a. All vowels are associated with at least one toneme.
- b. All tonemes are associated with at least one vowel.
- c. Association lines do not cross.

With the help of (5a) and (5b), we can now associate the tones and the text, leaving no tones and vowels unlinked. In the SFIP, we cannot link by (5c) the final L tone to the unaccented syllables *an* and *ka*. So the only syllable to link the final L to is the accented syllable *yo*. This *yo* thus gets a contour tone HL as the *ce* in the initial IP gets a LH.



However, if we have a more complex contour in the SFIP, we will need a regulation on default linking. Consider the following:

- (7) a. 
 na-lul I-ACC iky-e %
 beat-Q
 (You might think you can beat me, but it would not be so easy, since I'm stronger than you. <Sneering>)
- b. na-lul i* ky-e %
- *c. 
 na-lul I-ACC i* ky-e %
 beat-Q
 (You might think you can beat me, but it would not be so easy, since I'm stronger than you. <Sneering>)
- d. 
 na-lul I-ACC i* ky-e %
 beat-Q
 (You might think you can beat me, but it would not be so easy, since I'm stronger than you. <Sneering>)

Even though the accent mostly falls on the IP-final syllable, it is sometimes shifted to the IP-penultimate syllable (Park 1992). So if the IP-final accent in (7a) is shifted one syllable to the left as in (7b), we will face a question of where to link the second L tone. According to (3) and (5), this L may go to either *i* or *kye*. But in Korean we never allow the L to go to the *i* syllable, as in (7c). It should be linked to *kye*, as in (7d). Here we need a constraint on the direction of linking unaccented tones to the text. That is, the association of the tones with the text should be from left to right. By this, we link the concerned L to the *kye* syllable first and then the following H to *kye* again by default given in (5b). So we need to rewrite the tone mapping rule as follows:

(8) Tone Mapping Rule (Final)

- a. The accented tone is initially associated with the accented syllable.
- b. Associate the remaining tones with the syllables of the text on a one-to-one basis from left to right.

3. Sentence-Final Intonation Contour (SFIC)

The tune for sentence-final IP (SFIP) is closely tied to the grammatical sentence type. More sophisticated emotional, attitudinal, and other pragmatic functions are also involved in the tunes of the SFIPs.

An SFIC is a contour which is superimposed on the last IP of a sentence, which usually ends with a sentence-ending particle in Korean, or an utterance. In most cases, this contour is composed of two parts, one being a level-2 pitch portion that initiates the contour and the other being the following pitch complex that begins with a pitch higher than level-2.

The latter part of the contour is placed on the last one or two syllables of a sentence. In an SFIP in Korean, the nucleus usually falls on the last, but sometimes on the penultimate, syllable (Park 1992). Thus, in the sentences in (9a), (9b), and (9c), each composed of two IPs, the second IC is the SFIC, and in (9d) the only IP, which is utterance-final, bears the SFIC.

(9)³

- a. 2Yengswu-3ka % 2iltung-ul hay-ss-4e %
Youngswu-NOM 1st-ACC do-past-Q
(Did Youngswu take 1st place?) <Neutral>
- b. 2Yengswu-3ka % 2iltung-ul hay-ss-423e %
(Did Youngswu take 1st place?) <Sarcastic>
- c. 2Yengswu-3ka % 2iltung-ul 4hay-ss-23e %
(Did Youngswu take 1st place?) <Sarcastic>
- d. 2aka31ssi %
(Excuse me, Miss!) <Calling Attention>

3. 1. Sentence Types and SFIC

In Korean, major sentence types are marked by different sentence enders and by typical SFICs. The following shows a sample ender and the typical SFIC for each basic sentence type.

³ Hereafter, numbers appearing in example sentences represent the pitch level--from 1, the lowest, to 4, the highest--for the following syllable(s) which precede(s) another number or sentence boundary. More than one number coming together means that the following syllable bears a contour tone.

(10)

Sentence Type	Ender		SFIC
Declarative	-----	-ta	2-3-1
Interrogative	-----	-ni/-kka	2-4
		Y/N Q -----	2-3-1
		WH Q -----	2-3-1
Imperative	-----	-la	2-3-1
Propositive	-----	-ca	2-3-1
Exclamatory	-----	-kwun	2-3-1

The SFICs shown in (10) are context neutral in the sense that they do not have their own independent intonational meaning: that is, those ICs do not cause any change in semantic notion or speech act indicated in a neutral context by the sentence enders. Examples in (11) below show what is conveyed by each sentence type with its neutral SFIC.

(11)

- a. 2kyohoy -ey ka -pni -3lta (Assertion)
church to go POL DECL
(I am asserting that I am going to church.)
- b. 2kyohoy -ey ka -4ni (Y/N Question)
church to go Q
(I am asking if you are going to church.)
- c. 2nwuka kyohoy -ey ka -3lni (WH Question)
who church to go Q
(I am asking who is going to church.)
- d. 2kyohoy -ey ka -ke3lla (Command)
church to go IMP
(I am ordering you to go to church.)
- e. 2kyohoy -ey ka -3lca (Suggestion)
church to go PROP
(I am suggesting that we go to church..)
- f. 2kyohoy -ey ka -nun -3lkwun (Exclamation)
church to go PRES EXCL
(I now see that you are going to church.)

If we consider a sentence that takes a neutral ender, -e(-yo) /-a(-yo), which can be used in different sentence types, we can see that the role of IC in distinguishing major sentence types is limited only to telling a Y/N question from others.

(12)

- a. 2theyleypi pwa -3ljo (Assertion)
television watch DECL
(I am watching TV.)

Here we can see that in a sentence-final position a tone tends to intensify its own tonal characteristic. This tonal behavior can be illustrated by a single rule if we employ a feature [+Augment], which represents a tone as increasing its original tonal nature in the opposite direction to its counterpart.

(15) Sentence-final Tone Intensification

$$T \text{ -----} > [+AUG] / \text{ --- } \left. \vphantom{T} \right\}_{I-S}$$

Here we note that the characteristic tone for each sentence type is being strengthened. Hereafter, I will use L^* and H^* for intensified tones, if needed.

In a series intonation, the IC for the IP the final parallel item belongs to may take an SFIC when the IP occurs as an SFIP. In this case, the SFIC is more often realized as a low-fall 2-1 contour than the normal 2-3-1.

(16)

- a. *2chang3ho, 2mi3ca, (2kuli3ko) 2unmi-3nun 2khi-3ka 2khe-31yo*
 Changho Mica and Unmi-TOP height-NOM tall-DECL
 (Changho, Mica, and Unmi are tall.)
- b. A: *ecey phathi-ey nwukwu nwukwu wass-ni?*
 (Who and who came to the party yesterday?)
 B: *2chang3ho, 2mi3ca, (2kuli3ko) 2un(3)1mi*
 Changho Mica and Unmi
 (Changho, Mica, and Unmi.)
- b' B: *2chang32ho, 2mi32ca, (2kuli32ko) 2un(3)1mi*
- c *2ha3na, 23twul, 23seys, 23neys, 2ta(3)1ses*
 one two three four five
 (one, two, three, four, five.)
- c' *2ha32na, (2)32twul, (2)32seys, (2)32neys, 2ta(3)1ses*

Whereas in (16a) the final parallel item occurs in an NFIP, it belongs to an SFIP in (16b), (16b'), (16c), and (16c'). If it stands as part of an SFIP, its IC takes either a LHL or a LL^* pattern (2-1).

Although the LHL pattern is usually obtained for the SFIPs in normal nonquestion sentences, in a series structure an LL^* is more common. This suggests that the nuclear high tone H^* is deleted or assimilated to the adjacent L. To derive this LL^* pattern for the SFIC, we may suppose the following rules:

(17) Series-Final Low-Fall Contour (Optional)⁵⁾

a.	Hl*	----->	∅	/	L	—	L ⁺	}	I=S \ [SERIES]
a'.	H*	----->	L**	/	L	—	L ⁺	}	I=S \ [SERIES]
b.	H*	----->	∅	/	L	—	L ⁺	}	I=S \ [SERIES]
b'.	H*	----->	L ⁺	/	L	—	L ⁺	}	I=S \ [SERIES]

Rules (17a) and (17a') tell us that they are applied before tones are associated with the segmental texts, whereas rules (17b) and (17b') tell us that they are applied after the tone association. Rules (17a) and (17b) are accented tone deletion processes between two low tones, whereas rules (17a') and (17b') are tone assimilation. In terms of phonetic motivation, however, assimilation seems more plausible in this environment than deletion. Moreover, if we consider that the lowered L falls on the SFIP-final syllable but not on other syllables, it is understood that the accented tone should be active until the tone linking has been finished. Otherwise, there would be no way to have the L⁺ fixed on the final syllable. So (17a') and (17b') are better solutions to this low-fall contour.

The low-fall contour is found even in the SFIPs of normal sentences other than Y/N questions, when it sounds complaining, blunt or less polite, compared with the normal LHL pattern.

3. 2. SFICs and Discourse Functions

As shown so far, the SFICs for different sentence types are determined basically depending on whether they are Y/N questions or not. For the structures the sentence types of which are not clear on the surface, we should decide their sentence types from their restored original structure.

In echo questions we repeat a question for confirmation, as in speaker B's utterances in (18) and (19). In (18) the echo question repeats a Y/N question, and in (19) it repeats a WH-question. In Korean an echo question takes an indirect quotation form.

⁵ Hereafter '\ ' will be used to signal that the following is the information about something other than sentence types.

(18)

- A: *naytal-ey ilpon ka-ni?*
 next month-LOC Japan go-Q
 (Are you going to Japan next month?)
- B: *2naytal-3ey 2ilpon kanya-4kwu?*
 next month-LOC Japan go Q-QUOT
 (Did you ask me if I would go to Japan next month?)
- A: *ung.*
 yes
 (Yes.)

(19)

- A: *ne mwe mek-ni?*
 you what eat-Q
 (what are you eating?)
- B: *23na 2mwe meknya-4kwu?*
 I what eat Q-QUOT
 (Did you ask me what I am eating?)
- A: *ung.*
 yes
 (Yes.)

An echo question needs to be a full sentence, if it is addressed to the speaker's senior in very polite speech. In order to make the full sentence, we attach *ha* 'say' + *-si* 'HON' + *-ess* 'PAST' + *-eyo* 'Q' after the quotative marker of the plain level echo question. From this, we can see that both echo questions in (18) and (19) are originally Y/N questions. Their IC, 2-4, can thus be determined by this syntactic information that they are Y/N questions.

However, in certain cases, discourse function affects the SFIC. In these cases, as shown in reclamatory questions, the information about the discourse function as pragmatic information causes a change in the SFIC that is originally determined by the information about the syntactic sentence type.

Reclamatory questions (Bolinger 1989) request repetition of something, question or nonquestion, in part or in whole, said by the previous speaker. In example (20) below, the repetition of a nonquestion is requested.

(20)

- A: *Tongswu-nun kimchi -lul mos mek-e*
 Tongsoo-NOM kimchi-ACC can not eat-DECL
 (Tongsoo can not eat kimchee.)

- B: i) <Total Reclamation>
*2mwɛ-la4kwu?/24mwɛ? (*2mwɛ-la31kwu?/ *231mwɛ?)*
 what-QUOT
 (What (did you say)?)
- ii) <Partial Reclamation>
2mwɛl mos mek-nun -ta4kwu?
 (*2mwɛl mos mek-nun -ta31kwu?)
 what ACC can not eat-PRES-QUOT
 (What did you say he can not eat?)

As shown in the above example, reclamatory questions take a LH pattern, not LHL, even though the above reclamatory questions are derived from the full WH-questions with *ha* 'say' + *-si* 'HON' + *-ess* 'PAST' + *-eyo* 'Q' after a quotative marker, which are used in very polite speech. If the identical structure is used as only a normal WH-question, not as a reclamatory question, then its contour will of course be LHL. Here we see that the IC for a reclamatory question is determined by pragmatic information; that is, in the case where a question is "reclamatory", which is a pragmatic notion, that question should be given a LH contour.

(21) IC Assignment for Reclamatory Question

L -----> H / H* — } I=S [Q+WH] \ [RECLAIM]

3. 3. Affective State and SFIC

Although there are many other ways of expressing our inner states, such as metaphorical use of lexical items, code switching, change of grammatical forms and constructions, etc., nobody would disagree that intonation plays the most important role in expressing a speaker's emotions and attitudes. In the following we see some examples showing that the SFIC varies due to the addition of attitudinal meaning.

(22)

- a. 2yɛnghwa -lul po -n -31ta (Normal Statement)
 movie ACC see PRES DECL
 (I am watching a movie.)
- a'. 2yɛnghwa -lul po -n -4ta (Pondering over)
 (I am thinking over whether I will watch a movie.)
- b. 23nen 2ilum-3i 2mwɛ-31ni? (Normal WH-question)
 you TOP name-NOM what-Q
 (what's your name?)

- b'. 23nen 2ilum-3i 2mwe-4ni? (Being Polite)
 you TOP name-NOM what Q
- c. 2kyengchi-3ka 23cham 2coh-4ci? (Normal Y/N Question: Weak
 Request for Confirmation)
 scenery-NOM very good-Q
 (I think the scenery is very good, and don't you think so?)
- c' 2kyengchi-3ka 23cham 2coh-41ci? (Strong Request for
 Confirmation)
 scenery-NOM very good-Q
 (I think the scenery is very good, and you will agree with me.)

As shown above, the shape of an SFIC can vary if affected by the speaker's attitudinal states. In order to derive an SFIC which conveys a certain attitudinal state, we need to set up a rule that operates by the pragmatic information regarding the speaker's attitude and causes a tonal change in the SFIC determined by the syntactic sentence type.

(23)

- | | | | | | |
|---------------|----------|--------|-----|---|---|
| a. for (22a') | L -----> | H / H* | ___ | } | I=S[-Q]\[PONDERING] |
| b. for (22b') | L -----> | H / H* | ___ | } | I=S[Q(+WH)]\[POLITE] |
| c. for (22c') | ∅ -----> | L / H* | ___ | } | I=S[Q(-WH)]\[STRONG REQUEST FOR CONFIRMATION] |

Given more contexts, the IC shapes for various attitudinal meanings do not appear to be clear-cut, since emotion and attitude are mixed in utterances rather than realized separately. However, if we can separately describe emotion and attitude, there will be more room to grammaticize them. Here I distinguish the two terms *attitude* and *emotion* by the criterion of whether they are controllable or not: attitude is controllable, but emotion is uncontrollable. As Couper-Kuhlen (1986:174) puts it, attitude is a "cognitively monitored expression" of affective state that is "conventionalized and communicative in purpose," whereas emotion is an "unmonitored, purely physiologically determined externalization" of affective state. To express one's emotion, one usually employs both prosodic features such as pitch range (key, and register), pause, loudness, tempo, and tension, and paralinguistic features such as voice qualifiers (whisper, creak, falsetto, etc.) and voice qualifications (laugh, giggle, sob, cry, etc.). However, variation in tone pattern does not seem to contribute to expressing emotion. The

study, I hope the attempt on formal description of intonation contours in this paper will somehow contribute to the advance in the study of speech synthesis or speech recognition.

ABBREVIATIONS

ACC:	accusative	PAST:	past tense marker
DECL:	declarative ender	PRES:	present tense marker
EXCL:	exclamatory ender	POL:	politeness particle
HON:	honorific suffix	PROP:	propositive ender
IMP:	imperative ender	Q:	question ender
LOC:	locative	QUOT:	quotative marker
NOM:	nominative	TOP:	topic marker

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