THE INFLUENCE OF SENTENCE-FINAL INTONATION AND PHONOLOGICAL PHRASING ON THE INTERPRETATION OF *WH*-INDETERMINATES

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1 Introduction

Wh-words in many languages are ambiguous between interrogatives and indefinites. For example, the sentence with a *wh*-pronoun in Korean in (1) has at least three different interpretations: i) a *wh*-question with an interrogative pronoun, ii) an assertion with an indefinite pronoun, and iii) a yes/no-question with an indefinite pronoun. Following Kuroda (1965), I will use the term *wh-indeterminates* throughout this paper to refer to such versatile *wh*-words.

(1) Mina-ka **nuku**-lɨl manna
Mina-NOM who-ACC meet.NET[1]

i) 'Who is Mina seeing?'
ii) 'Mina is seeing someone.'
iii) 'Is Mina seeing someone?'

In recent years, there has been a surge of interest in the role of prosody in disambiguating those indeterminate *wh*-words (Fu 2002, Dong 2009 for Chinese; Ishihara 2002, Sugahara 2003 for Japanese; Jun & Oh 1996, Yun 2012 for Korean, among others). The majority of the studies confirm the importance of appropriate phonological phrasing: *wh*-questions create a single prosodic domain which starts with the *wh*-phrase and ends with the complementizer (cf. Richards

[1] The list of abbreviations used in this paper is as follows:

NOM: nominative	ACC: accusative	LOC: locative
PAS: passive	PRS: present	
DCL: declarative	Q: interrogative	NET: neutral

2010). However, whether the sentence-final intonation has an influence on the interpretation of the sentences containing *wh*-indeterminates has received relatively less attention.

The present study compares the influence of the two prosodic factors, sentence-final intonation and phonological phrasing, on the interpretation of *wh*-indeterminate words. The paper is organized as follows: Section 2 reviews previous studies on the prosodic factors that affect the meaning of sentences containing *wh*-indeterminates. Section 3 describes the experimental approach I adopted to compare the two prosodic factors introduced in section 2. Section 4 discusses the results of the experiment and remaining questions. Section 5 concludes the article.

2 Background

2.1 Phonological phrasing

It has been noted among phonologists that *wh*-interrogative words introduce changes of phonological phrasing in the sentence. Cho (1990) claims that a *wh*-word forms a single phonological phrase with the following word when it is interpreted as an interrogative, and Jun (1993) argues that the phonological phrase relevant to the prosody of *wh*-words is the Accentual Phrase. According to Jun's model of Korean intonation, the utterances of Korean consist of Intonational Phrases (IPs), which in turn consist of Accentual Phrases (APs), which in turn consist of Phonological Words. Usually, one AP contains one content word (Schafer and Jun 2001, Kim 2004). The example in (2) illustrates the phonological phrasing of a sentence that does not contain *wh*-indeterminates. When this sentence is uttered at a normal speech rate without any special context, it is parsed into one IP and three APs.

(2) [$_{IP}$ [$_{AP}$ Mina-ka] [$_{AP}$ Kəni-lɨl] [$_{AP}$ manna]]
Mina-NOM Ken-ACC meet.NET

'Mina is seeing Ken.'

When it comes to sentences containing *wh*-indeterminates, Jun (1993) argues that the AP boundaries between the *wh*-word and the IP-final word are deleted when the *wh*-word receives an interrogative reading. As a result, a *wh*-word and the following words must be in the same AP in a *wh*-question, which I will call post-*wh* dephrasing. Therefore, interrogative and indefinite *wh*-words involve different phrasing patterns, as illustrated below:

(3) a. Interrogative
[IP [AP Mina-ka] [AP nuku-lɨl manna]]
Mina-NOM who-ACC meet.NET

i) 'Who is Mina seeing?'

b. Indefinite
[IP [AP Mina-ka] [AP nuku-lɨl] [AP manna]]
Mina-NOM who-ACC meet.NET

ii) 'Mina is seeing someone.'
iii) 'Is Mina seeing someone?'

Then, how do we detect whether there exists an AP boundary or not in a certain position? One way to detect AP boundaries is to observe so-called AP-internal processes. Jun (1993) argues that Accentual Phrases are the domain of certain post-lexical phonological rules, such as intervocalic voicing, post-obstruent tensing, intersonorant /h/-deletion, and vowel shortening. If any of these phonological processes is observed across the boundary between two words, the word boundary cannot coincide with an AP boundary and the two words must be in the same AP. Thus, if such a phonological process occurs right after a *wh*-phrase, it can serve as an indicator of post-*wh* dephrasing, which in turn indicates that the given sentence is a *wh*-question.

2.2 Sentence final intonation

It has been known that sentence-final intonation signals different types of sentences. A number of Korean grammarians have argued that declarative sentences and *wh*-questions exhibit falling intonation at the end of the sentence, while yes/no-questions involve rising intonation (Martin 1951, Lee et al. 1984, Suh 1989, Hur 1991, Lee & Ramsey 2000, Kwon 2002):

Sentence type	Indeterminate reading	Sentence-final intonation
Wh-question	Interrogative	Fall
Declarative	Indefinite	Fall
Yes/no-question	Indefinite	Rise

Table 1. The correlation between meaning and sentence-final intonation of *wh*-indeterminates argued in the literature

Note that sentence-final intonation does not directly indicate the meaning of *wh*-indeterminate words (i.e. whether they are interrogative or indefinite) as illustrated in Table 1. Moreover, in his comprehensive study on Korean prosody, Lee (1997) argues that the choice of sentence-final intonation is influenced by the speaker's emotion or attitude, rather than determined by a concrete rule. He also notes, though, that certain types of sentences have fixed intonation, and yes/no-questions containing *wh*-indeterminates always end with rising intonation. If this claim is correct, sentence-final intonation provides at least a partial clue to discerning the meaning of sentences containing *wh*-indeterminate words: if the sentence involves falling intonation at the

end, it cannot be a yes/no-question. Furthermore, Hwang (2007) argues that what consistently distinguishes yes/no-questions from *wh*-questions is the sentence-final intonation rather than the phrasing pattern. This leads us to a question regarding the influence of sentence-final intonation on processing sentences with *wh*-indeterminate words.

Thus, the research question in this study is: how strong is the effect of sentence-final intonation in determining the meaning of *wh*-indeterminate words? More specifically, can it be stronger than the phonological phrasing effect? To compare the two effects, I conducted a perception experiment.

3 Method

3.1 Participants

24 native Seoul Korean speakers (12 females and 12 males) participated in the perception test. Most participants were in their early thirties (M = 32.04, SD = 2.90) and have lived in Seoul or its vicinity for most of their lives (M = 26.17, SD = 6.70).

3.2 Materials

The target sentences contained a *wh*-phrase ending with a vowel, followed by a word starting with /*h*/ to test different phrasing effects, as illustrated below. All sentences ended with a neutral intimate ending that can be used for either assertion or question. As a result, three different readings were available for each sentence: i) declarative, ii) yes/no-question, iii) *wh*-question.

(4) Example of stimuli

	cikɨm	mwə	hæ
	now	what	do.NET
i)	'I'm doing something now.' (declarative)		
ii)	'Are you doing something now? (yes/no-question)		
iii)	'What are you doing now?' (*wh*-question)		

The two levels of phonological phrasing (i.e. the presence or absence of post-*wh* dephrasing) were implemented in terms of inter-sonorant *h*-deletion. As Jun (1993) argued, such a phonological process can only occur within an AP. For example, the sentence (5) contains two instances of inter-sonorant /h/ in the underlying form but the first /h/ is very likely to drop, while the second /h/ is hard to drop. This is because the second /h/ and its preceding vowel /a/ do not belong to the same AP when the sentence is uttered in a normal rate.

(5) *H*-deletion: AP-internal process

ɨn**h**asu-ka	**h**anil-e	po-i-n-ta
Milky.way-NOM	sky-LOC	see-PAS-PRS-DCL

'The milky way is seen in the sky.'

Therefore, if /h/-deletion is observed across the boundary between the *wh*-word and the following word in the target sentences of this study as in (4), it indicates that post-*wh* dephrasing has occurred.[2]

I recorded myself (as a native speaker of Seoul Korean) reading the target sentences at a normal speech rate. Each sentence was read four times as two factors varied in each repetition: whether the sentence-final intonation was falling or rising and whether the post-*wh* *h*-sound was maintained or deleted. The recording was done carefully so that each repetition differed only in the relevant factors. Visual inspections into the waveforms and pitch contours were also made after recording to confirm the minimal variation of other factors. Figure 1 provides examples of the spectrogram and F0 track of the stimuli.

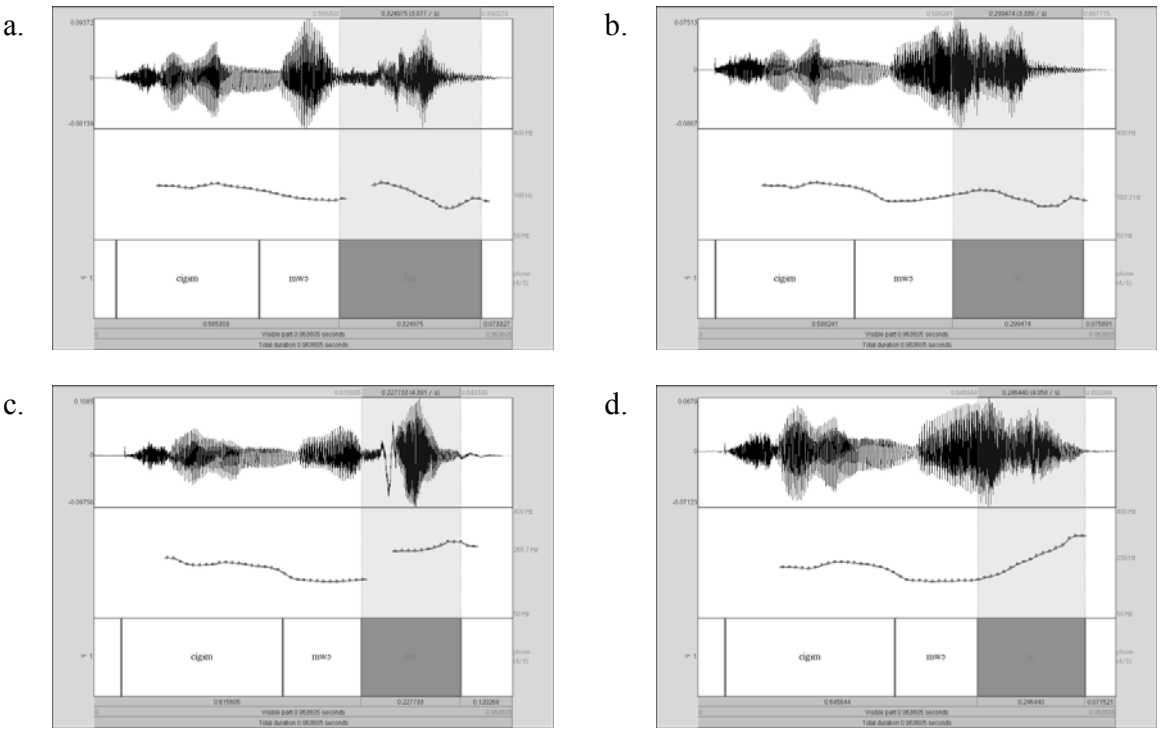

Figure 1. Examples of spectrograms and F0 tracks of the stimuli: (a) Fall; (b) Fall + *h*-deletion; (c) Rise; (d) Rise + *h*-deletion.

3.3 Procedure

I built a web application for the perception test. A target sentence was displayed on the screen with a context that facilitated one of the three different readings available for the target sentence. An example of such a context is given below:

[2] Note that /h/-deletion is optional. If the *h* sound is maintained, we simply cannot tell the sentence type.

(6) Assertion

A: Na-laŋ jæki com hallæ?
I-with talk please do
'Would you talk with me?'

B: Camk'an-man. Na **cikɨm mwə hæ**.
moment-only I now what do
'Wait a moment. I'm doing something.'

(7) Yes/no-question

A: Nə **cikɨm mwə hæ**?
you now what do
'Are you doing something?'

B: Ani.
no
'No.'

(8) *Wh*-question

A: Nə **cikɨm mwə hæ**?
you now what do
'What are you doing?

B: Sukc'e.
homework
'Homework.'

The dialogues were provided in written form in Korean. The participants were instructed to read the dialogue including the target sentence, and then to listen to the target sentence by clicking a button on the screen, and finally to assign a score from 0 (completely bad) to 10 (completely fine) depending on how natural the sentence sounded in the given context. They were allowed to hear the stimuli repeatedly. Once they gave a score, however, they were not allowed to go back and change their answer. In total, 24 stimuli (2 sentences × 4 prosody types × 3 context types) were presented in a pseudo-random order as well as fillers so that the same sentence did not appear twice in a row.

3.4 Results

Table 2 shows the average acceptance rates of three different readings for each prosody type and the results of ANOVA and Tukey post-hoc tests (at the .01 level). The most prominent reading in each condition is emphasized in bold.

Prosody	Average ratings			Effects		
	DCL	YN-Q	*WH*-Q	*d.f.*	F	Tukey
Falling	8.77	0.85	1.02	(2,141)	366.89	**DCL**>*WH*-Q=YN-Q
Rising	0.41	9.10	5.71	(2,141)	176.24	**YN-Q**>*WH*-Q>DCL
Falling + *h*-deletion	1.75	1.51	6.90	(2,141)	62.50	***WH*-Q**>DCL=YN-Q
Rising + *h*-deletion	0.40	2.29	9.48	(2,141)	317.54	***WH*-Q**>YN-Q>DCL

Table 2. Mean acceptance rates and differences in Experiment 2 (all effects at p<.01).

As shown in the above table, there is a sharp contrast between the results with and without *h*-deletion. When *h*-deletion did not occur, there was a clear association of the sentence-final intonation with sentence types: falling intonation created a strong bias toward a *declarative* reading, while rising intonation toward a *yes/no-question* reading. On the other hand, when *h*-deletion occurred, the sentence-final intonation did not help distinguish the meaning of the sentence: a *wh-question* reading was strongly preferred regardless of the sentence-final intonation.

4 Discussion

The results of the perception test suggest that the influence of sentence-final intonation is not strong enough to change the meaning of *wh*-indeterminates, contrary to Hwang (2007). Note that the test results are in accordance with the claim by Lee (1997): if a sentence containing *wh*-indeterminates has a yes/no-question reading, it must be associated with rising intonation at the end of the sentence. However, the test results reveal that the converse is not true: sentence-final rising does not guarantee a yes/no-question reading.

A remaining question comes from the fact that there is a mismatch between the claim of many traditional Korean grammarians and my experimental results. As summarized in Table 1, it has been argued that *wh*-questions are associated with sentence-final *falling* intonation. However, the participants in the experiment perceived *rising* intonation rather than falling intonation as more natural for *wh*-questions. It seems the puzzling mismatch is due to the difference in sentence ending particles between the data in previous studies and my experiment. Previous studies mostly took examples of sentences ending with explicit question markers such as *-ni* or *-k'a*, and paid attention to the distinction between a yes/no question or a *wh*-question. On the other hand, the stimuli for the perception experiment in this study were all with a neutral ending (*-e/a*), which involves more ambiguity.[3] The exact patterns of intonation associated with different types of sentence endings are to be investigated in a follow-up study. It suffices for our purposes here to note that replacing the sentence endings with other types does not seem to affect the results: post-*wh* dephrasing creates a strong bias toward a *wh*-question reading regardless of the sentence-final intonation associated with question markers.

[3] I chose neutral sentence endings as the target of investigation because they are preferred over explicitly assertive or interrogative sentence endings in contemporary Korean for all types of sentences (Kwon 2002).

5 Conclusion

The results of the experiment in this study demonstrate that the effect of phonological dephrasing overrides the influence of the sentence-final intonation in deciding the meaning of the sentence containing *wh*-indeterminate words. Thus this study reinforces the findings in the previous studies (Jun & Oh 1996 and Yun 2012) that phonological phrasing is a primary prosodic factor to disambiguate the meaning of *wh*-words in Korean. It further supports the argument that creating a single prosodic domain from the *wh*-word to the complementizer is a cross-linguistically crucial factor in forming *wh*-questions (Richards 2010).

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