WH-INDEFINITES: MEANING AND PROSODY

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

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August 2013

WH-INDEFINITES: MEANING AND PROSODY

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Cornell University 2013

This dissertation investigates the semantics and prosody of *wh*-indefinites, i.e. indefinite expressions that are morphologically related to *wh*-interrogatives.

The first part of the dissertation explores the semantics of *wh*-indefinites. It identifies a cross-linguistic pattern that bare *wh*-indefinites (BWIs) appear in more restricted environments than complex *wh*-indefinites (CWIs) and it proposes that the contrasting behaviors of the two types of *wh*-indefinites can be attributed to their contrasting compositional semantics. It also provides a more precise description of the scope configurations of *wh*-indefinites, refuting the claim in previous works that BWIs cannot take wide scope.

The second part of the dissertation concerns the semantics-prosody interface, i.e. how *wh*-indefinites are distinguished from their interrogative counterparts prosodically, focusing on the case of Korean. This issue is approached both from the side of production, through a pair of corpus studies, and from the side of perception, through a pair of perceptual experiments. The corpus studies indicate that *wh*-interrogatives are characterized by prominence on the *wh*-word and dephrasing after the *wh*-word, and the experimental results suggest that post-*wh* dephrasing is the most influential factor in determining the interpretation of the *wh*-word. The results further show that the primary role of phonological prominence on the *wh*-word is rather to force a wide-scope interpretation, which in turn provides additional empirical evidence for the existence of wide-scope BWIs.

BIOGRAPHICAL SKETCH

Jiwon Yun was born on April 24, 1978 in Seoul, Korea. She graduated from Seoul Science High School in 1997 and entered the School of Natural Sciences at Seoul National University that same year. In her senior year, she read a biography of Noam Chomsky and became fascinated by the field called *linguistics*. After she received her Bachelor's degree in Computer Science and Engineering at Seoul National University in 2002, she started studying linguistics and obtained an M.A. in Linguistics at Seoul National University in 2004. She joined the Ph.D. program in Linguistics at Cornell University in 2005. Following the completion of her Ph.D. she will begin an appointment as an Assistant Professor in the Department of Linguistics at the State University of New York at Stony Brook.

To my parents

ACKNOWLEDGMENTS

My first and foremost thanks go to my thesis committee chairs, Mats Rooth and John Whitman. Mats has been my mentor since the first year of my graduate program and has continuously inspired me to expand my interests in semantics, phonology, and computational linguistics. He has always been very generous with his time and ideas, and discussions with him helped me a lot in developing the ideas in this dissertation. For a scholar who is famous for his own theory, he is very open-minded and always shows respect for the ideas and works of other people, including even the immature and imperfect ones of his own student, which makes him more admirable. I sincerely appreciate his contribution to my intellectual growth as a linguist. I am also deeply indebted to John for his guidance and advice for literally every aspect of my research and life at Cornell. He has been in Japan for a substantial amount of time during my graduate program, but his physical absence in Ithaca has never prevented him from being an excellent advisor to me. He has been always very responsive to my e-mails wherever in the world he is, offering invaluable feedback on drafts of my works. His vast knowledge of a number of languages and all aspects of linguistics, especially when it comes to topics in Korean language and linguistics, has helped strengthen various points in this dissertation. He has been much more than an ordinary advisor, and I cannot thank him enough for his tremendous amount of support throughout and beyond my doctoral studies.

I also thank the other members in my special committee, Dorit Abusch, Michael Wagner, and John Hale. Dorit was the instructor of the first semantics course I took at Cornell, and ever since then she has given me a great amount of academic and emotional support. She gave me constructive comments on my semantics works, and she has constantly encouraged me to keep working on what I like. My heartfelt thanks go to her

There are also many people who have provided indirect help with completing this dissertation. I thank many faculty members at Cornell outside my special committee: John Bowers, Abby Cohn, Molly Diesing, Sue Hertz, Sarah Murray, Sam Tilsen, Michael Weiss, and Draga Zec, as well as Julie Legate when she was at Cornell, who

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LIST OF ABBREVIATIONS

NOM: nominative

ACC: accusative

DAT: dative

TOP: topic

FOC: focus

DEM: demonstrative

PRS: present tense

PST: past tense

PRG: progressive

HON: honorific

ADN: adnominal

DCL: declarative sentence ending

Q: interrogative sentence ending

LIST OF SYMBOLS

⊆ subset of

∈ element of

∩ intersection

∪ union

≠ not equal

∧ logical 'and'

∨ logical 'or'

¬ negation

→ conditional

∀ universal quantifier

∃ existential quantifier

λ lambda operator

$[\![\ ]\!]^{w,g}$ the interpretation function with respect to the world w and under the assignment

g

CHAPTER ONE

INTRODUCTION

1.1. Introduction

It has long been noticed that *wh*-interrogative words 'who/what/...' can be used as indefinites 'someone/something/...' in a number of languages. This phenomenon is not limited to a small number of languages or to a specific language family; rather observed in a wide variety of languages (e.g. Indo-European: Latin, Classical Greek, German, Dutch, Russian; Sino-Tibetan: Chinese; Vietnamese; Austronesian: Indonesian, Acehnese), even including isolated languages such as Korean, Japanese, and Basque (Haspelmath 1997). The extremely wide distribution of *wh*-indefinites in the world's languages suggests that the interrogative-indefinite polysemy cannot be accidental; rather it reflects a general conceptual affinity between them. Especially since interrogatives and indefinites are very basic concepts that exist in every human language, the issue of *wh*-indefinites deserves in-depth investigation, if nothing else for the purpose of gaining fundamental insights into certain semantic universals and their status in the human mind.

1.2. Roadmap

This dissertation aims to answer several questions regarding the meanings and prosodical behavior of *wh*-indefinites. The first group of questions concerns the semantics of *wh*-indefinites: Do *wh*-indefinites have the same semantics as 'genuine indefinites' that are morphologically independent of interrogatives? What is the role of *wh*-morphology in the semantic representation of *wh*-indefinites? Chapter 2 aims to answer these questions. It first classifies *wh*-indefinites in the world's languages into

two groups, depending on whether they have exactly the same form with the interrogatives (bare-*wh* indefinites; BWIs) or they involve certain additional morphology to mark an indefinite reading explicitly (complex *wh*-indefinites; CWIs), and it demonstrates a cross-linguistic pattern in which CWIs pattern together with genuine indefinites while BWIs appear in more restricted environments. Then, it proposes that the contrasting behaviors of the two groups are attributable to their contrasting compositional meanings. It also provides a more precise description of the scope configurations of *wh*-indefinites, refuting the claim in previous works that BWIs cannot take wide scope.

The other group of questions to be answered in this dissertation is regarding the prosody of *wh*-indefinites: i.e. how *wh*-indefinites are distinguished from their interrogative counterparts prosodically. To this end, Chapter 3 and Chapter 4 explore *wh*-prosody in terms of perception and production, respectively. Chapter 3 demonstrates two perception experiments designed to compare the relative importance of each of the acoustic factors that potentially aid in the distinction of *wh*-indefinites and *wh*-interrogatives. The first experiment compares the effects of phrasing and prominence. The second experiment compares the effects of sentence-final intonation and phrasing. The typological and theoretical implications of the findings are discussed at the end. Chapter 4 presents two surveys on *wh*-prosody patterns manifested on a Korean speech corpus. To facilitate this procedure, an automatic segmentation system is developed to annotate the corpus. The first survey concerns the effect of semantics on the relative prominence of *wh*-words. The second survey concerns the effect of semantics on post-*wh*-word phrasing patterns. After discussing the implication of the findings from these surveys, directions for future studies are suggested at the end.

1.3. Transcription

The data from languages other than English presented in this dissertation are glossed in English in the following way. Each linguistic example consists of three or four tiers, depending on whether it contains characters other than Roman letters or not. The first tier presents the data in the native writing system, if available, for the convenience of readers who are familiar with the language. The second tier is a transliteration of the data into the Roman alphabet. The third tier is the gloss, and the fourth tier is a translation of the data into English.

For the transliteration of the Korean language, the Yale Romanization system (Martin 1992) is adopted because it preserves the morphophonemic structure presented in Hangul and thus it is regarded as the standard romanization system for the Korean language in the linguistic literature. The actual romanization system used in this dissertation, shown in (1), deviates slightly from the original Yale system in order to maintain a strict one-to-one correspondence between Hangul symbols and the romanized transcription symbols[1].

(1)   The transliteration of Korean characters in this dissertation

ㄱ   ㄲ   ㄴ   ㄷ   ㄸ   ㄹ   ㅁ   ㅂ   ㅃ

k   kk   n   t   tt   l   m   p   pp

ㅅ   ㅆ   ㅇ   ㅈ   ㅉ   ㅊ   ㅋ   ㅌ   ㅍ   ㅎ

s   ss   ng   c   cc   ch   kh   th   ph   h

ㅏ   ㅐ   ㅑ   ㅒ   ㅓ   ㅔ   ㅕ   ㅖ   ㅗ   ㅘ

---

[1] For example, in the original Yale system, ㅜ is transcribed as *u* after a labial consonant and as *wu* in other environments.

a	*ay*	*ya*	*yay*	*e*	*ey*	*ye*	*yey*	*o*	*wa*
개	괴	교	ㅜ	궈	게	귀	ㅠ	ㅡ	ㅓ	ㅣ
way	*oy*	*yo*	*wu*	*we*	*wey*	*wi*	*yu*	*u*	*uy*	*i*

In addition, phonetic transcriptions in the IPA style as in Table 1 and Table 2 are provided for the Korean examples in the chapters dealing with prosody, the reason being that there are cases that could cause confusion if transcribed solely in the Yale Romanization system, due to mismatches with symbols in the IPA transcription system (e.g. *e* for /ʌ/ and *ey* for /e/; *u* for /ɨ/ and *wu* for /u/). In these cases, the romanized transcription in the Yale style is still provided as well because it is useful for indicating morpheme boundaries.

		Bilabial	Alveodental	Palatal	Velar	Glottal
Stop	Lax	p	t	c	k	
	Aspirated	p^h	t^h	c^h	k^h	
	Tense	p'	t'	c'	k'	
Fricative	Aspirated		s			h
	Tense		s'			
Nasal		m	n		ŋ	
Liquid	Lateral		l			
	Flap		r			
Approximant		w		j	ɥ	

Table 1. Korean consonant inventory.

	Front		Back	
	Unround	Round	Unround	Round
High	i	y	ɨ	u
Mid	e	ø	ə	o
Low	ɛ		a	

Table 2. Korean vowel inventory.

TWO TYPES OF *WH*-INDEFINITES

2.1. Introduction

This chapter investigates the typology and semantics of *wh*-indefinites, i.e., indefinite expressions that share their forms with *wh*-interrogative words. *Wh*-indefinites can be placed into one of two groups, depending on whether they have exactly the same form as interrogatives (bare *wh*-indefinites; BWIs henceforth) or they involve a certain affix attached to the interrogative form to explicitly mark an indefinite reading (complex *wh*-indefinites; CWIs henceforth)[2]. The following examples from Korean illustrate how interrogatives (2) are morphologically related to the two types of *wh*-indefinites, BWIs (3) and CWIs (4).

(2)   *Wh*-question

        민호가   뭘   먹었니?

        Minho-ka   ***mwe*-l**   *mek-ess-ni*?

        Minho-NOM   what-ACC   eat-PST-Q

        'What did Minho eat?'

(3)   BWI

        민호가   뭘   먹었다.

        Minho-ka   ***mwe*-l**   *mek-ess-ta*.

---

[2] The term 'bare *wh*-indefinites' is taken from Bruening (2007). For what he called '*wh*-indefinites in combination with particles', I am using the term 'complex *wh*-indefinites' for ease of reference.

Minho-NOM   what[3]-ACC   eat-PST-DCL

'Minho ate something.'

(4)   CWI

민호가   뭔가를   먹었다.

Minho-ka   **mwe-nka**-*lul*   *mek-ess-ta*.

Minho-NOM   what-IND[4]-ACC   eat-PST-DCL

'Minho ate something.'

Both types of *wh*-indefinites are found in a number of languages in the world[5]. The lists in (5) and (6) provide examples of *wh*-indefinites that belong to each group[6].

(5)   Examples of BWIs

a. *shenme* 'what' / 'something' (Chinese)

---

[3] Just for ease of reference, *wh*-morphemes are glossed as simple *wh*-words in English regardless of their meaning.

[4] The types of the affixes attached to the bare form of *wh*-words vary from language to language, and in many cases their meanings are not clear (Haspelmath 1997). I will not attempt to investigate the meaning of such affixes in this dissertation and will simply gloss them as IND (indefinite marker) in the examples.

[5] Languages that have *wh*-indefinites can be divided into groups according to what type of *wh*-indefinites they allow. Some languages such as Chinese and Japanese allow only one type, and some other language such as Korean and Russian allow both. All logical possibilities of the occurrence of BWIs and CWIs within a language are attested in the world's languages, as illustrated in the following table.

	BWIs	no BWIs
CWIs	Korean	Japanese
no CWIs	Chinese	English

Typology of *wh*-indefinites

[6] The examples provided here are limited to *wh*-indefinites with the meaning 'something' for the sake of simplicity, but languages with *wh*-indefinites usually have a complete inventory of interrogative-indefinite pairs (e.g. see section 2.4 for Korean).

b. *ti*   'what' / 'something' (Classical Greek)

c. *was*   'what' / 'something' (German)

d. *wat*   'what' / 'something' (Dutch)

e. *čto*   'what' / 'something' (Russian)

f. *mues*   'what' / 'something' (Korean)

(6)   Examples of CWIs

    a. *nani*   'what'   + *-ka*   = 'something' (Japanese)

    b. *čto*   'what'   + *-to*   = 'something' (Russian)

    c. *mues*   'what'   + *-inka*   = 'something' (Korean)

    d. *ce*   'what'   + *-va*   = 'something' (Romanian)

    e. *irgend-*   +   *was*   'what'   = 'something' (German)

    f. *ein-*   +   *hvað*   'what'   = 'something' (Icelandic)

    g. *ne-*   +   *što*   'what'   = 'something' (Serbian)

    h. *vala-*   +   *mi*   'what'   = 'something' (Hungarian)

An immediate question raised by the above data is if there is any syntactic or semantic difference between the two types of *wh*-indefinites. We will see in this chapter that the answer to this question is yes. We will also see how differing morphology corresponds to distinct semantics compositionally.

2.2. Bare *wh*-indefinites (BWIs)

Cross-linguistically, BWIs are restricted in terms of the contexts in which they can appear. The specific contexts that allow BWIs vary from language to language, but they can be classified roughly into two types. In some languages, BWIs must obey syntactic requirements that they be inside a certain maximal projection. In other languages, BWIs

exhibit semantic restrictions requiring them to be accompanied by certain types of expressions. The two kinds of restrictions on BWIs are described in detail in the following sections.

2.2.1. Syntactic restrictions

BWIs in some languages exhibit restrictions regarding their position in the sentence. For instance, Haspelmath (1997) points out that BWIs cannot appear at the beginning of a sentence in Classical Greek or in German, as illustrated in (7) and (8). In these examples, the BWI must appear at the end of the sentence as in (7)-a and (8)-a. If it is moved to the beginning of the sentence, its indefinite reading is not available anymore. In that case, the sentence either becomes ill-formed as in (7)-b or receives an interrogative reading (8)-b. Note that regular indefinites can appear at the beginning of the same sentence as shown in (8)-c.

(7)   Classical Greek (Hapelmath 1997: 170)

    a. *Ẽlthen*   ***tis***

       came   *who*

       'Someone came.'

    b. ****Tis***   *ẽlthen*

       who   *came*

       (Intended meaning: 'Someone came.')[7]

---

[7] The sentence (7)-b can receive an interrogative reading if the *wh*-word is stressed.

    Tís   *ẽlthen*
    who   came
    'Who came?'

(8)   German (Haspelmath 1997: 171)

    a. *Da   kommt   **wer***

       here   come   who

       'Someone is coming.'

    b. ***Wer**   kommt   da*

       who   come   here

       'Who is coming?'

    c. ***Jemand**   kommt   da*

       someone   come   here

       'Someone is coming.'

Bruening (2007) observes a similar restriction on bare *wh*-indefinites in Passamaquoddy[8]. As illustrated in (9), the *wh*-pronoun *wen* 'who' is interpreted as an indefinite when it remains in-situ (a) but as an interrogative if it is initial in the clause (b).

(9)   Passamaquoddy (Bruening 2007:153)

    a. *Itom   **wen**-il   nemiy-a-t*?

       say.3   who-OBV   IC.see-DIR-3CONJ[9]

       'Did he say he saw someone?'

---

[8] Passamaquoddy is an Eastern Algonquian language spoken in Sipayik (Pleasant Point) and Indian Township, , in the state of Maine.
[9] OBV: obviative third person, IC: initial change (ablaut), DIR: direct voice, 3: proximate third person, CONJ: conjunct inflection (subordinate clauses, *wh*-questions) (Bruening 2007: 149).

b. ***Wen**-il*   *itom*   *nemiy-a-t?*

    who-OBV   say.3   IC.see-DIR-3CONJ

    'Who did he say he saw?'

Postma (1994) presents a more specific claim concerning positional restrictions on BWIs, namely that they must be inside of VP in German and Dutch. In German, *wh*-words are interpreted as indefinites only if they are generated VP-internally as in (10)-a. If they are generated externally to VP as an adjunct, an indefinite reading is not available, as shown in (10)-b. In Dutch, BWIs cannot be scrambled out of VP, as illustrated in (11). Note that regular indefinites can be scrambled out of VP as in (12). Postma also points out that German does not allow an indefinite reading for *wie* 'how', which is in line with his claim because *wie* as an argument is external to VP.

(10)   German (Postma 1994: 192)

    a. *Er*   *hat*   ***wo***   *gewohnt*.

     he   has   where   lived

     'He has lived somewhere.'

    b. **Er*   *hat*   *das*   *Buch*   ***wo***   *gekauft*.

     he   has   the   book   where   bought

     'He has bought the book somewhere.'

(11)   Dutch (Postma 1994: 193)

    a. *Jan*   *heeft*   [VP *snel*   ***wat***   *opgeschreven*].

     John   has   quickly   what   written

    b. **Jan*   *heeft*   ***wat***   [VP *snel*   *opgeschreven*].

     John   has   what   quickly   written

'John has quickly written down something.'

(12)   Dutch (Postma 1994: 193)

    a. *Jan heeft* [VP *snel* ***iets*** *opgeschreven*].

       John has   quickly   something written

    b. *Jan heeft* ***iets*** [VP *snel* *opgeschreven*].

       John has something   quickly   written

    'John has quickly written down something.'

In sum, the data we have seen so far indicate that BWIs in certain languages are restricted configurationally. To explain these restrictions, several researchers have argued that BWIs in those languages are variables that lack quantificational force of their own, and their existential reading is derived when they are bound by existential closure at VP (Cheng 1991, Postma 1994, Ha 2004)[10]. The basic idea stems from the semantics of regular indefinites proposed by Heim (1982) and Diesing (1990). According to this line of analysis, the rule of existential closure applies only at a certain level such as VP, and indefinites outside the domain of existential closure cannot receive an existential reading. In such a case, the indefinite ends up receiving a generic reading (for regular indefinites) or an interrogative reading (for *wh*-indefinites).

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[10] This argument was first suggested by Cheng (1991) to explain the indefinite reading of *wh*-words in Chinese, and it was also pursued by Postma (1994) for German and Dutch, as well as by Ha (2004) for Korean. As we will see later, however, Chinese is not a language that fits into this line of argument, and the analysis of Korean must be revised to some extent to accommodate the exceptional data. Note that these previous analyses are inadequate not because the argument itself has a logical flaw but because they are based on the incorrect generalization on the data.

2.2.2. Semantic restrictions

Some languages exhibit restrictions on BWIs in terms of the semantic contexts in which they can occur. For instance, it is well known that *wh*-words in Chinese have indefinite readings only when they co-occur with certain expressions (Cheng 1991, Li 1992, Lin 1998, Aldridge 2007, among others). Those licensing expressions are widely distributed and not easy to be characterized in terms of a single semantic property. At first glance, the licensing contexts for BWIs seem to coincide with the contexts where negative polarity items (NPIs) are allowed, such as negation, conditionals, and polar questions as illustrated in (13). Besides the traditional NPI contexts, however, there are additional cases where BWIs are allowed, such as (a) non-factive verbs *yiwei* 'think', *renwei* 'think', *cai* 'guess', *xiwang* 'hope', or (b) adverbs expressing tentativeness or uncertainty: *dagai/keneng* 'probably', *haoxiang* 'seem', *sihu* 'seem', *de yangzi* 'the appearance of', *yexu* 'perhaps', or (c) circumstantial *le*, as illustrated in (14). To generalize all these environments, Li (1992) suggests that Chinese *wh*-indefinites are allowed only when the truth value of the sentences is not positively fixed.

(13)   BWI-licensing expressions in Chinese (Li 1992)

   a. Negation

     Ta <u>*bu*</u>   *xihuan*   **shenme.**

     he   not   like   what

     'He doesn't like anything.'

   b. Yes/no-question

     Ta   *xihuan*   **shenme**   <u>*ma*</u>?

     he   like   what   Q

'Does he like something?'

c. A-not-A question

    *Ta   xi-<u>bu</u>-xihuan   **shenme**?*

    he   like-not-like   what

    'Does he like something?'

d. *If*-clause

    <u>*Yaoshi*</u>   *ta   xihuan   **shenme*** ...

    if   he like   what

    'If he likes anything ...'

(14)   BWI-licensing expressions in Chinese (Li 1992)

a. Non-factive verbs

    *Wo <u>yiwei</u> ni   xihuan **shenme** (dongxi).*

    I   think you like   what   thing

    'I think that you like something.' (Li 1992: 129)

b. Expressions of tentativeness or uncertainty

    *Ta   <u>keneng</u>   xihuan   **shenme**.*

    he   probably like   what

    'He probably likes something.' (Li 1992: 131)

c. Circumstantial *le*

    *Ta   zuo (le) **shenme**   <u>le</u>.*

    he   do   LE   what   LE

'He did something[11].' (Li 1992: 132)

Russian also exhibits similar restrictions on BWIs: they must be in the scope of certain licensors as illustrated in (15).

(15)   BWI-licensing expressions in Russian (Yanovich 2005: 321)

   a. Particles forming yes/no-questions

   Ne prixodil   li   kto?

   not came   Q   who

   'Did anyone come?'

   b. *If*-clauses

   Esli   kto   pridet, zovi   menja.

   if   who   come   call   me

   'If anyone comes, call me.'

   c. Subjunctive clauses

   Petja   zaper dver'   čtoby   kto   ne   vošel.

   Petja   locked the-door   that-SUBJ   who   not   come-in

   'Petja locked the door in order that anyone cannot come in.'

   d. Epistemic operators

   Možet,   kto   prixodil.

   It-may-be-that   who   came

   'It may be that someone came.'

---

[11] Lin (1998) argues that the circumstantial/inferential *le* functions as a BWI-licensor because it involves a certain kind of modality in that the speaker infers something must have happened solely on the basis of his/her observation of the environment, without witnessing the event or changing state. The modality can be expressed explicitly in translation, e.g. 'It seems he did something (a la Lin 1998)' or 'He must have done something (a la Dong 2009)'.

To account for such restrictions, it has been proposed that BWIs in these languages require certain lexical licensors (e.g. Yanovich 2005 for Russian, Dong 2009 for Mandarin Chinese). The licensors seem to be determined by the lexicon rather than by their semantic properties because they do not form any stable natural class cross-linguistically, or even within a language. For instance, Yanovich (2005) points out that Slovene and Byelorussian allow BWIs in imperatives while Russian does not. He further mentions that in Russian, *možet* 'it-may-be' can license BWIs while *dolžno byt'* 'it-is-likely' cannot, even though both are epistemic operators bearing similar meanings. There is certainly a tendency for most licensors to involve some kind of modality but for the moment until a better generalization is made, it seems reasonable to assume that licensors are lexically determined.

2.2.3. Generalized restrictions

As we have seen so far, a bare *wh*-word can be interpreted as indefinite only if it is licensed properly; otherwise the sentence containing them is interpreted as a *wh*-question[12]. In languages such as German and Dutch, BWIs are restricted in terms of their position in the sentence. In languages such as Chinese and Russian, BWIs are restricted in terms of co-occurrence with other expressions. Note, however, that BWIs in Chinese/Russian-type languages also involve a certain kind of structural restriction: a BWI is required to be within the scope of its licensor. In Chinese, for instance, the BWI is allowed in the object position of the verb but not in the subject position, even though negation is a licensor of BWIs in Chinese, as shown in (16). Li (1992) states this

---

[12] The sentence can also be interpreted as ill-formed if it is uttered with inappropriate prosody, as shown in the Classical Greek example in (7). The influence of prosody on the interpretation of *wh*-words will be discussed in detail in Chapter 3.

restriction in terms of c-commanding because the negation c-commands the object but does not c-command the subject.

(16) Chinese (Li 1992:135)

    a. *Ta*   *bu*   *xihuan*   **shenme**   **ren**

        he   not   like   what   person

        'He does not like someone.'

    b. **Shenme**   **ren**   *bu*   *xihuan*   *ta*

        what   person   not   like   him

        'Who does not like him?'

        *'Someone does not like him.'

Therefore, setting aside the lexical restrictions in Chinese/Russian-type languages, we can make the cross-linguistic generalization that a BWI must be in the scope of a certain licensor. In German/Dutch-type of languages, the licensor is existential closure that applies to a *wh*-indefinite inside VP. In Chinese/Russian-type languages, the licensor is a lexically determined expression, which presumably introduces existential closure for the BWI.

    With this background, let us now consider a noteworthy remark on the general restrictions on BWIs. While most previous researchers have worked on individual languages, Bruening (2007) has made an attempt at a typological generalizaion as follows:

(17) Scope restriction of BWIs (Bruening 2007:160)

    Bare *wh*-indefinites may never take widest scope, nor have a specific reading.

If we interpret 'widest scope' as 'sentential scope', the statement in (17) correctly characterizes all BWIs we have seen so far. First, it is obvious that this statement holds for languages that have lexical licensors for BWIs. Since BWIs must be within the scope of their lexical licensors, they cannot take sentential scope. Note that this does not mean that BWIs cannot take wide scope over other elements in general. A long-distance-scope reading should be available as long as it is interpreted within the scope of the licensor. For instance, a modal expression such as *haoxiang* 'it seems' is a licensor of BWIs in Mandarin Chinese, while universal quantifiers are not; thus a scope configuration such as [seem > some > all] is possible in the following example:

(18)   Chinese

    *<u>Haoxiang</u> tamen <u>dou</u>   chiguo **shenme**.*

    seem   they   all   ate   what

    'It seems they all ate something.'

For languages that have structurally determined licensors, BWIs cannot take sentential scope because they cannot be interpreted outside VP. Of course, it is still possible in theory that BWIs take wider scope than other elements within VP. Such a case has not been found yet, though. For instance, Postma (1994) suggests that BWIs in Dutch can only take narrowest scope. In (19), the BWI *wat* 'what/something' cannot take scope over the universal quantifier *alle boeken* 'all books', regardless of the surface word order.

(19)   Dutch (Postma 1994: 192)

    a. *Jan   heeft   **wat**   in <u>alle   boeken</u>   geschreven*

       John   has   what   in all   books   written

      (all > some, *some > all)

b. *Jan   heeft **iets**   in <u>alle   boeken</u>   geschreven*

John   has   seomthing in all   books   written

(all > some, some > all)

'John has written something in all books'

Thus it seems that Bruening's generalization holds for all BWIs we have seen so far. The restrictions on BWIs discussed in this section can be summarized as follows:

(20)   Generalized restrictions on BWIs:

a. BWIs must be in the scope of their licensors.

b. BWIs cannot take sentential scope.

2.3. Complex *wh*-indefinites (CWIs)

Unlike BWIs, which are restricted syntactically and semantically, CWIs seem to occur relatively freely. It is especially noticeable that CWIs pattern together with regular indefinite expressions that are not morphologically related to interrogatives.

2.3.1. Parallels between CWIs and regular indefinites

It seems that CWIs do not exhibit any restrictions that BWIs have. For instance, BWIs cannot appear at the beginning of simple declarative sentences, as illustrated in (21), regardless of whether the given language has syntactic or semantic restrictions on BWIs. On the other hand, CWIs can occur in this context, as shown in (22). Note that this difference between BWIs and CWIs is observed within a single language (e.g. Russian) as well as across languages (e.g. German vs. Japanese).

(21)   BWIs

a. German

****Wer*** *kommt* *da.*

*who came here

'(intended meaning: Someone came.)'

b. Russian

****Kto*** *vose* *v komnatu.*

 who came into the room

'(intended meaning: Someone came into the room.)'

(22)   CWIs

a. Japanese

Dare-ka*-ga* *heya-ni* *haittekita.*

who-IND-NOM   room-LOC   came-into

'Someone came into the room.'

b. Russian

Kto-to *vose* *v komnatu.*   (Yanovich 2004: 311)

who-IND   came   into the room

'Someone came into the room.'

In this sense, CWIs pattern together with regular indefinites. As shown in (23), regular indefinites can appear freely in the same environments.

(23)   Regular indefinites

a. German

Jemand *kommt* *da.*

someone   came   here

39

'Someone is coming.'

b. Chinese

Youren *jin* *le* *fangjian*

someone enter LE room

'Someone came into the room.'

Furthermore, CWIs and regular indefinites can escape scope islands, while BWIs cannot. In the following examples, the BWI *shenme ren* 'someone' in Chinese cannot take scope outside of the *if*-clause (24), while the CWI *dare-ka* 'someone' in Japanese can take scope over the *if*-clause (25). The issue of scope islands is important to explain the syntactic and semantic properties of indefinites; thus it will be dealt with in more detail in the next section.

(24)   Chinese

Yaoshi **shenme ren**   lai,   Mei   hui   hen   gaoxing

if   what-person   come   Mei   will   very   happy

'If someone comes, Mei will be very happy.'

(if > some, *some > if)

(25)   **Dare-ka**-ga   ki-tara   Mei-wa   sugoku yorokobu-daroo.

who-IND-NOM   come-if   Mei-TOP   very   happy-will

'If someone comes, Mei will be very happy.'

(if > some, some > if)

2.3.2. The scope problem of indefinites

It has been known since 1970s (e.g. Rodman 1976) that semantic scope configuration and syntactic movement exhibit similar restrictions. As illustrated in the paired sentences from (26) to (29) (from Reinhart 1997), a quantified NP can take wide scope when a *wh*-constituent can be extracted from the same position.

(26)   A doctor will interview **every new patient**.
         (^{OK} every > a)

(27)   **Which patients** will a doctor interview **<e>**?

(28)   A doctor will examine the possibility [that we give **every new patient** a tranquilizer].
         (* every > a)

(29)   *****Which patients** will a doctor examine [the possibility that we give **<e>** a tranquilizer]?

This correlation between covert scope-taking operations and overt movement supports the view that quantifiers undergo invisible syntactic movement. Then the semantic scope of NPs is restricted by syntactic constraints on movement, such as island constraints (Ross 1967) preventing extraction from occurring across syntactic 'islands' such as relative clauses or *if*-clauses. However, not all NPs obey such restrictions, as illustrated in the contrast between (30) and (31). The sentence in (30) shows that an *if*-clause constitutes a scope island, since the universal quantifier *everyone* cannot take scope over *if*. However, an indefinite expression such as *someone* can escape scope islands as shown in (31).

(30)   If everyone comes to the party, Mary will be happy.

        (if > every, *every > if)

(31)   If someone comes to the party, Mary will be happy.

        (if > some, some > if)

To explain the exceptional scope-taking property of existential/weak quantifiers such as *a man* or *someone*, Fodor and Sag (1982) propose that those indefinites are ambiguous between referential and quantificational expressions. According to them, the apparent scope ambiguity in sentences like (31) is in fact not due to the scope interaction, but due to the lexical ambiguity of the indefinite expression. As evidence for this argument, Fodor and Sag claim that indefinites can take narrowest scope (as quantificationals) or widest scope (as referentials), but they cannot take intermediate scope because there is no way to construe such a reading. One of their examples is given below (32). The sentence in (32) can mean that each teacher heard that "a student of [the speaker] has been called before the dean" (i.e. a narrowest-scope reading for *a student*), or that there is a certain student, namely John, such that each teacher heard that "John had been called before the dean" (i.e. a widest-scope reading for *a student*), but cannot mean that each teacher heard about potentially different students of the speaker, as Teacher 1 heard that "John had been called before the dean" and Teacher 2 heard that "Bill had been called before the dean" and so on (i.e. an intermediate-scope reading for *a student*).

(32)   No intermediate scope of indefinites (Fodor & Sag 1982: 374)

        Each teacher overheard the rumor [*that a student of mine had been called before the dean*].

        a. each > relative clause > **a**   (NS: narrow scope)

        b. *each > **a** > relative clause   (IS: intermediate scope)

c. **a** > each > relative clause   (WS: wide scope)

However, a number of researchers have objected to this lexical ambiguity view of indefinites, pointing out that intermediate readings for the existential quantifiers become available when appropriate contexts are given (Abusch 1994, Reinhart 1997, Winter 1997, Kratzer 1998, among others). Some of the examples are listed below, in which intermediate readings of indefinites are even preferred over narrow- or wide-scope readings.

(33)   Intermediate-scope reading for indefinites

a. *Every gambler will be surprised if **one** horse wins*. (Abusch 1994)

b. *Every one of them moved to Stuttgart because **a** woman lived there*.
(Abusch 1994)

c. *Every linguist has looked at every analysis that solves **some** problem*.
(Winter 1997)

d. *Every country's security will be threatened if **some** building is attacked
by terrorists*. (Winter 1997)

Thus, instead of lexical ambiguity, a number of researchers have argued that the source of free scope for indefinites comes from the fact that indefinites involve a choice function (CF) in their semantic representation (Reinhart 1997, Winter 1997, Kratzer 1998, Matthewson 1999). Among the variations of the Choice Function analysis, let us start with the version of Reinhart (1997) and Winter (1997). The basic assumptions of their approach are stated in (34).

(34)   Assumptions for the Choice Function analysis (Winter 1997:409)

a. Indefinites lack quantificational force of their own. They are basically predicates.

b. An indefinite NP in an argument position, however, ends up denoting an individual. This is because its semantics involves a free function variable that assigns an individual to the restriction predicate.

c. This function variable is existentially closed, together with the restriction that it is a choice function: a function that chooses a member from any non-empty predicate it gets. This quantificational procedure can apply at any compositional level.

According to Reinhart (1997) and Winter (1997), the scope configuration of an indefinite is decided depending on at which level the choice function variable introduced by that indefinite is existentially closed. The semantic representations in (35) illustrate how the two different scope readings of the sentence in (31) are derived via a choice function. In (35)-a, existential closure appears within the conditional clause; thus the indefinite receives a narrow-scope reading. If existential closure takes scope over the conditional as in (35)-b, a wide-scope reading is given to the indefinite. Note that in both readings the representation of the indefinite remains inside the conditional clause, which is a scope island. Thus the choice function analysis enables a wide-scope reading of indefinites without any movement violating island constraints.

(35)   If **someone** comes to the party, Mary will be happy.

    a. NS: if > some

       $\exists f\,[CH(f) \wedge [\text{comes-to-the-party'}(f(person))]] \rightarrow happy'(Mary')$

    b. WS: some > if

       $\exists f\,[CH(f) \wedge [\text{comes-to-the-party'}(f(person)) \rightarrow happy'(Mary')]]$

In this sense, the choice function analysis treats all scope readings of indefinites equally, according to the level of existential closure. (36) illustrates how the choice function analysis derives the narrow, intermediate, and wide-scope readings of indefinites in a unified way.

(36) Every linguist has looked at every analysis that solves **some problem**.
       (Winter 1997:431)

   a. NS: Every linguist has looked at every analysis.

     $\forall$x[linguist'(x) $\rightarrow\forall$y[analysis'(y)$\land\exists$**f**[CH(f)$\land$solve'(f(problem'))(y)]$\rightarrow$look-at'(y)(x)]]

   b. IS: For every linguist x there is a problem y such that x has looked at every analysis that solves y.

     $\forall$x[linguist'(x) $\rightarrow\exists$**f**[CH(f)$\land\forall$y[analysis'(y)$\land$solve'(f(problem'))(y)$\rightarrow$look-at'(y)(x)]]]

   c. WS: There is a problem x, such that every linguist has looked at every analysis of x.

     $\exists$**f**[CH(f)$\land\forall$x[linguist'(x)$\rightarrow\forall$y[analysis'(y)$\land$solve'(f(problem'))(y)$\rightarrow$look-at'(y)(x)]]]

Kratzer (1998), however, opposes the view that all scope readings for indefinites are derived by the same mechanism. She brings particular attention to the peculiar property of indefinite NPs modified by *a certain* discussed in Hintikka (1986). While *a certain* indefinites pattern with other indefinites in that they can escape scope islands, their scope configuration is further erratic in that they can only take widest scope in some environments, such as negation:

(37) *a certain* indefinites and negation (Kratzer 1998: (12))

   a. Richard does not have time to date a certain woman, but he sends her flowers.

   b. *Richard does not have time to date a woman, but he sends her flowers.

Unlike Reinhart and Winter, Kratzer claims that a choice function variable is not bound by a local existential operator but left free, and that its value is determined by the context later. Consequently, a choice function indefinite necessarily receives the widest-scope reading. According to her, *a certain* indefinites are always choice function indefinites, and their default scope reading is the widest one. On the other hand, other indefinites such as *a/some* NPs are ambiguous between choice function indefinites that take widest scope and quantifier phrases that are subject to scope restrictions. In a sense, Kratzer's proposal can be thought of a cross between the lexical ambiguity analysis and the choice function analysis. Like Fodor and Sag, she assumes that indefinites are ambiguous, but in her theory the wide-scope interpretation is due to a choice function rather than a referential interpretation.

Note that choice function indefinites do take scope that is narrower than the widest scope in some cases as shown in (38). Kratzer attributes such an apparent narrow-scope reading to a 'parameterized' choice function, i.e. a choice function parameterized with an implicit argument against the other scope-bearing expression. In (38), for example, the choice function variable for *a certain date* has each individual as an implicit argument and picks a date from the set of all dates that is specific to this argument, which is the man's wife's birthday. Since such parameterization is impossible for non-quantificational expressions such as negation, choice function indefinites cannot be interpreted in scope of negation, as previously illustrated in (37).

(38)   *a certain* indefinites and universal quantification (Kratzer 1998:(10))

    a. Each husband had forgotten a certain date - his wife's birthday.

      (each > a certain)

    b. $\forall x$ (husband(x) $\wedge$ had forgotten (x, f(x, date)))

The intermediate-scope reading in (36) can be explained in the same vein, as shown in (39). In this reading, the indefinite *some problem* is interpreted outside the relative clause. Since it escapes the scope island, its semantic representation cannot be a quantifier but should involve a choice function. However, it does not take widest scope because the choice function is parameterized against the universal quantifier *every linguist.*

(39)   Every linguist has looked at every analysis that solves **some problem**.

    IS: For every linguist x, f(x, problem) selects a problem such that x has looked at every analysis that solves the problem.

      $\forall x$[linguist'(x) $\rightarrow \forall y$[analysis'(y)$\wedge$solve'(f(x, problem'))(y)$\rightarrow$look-at'(y)(x)]]

Table 3 summarizes the analyses of the different scope readings of indefinites discussed in this section so far. In this table, IS (intermediate-scope reading) indicates a reading in which the indefinite takes scope outside a scope island but still inside another quantificational expression.

	WS	IS	NS
Fodor & Sag (1982)	referential	(does not exist)	quantificational
Reinhart (1997)	CF	CF	CF
Kratzer (1998)	CF	parameterized CF	quantificational

Table 3. Scope configurations of indefinites.

2.3.3. Semantic analyses on CWIs

Since CWIs and regular indefinites pattern together, it seems natural to conclude that they have the same semantic representations. Indeed, previous researchers have adopted

a choice function analysis (e.g. Ha 2004 for Korean, Yanovich 2005 for Russian, and Yatsushiro 2009 for Japanese) for the semantic representation of CWIs, suggesting that the additional morphology after the *wh*-word in a CWI is an explicit choice function marker. The details of the analysis vary depending on which specific choice function analysis is adopted. It seems the most suitable analysis of CWIs as choice functions is the one proposed by Kratzer (1998) in that it correctly predicts the relative scope configuration of negation and CWIs. Recall that in her analysis, choice function indefinites cannot take scope within the immediate scope of negation. If CWIs are necessarily interpreted as choice function variables as explicitly indicated by the morphology, they are expected to scope over negation. This expectation seems to hold, at least for the languages considered so far.

(40)   Japanese

  Kare-wa   **nani-ka**-*o*   *tabe-nakatta.*

  he-TOP   what-IND-ACC   eat-NEG.PST.DCL

  'He didn't eat a certain thing.' (IND > NEG)

  *'He didn't eat anything.' (NEG > IND)

(41)   Russian (Yanovich 2005:313)

  Petja   *ne*   *zametil*   *kogo-to*   *iz svoix odnoklassnic.*

  Petja   NEG   has.noticed   who-TO   of his girl-classmates

  'There is a girl from his class that Petja did not notice.' (IND > NEG)

  *'Petja did not notice any of the girls in his class.' (NEG > IND)

2.4. The two types of *wh*-indefinites in Korean

So far, we have seen the different distributions of BWIs and CWIs. Those differences are cross-linguistically observed, even within a language that has both types of *wh*-indefinites (e.g. see Yanovich 2005 for Russian data). Korean is one of the languages that have both types of *wh*-indefinites, as shown in Table 4.

wh-interrogative	BWI	CWI
nwukwu 'who'	*nwukwu* 'someone'	*nwukwu-nka* 'someone'
mwe 'what'	*mwe* 'something'	*mwe-nka* 'something'
eti 'where'	*eti* 'somewhere'	*eti-nka* 'somewhere'
encey 'when'	*encey* 'sometime'	*encey-nka* 'sometime'
ettehkey 'how'	*ettehkey* 'somehow'	*ettehkey-nka* 'somehow'
enu N 'which N'	*enu* N 'some N'	*enu N-(i)nka* 'some N'

Table 4. Inventory of *wh*-indefinites in Korean

However, Korean *wh*-indefinites constitute an apparent exception to the distributional generalization that holds for other languages, since none of the restrictions on BWIs described in the previous section is attested for Korean BWIs. This section introduces the data illustrating the exceptional properties of Korean BWIs and attempts to provide a proper account for the data.

2.4.1. Apparent exception to the typology

In Korean, none of the restrictions presented so far holds for BWIs, and it seems that BWIs and CWIs simply pattern together. First, BWIs are not subject to any syntactic restrictions. Both BWIs and CWIs can appear at the beginning of a sentence.

(42) 뭐가 땅에 떨어졌다.

   ***Mwe**-ka*   *ttang-ey*   *ttelecy-ess-ta*.

   what-NOM   ground-to fall-PST-DCL

   'Something fell to the ground.'

(43) 뭔가가 땅에 떨어졌다.

   ***Mwe-nka**-ka*   *ttang-ey*   *ttelecy-ess-ta*.

   what-IND-NOM   ground-to fall-PST-DCL

50

'Something fell to the ground.'

In addition, both BWIs and CWIs can be displaced out of the position where they are generated. In both examples shown below, the object *wh*-indefinite is scrambled over the subject.

(44)   누구를 윤아가 꼭 만나고 싶어한다.

       Nwukwu*-lul   Yuna-ka   kkok   manna-ko sipheha-n-ta*.

       who-ACC   Yuna-NOM   really   meet-want-PRS-DCL

       'Yuna really wants to see someone.'

(45)   누군가를 윤아가 꼭 만나고 싶어한다.

       Nwukwu-nka*-lul Yuna-ka   kkok   manna-ko sipheha-n-ta*.

       who-IND-ACC   Yuna-NOM   really   meet-want-PRS-DCL

       'Yuna really wants to see someone.'

BWIs are not subject to any semantic restrictions, either. As for the scope configuration, both BWIs and CWIs can take wide scope in general. The *wh*-indefinite can take scope over negation in both examples below.[13]

(23)   민호가 뭘 안 가져왔다.

       *Minho-ka   **mwe**-l   an   kacyewa-ss-ta*.

---

[13] Ha (2004) argues that only CWIs can take wide scope in Korean, providing examples in which he claims that BWIs cannot scope over negation, other quantifiers, or *if*-clauses. However, almost every native Korean speaker I have consulted, including myself, did accept those examples with wide-scope BWIs. Furthermore, perception experiments that will be presented in Chapter 3 of this dissertation show that a wide-scope reading of BWIs is even preferred over a narrow-scope reading if they are phonologically more prominent than other elements in the sentence.

Minho-NOM   what-ACC   NEG   bring-PST-DCL

'Minho didn't bring something.'

(46)   민호가 뭔가를 안 가져왔다.

Minho-ka   ***mwe-nka****-lul*   *an*   *kacyewa-ss-ta.*

Minho-NOM   what-IND-ACC   NEG   bring-PST-DCL

'Minho didn't bring something.'

Furthermore, both BWIs and CWIs can escape scope islands. The *wh*-indefinite can be interpreted outside of the *if*-clause in both examples below.

(47)   누가 오면 윤아가 참 좋아할 거다.

Nwu*-ka*   *o-myen*   *Yuna-ka*   *cham cohaha-l ke-ta.*

who-NOM   come-if   Yuna-NOM   very   happy-will-DCL

'If someone comes, Yuna will be very happy.'

(48)   누군가가 오면 윤아가 참 좋아할 거다.

Nwukwu-nka*-ka o-myen*   *Yuna-ka*   *cham cohaha-l ke-ta.*

who-IND-NOM   come-if   Yuna-NOM   very   happy-will-DCL

'If someone comes, Yuna will be very happy.'

The above examples seem to suggest that BWIs and CWIs pattern together in Korean. Thus, one might conclude that the two types of *wh*-indefinites have an identical semantic representation in this language. Indeed, many researchers who have attempted a compositional approach to CWIs in Korean have considered that a BWI is merely a contracted form of the corresponding CWI (C.-S.Suh 1989, D.-H.Chung 1996, Y.-

J.Jang 1999) without further explanation. However, closer scrutiny reveals that there are actually differences between them.

2.4.2. Ignorance implication of CWIs

A CWI introduces an implication that the speaker does not know the identity of the entity associated with it, whereas such an ignorance implication is not involved in the interpretation of a BWI. It has been observed by several researchers that a CWI sounds strange in the context where the speaker is expected to know which individual satisfies the existential proposition expressed by the CWI (H.-B. Im 1998, S.-W. Yi 2000, J.-M. Yoon 2005). For instance, let us consider the conversation in (50). The response with the CWI *nwukwunka* 'someone' sounds somewhat odd because it is unlikely that B came to the current place with the intention to meet someone who s/he cannot specify.

(49)   Ignorance implication of CWI

    A: 여기   무슨   일로   왔니?

        yeki   mwusun   il-lo   w-ass-ni?

        here   what.kind.of   matter-by   come-PST-Q

        'What brought you here?'

    B: 누구   만나러   왔어요.

        nwukwu   manna-le   w-ass-e-yo.

        who   meet-to   come-PST-INT-HON

        'I came to meet someone.'

    B: #누군가   만나러   왔어요.

        #nwukwu-nka   manna-le   w-ass-e-yo.

        who-IND   meet-to   come-PST-INT-HON

'#I came to meet someone (that I don't know).'

Similarly, B's response with the CWI *mwenka* 'something' in (50) describes an uncommon situation in which s/he is eating something without knowing what it is. Note that the same response with a third person subject (which is implicit here) as in (51) is fine, which confirms that the degraded acceptability in the previous examples is only for pragmatic reasons.

(50)   Ignorance implication of CWI

    A: 너   지금   뭐   해?

       ne   cikum   mwe   hay?

       you   now   what   do

       'What are you doing now?'

    B: 뭐   먹고 있어.

       mwe   mek-ko iss-e

       what   eat-PRG-INT

       'I'm eating something.'

    B': #뭔가   먹고 있어.

       #mwe-nka   mek-ko iss-e

       what-IND   eat-PRG-INT

       '#I'm eating something (and I don't know what it is).'

(51)   Ignorance implication of CWI

    A: 민호는   지금   뭐   해?

Minho-nun   cikum   mwe   hay?

Minho-TOP   now   what   do

'What is Minho doing now?'

B: 뭐   먹고 있어.

mwe   mek-ko iss-e

what   eat-PRG-INT

'He's eating something.'

B':   뭔가   먹고 있어.

mwe-nka   mek-ko iss-e

what-IND   eat-PRG-INT

'He's eating something (and I don't know what it is).'

Note that in all cases above, the responses of B with BWIs are perfectly fine. The speaker may choose to use BWIs to conceal the identity of what is said from the listener when s/he consider it is not important in the given discourse, but the speaker may know what it is. The fact that only CWIs involve an ignorance implication further suggests that BWIs are not just a contracted form of CWIs in Korean.

2.4.3. Scope configuration relative to negation

BWIs and CWIs also exhibit different properties in terms of their scope configuration relative to negation. There are three types of negation in Korean (cf. Sells 2001): (i) inherently negative predicates such as *eps-* 'not exist' *molu-* 'not know', (ii) short-form negation in which the negative adverb *an* precedes the predicate, and (iii) long-form negation in which the predicate is followed by a complex predicate *-ci ahn-*. Those different types of negation have been argued to exhibit different scope properties: i.e.,

only the long-form type can adjust the scope of negation (Sohn 1999). For instance, the sentence 'Everyone didn't come.' in (52) is ambiguous when it involves long-form negation (a), while only a wide-scope reading of negation is available for short-form negation (b).

(52) Type of negation

    a. Long-form negation

      모든 사람이   오지 않았다.

      motun salam-i   o-ci anh-ass-ta.

      every person-NOM come-NEG-PST-DCL

      '(i) No one came.' (every > NEG)

      '(ii) Not everyone came.' (NEG > every)

    b. Short-form negation

      모든 사람이   안   왔다.

      motun salam-i   an   w-ass-ta.

      every person-NOM NEG   come-PST-DCL

      'No one came.' (every > NEG)

Interestingly, the relative scope configuration between *wh*-indefinites and negation seem to be independent of the type of negation. As illustrated in the examples (53), (54), and (55), BWIs are always ambiguous, whereas CWIs always take scope over negation, regardless of the type of negation.

(53) Lexical negation

   a. BWI

여기엔   뭐가   없다.

yeki-ey-n   **mwe**-*ka*   *eps-ta*.

here-LOC-TOP   **what**-NOM   not.exist-DCL

'(i) There is nothing here.'

(ii) There is something missing here.'

b. CWI

여기엔   뭔가가   없다.

yeki-ey-n   **mwe-nka**-*ka*   *eps-ta*.

here-LOC-TOP   **what**-IND-NOM   not.exist-DCL

'There is something missing here.'

(54)   Short-form negation

a.   BWI

나 뭐   안   가져왔어.

*na **mwe**   an   kacyewa-ss-e*.

I   what   NEG   bring-PST-DCL

'(i) I didn't bring anything.'

(ii) There is something I didn't bring.'

b. CWI

나 뭔가   안   가져왔어.

*na **mwe-nka** an   kacyewa-ss-e*.

I   what-IND NEG   bring-PST-DCL

'There is something I didn't bring.'

57

(55) Long-form negation

  a. BWI

    그는 무엇을   먹지 않아서   병에 걸렸다[14].

    ku-nun mwues-ul   mek-ci anh-ase   pyeng-ey kelly-ess-ta.

    he-NOM what-ACC   eat-NEG-because become-ill-PST-DCL

    '(i) He became ill because he didn't eat anything.'

    '(ii) He became ill because he didn't eat something.'

  b. CWI

    그는   무엇인가를   먹지 않아서   병에 걸렸다.

    ku-nun   mwues-inka-lul   mek-ci anh-ase   pyeng-ey kelly-ess-ta.

    he-NOM   what-IND-ACC   eat-NEG-because become-ill-PST-DCL

    'He became ill because he didn't eat something.'

As shown in (56), CWIs sound awkward in a situation where the indefinite is forced to remain in the scope of negation.

(56) a. 뒤에   한   번   보고,

    twi-ey   han   pen   po-ko,

    back-DAT one   time   see-and

    누가   안   오면   출발하세요

    ***nwu**-ka   an   o-myen   chwulpalha-sey-yo.*

    who-NOM   not   come-if   start-HON-DCL

    (the most natural reading: NEG > indefinite)

---

[14] The acceptability of the sentence (55)-a is somewhat degraded because BWIs most naturally occur in colloquial speech, while long-form negation is rather formal.

'Look behind (the car), and if no one is approaching, you may go.'

b. #누군가가　　　안　　오면　　출발하세요.

nwukwu-nka-*ka*　　　*an*　　*o-myen*　　*chwulpalha-sey-yo*.

who-IND-NOM　　　not　　come-if　　start-HON-DCL

(*NEG > indefinite)

The important implication of the above data is twofold. First, CWIs must take scope over negation. This is a property of Kratzer-style choice functions, as we have seen in section 2.3.3. Thus I will adopt the choice function analysis of Kratzer (1998) to explain the semantics of Korean CWIs. A detailed analysis will be presented later in 2.5.

Second, BWIs can always take scope under negation, even in the contexts where other NPs cannot. As we will see in what follows, this property can be explained well by the view that Korean BWIs are ambiguous between referential and quantificational readings since referential expressions always elicit the widest-scope interpretation. The details of this view will be discussed in the next subsection.

2.4.4. Lexical ambiguity of BWIs

The previous two subsections have shown that, in Korean, CWIs are not semantically the same as BWIs. They are subject to the same semantic analysis for CWIs in other languages. Then, what about BWIs in Korean? As illustrated in 2.4.1, Korean BWIs seem to constitute a typological exception in that they can occur in the contexts where BWIs in other languages cannot. This subsection provides a closer examination of the contexts where BWIs can occur and concludes that the seemingly exceptional behaviors of Korean BWIs are due to their ambiguity between referential and quantificational readings.

First of all, note that a BWI can appear in contexts where a typical non-restricted indefinite expression cannot appear. For instance, the BWI *nwukwu* 'who/someone' can occur in an exceptive phrase X-*pakkey eps-* 'nobody but X' (57), as a subject complement of the copular verb (58), or as an answer to the question 'who are you talking about?' (59). When a BWI is used in those contexts, the speaker has a specific person in mind and often presupposes the listener also knows that person, but does not want to mention the person's name explicitly. Note that CWIs or regular non-restricted indefinites cannot be used in this way, as revealed by the unacceptability of the corresponding sentences with CWIs or their English translation with a regular indefinite *someone*.

(57) a. 이런 짓을   할 사람은   누구밖에   없다.

        Ilen cis-ul   *hal salam-un*   ***nwukwu**-pakkey*   *epsta*.

        such thing-ACC   do person-TOP   who-FOC   not.exist

        'No one but a certain someone would do such a thing.'

    b. #이런 짓을   할 사람은   누군가밖에   없다.

        #Ilen cis-ul   *hal salam-un*   ***nwukwu-nka**-pakkey* *epsta*.

        such thing-ACC   do person-TOP   who-IND-FOC   not.exist

        '# No one but someone would do such a thing.'

(58) a. 범인은   누구라고   소문이   났다.

        Pemin-un   ***nwukwu**-lako* *somwun-i*   *na-ss-ta*.

        criminal-TOP who-be.that   rumor-NOM   spread-PST-DCL

        'The rumor spread that the criminal is a certain someone.'

b. #범인은　　　누군가라고　　　소문이　　　났다.

　　#*Pemin-un*　　***nwukwu-nka***-*lako*　　*somwun-i*　　*na-ss-ta*.

　　criminal-TOP　who-IND-be.that　　　rumor-NOM　spread-PST-DCL

　　'#The rumor spread that the criminal is someone.'

(59)　A: 지금　누구　　애기하는 거야?

　　　Cikum　*nwukwu*　*yaykiha-nun ke-ya*?

　　　now　　who　　talk-PROG-Q

　　　'Who are you talking about?'

　　B: a. 누구　　말이야,　누구.

　　　　Nwukwu　*maliya,*　*nwukwu.*

　　　　who　　you.know　who

　　　　'A certain someone, you know.'

　　B: b. #누군가　　　말이야,　누군가.

　　　　#***Nwukwu-nka***　*maliya,*　*nwukwu-nka*.

　　　　who-IND　　you.know　who-IND

　　　　'#Someone, you know.'

Based on these observations, I argue that there exist referential expressions that have the same form as *wh*-interrogatives in Korean, and that the seemingly exceptional scope reading of Korean BWIs is in fact due to their referential homonyms. This approach is in the same vein as the view that attributes the exceptional wide-scope reading of certain genuine indefinites to their lexical ambiguity (cf. Fodor & Sag 1982, Kratzer 1998).

The lexical ambiguity analysis of BWIs is further supported by the observation that the distribution of BWIs is in fact not entirely free in Korean. Note that although referential expressions do not take scope, their interpretation is truth-conditionally compatible with the widest-scope reading of indefinites. Thus, our analysis predicts that the non-canonical occurrence of BWIs can only have the widest-scope reading when they co-occur with other scope-taking elements. The following examples show that this prediction is borne out.

First, BWIs cannot be interpreted in the scope of other quantifiers when they escape syntactic islands. In the sentence (60)-a, which has three scope-bearing elements, the BWI can take either narrowest scope [many > if > **some**] or widest scope [**some** > many > if] but not an intermediate scope [*many > **some** > if]. On the other hand, the sentence in (60)-b allows all three scope configurations for the CWI *mwe-nka* 'something'.

(60) a. 많은 사람들이 뭘 먹으면 알레르기를 일으킨다.

*Manhun   salamtul-i   **mwe**-l   mek-umyen*

many   people-NOM   what-ACC   eat-if

alleyluki-lul   ilukhinta.

allergy-ACC   occur

'Many people show allergic reaction if they eat something.'

b. 많은 사람들이 뭔가를 먹으면 알레르기를 일으킨다.

*Manhun   salamtul-i   **mwe-nka**-lul   mek-umyen*

many   people-NOM   what-IND-ACC   eat-if

alleyluki-lul   ilukhinta.

allergy-ACC   occur

'Many people show allergic reaction if they eat something.'

Second, BWIs necessarily have a wide-scope reading when they are scrambled. In the previous scrambled examples, repeated below, the sentence with the BWI in (61) only has the wide-scope reading that Yuna wants to see a specific person, while the one with the CWI in (62) allows a narrow-scope reading.

(61) 누구를   윤아가   꼭   만나고 싶어한다.
     Nwukwu-lul Yuna-ka   *kkok*   *manna-ko sipheha-n-ta*.
     who-ACC   Yuna-NOM   really   meet-want-PRS-DCL
     'Yuna really wants to see someone.'

(62) 누군가를   윤아가   꼭   만나고 싶어한다.
     Nwukwu-nka-lul Yuna-ka   *kkok*   *manna-ko sipheha-n-ta*.
     who-IND-ACC   Yuna-NOM   really   meet-want-PRS-DCL
     'Yuna really wants to see someone.'

This observation might be hard to disentangle from the general preference for a wide-scope reading in the scrambled position, as a wide-scope reading is strongly preferred even in the sentence with a CWI in (62). However, it becomes clearer when we consider a context that forces a narrow-scope reading. Suppose that there is a dispute in some area and every country dispatched someone to mediate. The most natural reading is that each country dispatched different people. In such a case, BWIs cannot appear in the scrambled position as in (63), while CWIs can, as in (64).

(63) *누구를   모든 나라가   파견했다.
     **Nwukwu*-lul* *motun nala-ka*   *phakyenhay-ss-ta*.

who-ACC   all   country-NOM   dispatch-PST-DCL

'Every country dispatched someone.'

(64) 누군가를   모든 나라가   파견했다.

Nwukwu-nka-lul   *motun nala-ka*   *phakyenhay-ss-ta*.

who-IND-ACC   all   country-NOM   dispatch-PST-DCL

'Every country dispatched someone.'

2.4.5. Evidence from other languages

To summarize the argument in the previous section, BWIs in Korean are apparently exceptional not because they are completely different from BWIs in other languages but because they have an additional (i.e. referential) reading. A question then arises: is Korean the only language whose BWIs are ambiguous? Are there any other languages in which a non-quantificational usage of BWIs is found? As an answer to this question, this section introduces the so-called placeholder usage of bare *wh*-words.

Ganenkov et al. (2010) report that in certain Northeast Caucasian languages such as Udi and Agul, *wh*-pronouns can be used as placeholders, i.e., "hesitation markers whose use is motivated by production difficulties on the side of the speaker." In such a case, the speaker knows that there exists a specific expression that is appropriate for the utterance but cannot recall it in the moment, so he or she replaces the expression with a *wh*-pronoun. The target expression can appear after the *wh*-placeholder if the speaker successfully recalls it in the end as in (65), but not necessarily, as in (66).

(65)   Agul (Ganenkov et al. 2010: 99)

na-s   *aʁ-a-a*   *zun,*

who-DAT say-IPF-PRS   I

me   we   jazna   q'ulban-a-s=na ...

DEM   your:SG   brother_in_law   Qurban-O-DAT=ADD[15]

'Then I tell [WHOM], your brother-in-law Qurban and ...'

(66)   Udi (Ganenkov et al. 2010: 99)

*bur=e=q-sa   lül-in-aχun   tːe   **he**   cːoroj-e-s-a.*

begin=3SG=ST-PRS   pipe-O-ABL   DEM   what   flow-LV-INF-DAT[16]

'This [WHAT] begins to flow from the pipe.'

Cheung (2011) also discusses a placeholder usage of *wh*-expressions in Chinese, in which the exact reference is not uttered due to momentary retrieval problem (67) or to avoid direct mentioning of the reference for some pragmatic reasons (68). Especially, he notices that the placeholder *wh*-words do not require a licensor, contrary to the well-established restrictions on non-interrogative *wh*-words in Chinese.

(67)   Cantonese (Cheung 2011)

*Hoizoek   **me**   la*!

switch.on   what   SP

'Switch on [WHAT]!' (what = router)

(68)   Mandarin (Cheung 2011)

*Na   ge **shei**   yijing   you   nanyou   le.*

---

[15] IPF: imperfective stem
ADD: additive particle
[16] ST: detached part of verbal stem
O: oblique
ABL: ablative
LV: light verb
INF: infinitive

DEM   CL who   already have boyfriend SP

'That [WHO] has already got a boyfriend.'

The 'placeholder usage' of *wh*-words provides evidence that the non-interrogative bare *wh*-words are not limited to the homogeneous function (i.e. existential quantification) in many languages. Note that a referential reading is naturally derived when such a *wh*-word replaces a proper noun. Finding more instances of non-canonical usage of bare *wh*-words in other languages is a worthy case for future research.

2.5. Semantics of *wh*-indefinites

Based on the observations so far, this section provides semantic representations of *wh*-indefinites. As a starting point, I adopt the Alternative Semantics approach (Hamblin 1973, Rooth 1985) for the semantic representation of bare *wh*-words, since it provides a neat account of how different readings (i.e. indefinite and interrogative) are derived from the same root.

Let us first consider the original analysis of Hamblin (1973) on English questions. Seeking a way to incorporate questions in Montague's grammar, Hamblin suggests that interrogative words of English denote sets of individuals. For instance, *who* and *what* denote the set of humans and the set of non-humans, respectively. For a unified account of interrogatives and indicatives, he further suggests that non-interrogative expressions denote a unit set, e.g. *Mary* denotes the set whose only member is Mary. Some examples of denotations in Hamblin semantics are presented below.

(69)   Denotations in Hamblin semantics

   a. *wh*-words

$[\![\textit{who}]\!]^g = \{x \in D_e: \text{person}(x)\}$ [17]

$[\![\textit{what}]\!]^g = \{x \in D_e: \text{thing}(x)\}$

b. others

$[\![\textit{Mary}]\!]^g = \{m\}$

$[\![\textit{person}]\!]^g = \{\lambda x{:}x \in D_e. \text{person}(x)\}$

$[\![\textit{dances}]\!]^g = \{\lambda x{:}x \in D_e. \text{dance}(x)\}$

In this semantics, Functional Application is defined as in (70) so that each member of the set denoted by one node applies to each member of the set denoted by the other node. Consequently, a question denotes a set of propositions, while an assertion denotes a singleton set that contains only one proposition. For instance, if Mary, John, and Kenneth are all the people in the context, the interrogative sentence "*Who dances?*" denotes the set of propositions {dance(m), dance(j), dance(k)}, while the indicative sentence "*Mary dances.*" denotes the singleton set {dance(m)}, as illustrated in (71).

(70)   Functional Application (cf. Hamblin 1973:49)

If α is a branching node and $\{\beta, \gamma\}$ is the set of α's daughters

and $[\![\beta]\!]^g \subseteq D_{\langle \sigma,\tau \rangle}$ and $[\![\gamma]\!]^g \subseteq D_\sigma$,

$[\![\alpha]\!]^g = \{y(z) \in D_\tau: y \in [\![\beta]\!]^g \ \& \ z \in [\![\gamma]\!]^g\}$

(71)   Derivations

a. $[\![\textit{who dances?}]\!]^g$

$= \{f(x): f \in [\![\textit{dances}]\!]^g \ \& \ x \in [\![\textit{who}]\!]^g\}$ (FA)

$= \{f(x): \text{dance}(x) \ \& \ x \in \{y: \text{person}(y)\}\}$

---

[17] All Logical Forms in this section are presented in the notation of Heim & Kratzer (1998).

b. ⟦ *Mary dances.* ⟧^{g}

     = {f(x): f ∈ ⟦ *dances* ⟧^{g} & x ∈ ⟦ *Mary* ⟧^{g}}   (FA)

     = {dance(m)}

2.5.1. Bare wh-words

The view that *wh*-words denote sets of alternatives has been adopted by a number of researchers to account for indeterminate *wh*-words that are ambiguous between interrogative and indefinite readings (Ramchand 1997 for Bengali; Hagstrom 1998, Shimoyama 2006, Yatsushiro 2009 for Japanese; Lin 1996, Dong 2009 for Chinese, among others). I will also adopt the basic idea that a *wh*-word denotes a set of alternatives but deviate a little from the framework in Hamblin (1973) as follows, mainly for expository purposes.

First, I will keep the ordinary semantic representations for non-*wh* words, instead of singleton set representations, in order to maintain systematic distinctions between questions and assertions[18]. In the 'unified' approach in Hamblin (1973), all types of sentences denote sets, and assertions are distinguished from questions in that they denote sets that contain only one element. However, the cardinality of the set does not seem strong enough to establish a definite distinction, as a question that has only one possible answer is not distinguished from a statement in the semantic representation.

Second, I will assign a new semantic type for *wh*-words following Yatsushiro (2009)[19], to avoid conceptual confusion due to the common practice of regarding one-place predicates as sets of individuals (Heim & Kratzer 1998: 24). In this practice, an

---

[18] Note that Hamblin himself has also suggested the possibility of establishing separate semantic rules for questions and assertions (Hamblin 1973:48). I agree with him that either account is tenable.

[19] Yatsushiro proposes the new semantic type for the analysis of *wh*-indefinites in Japanese. Though she does not explicitly state the motivation for introducing a new type for *wh*-words, she suggests that with this new type, structural restrictions on the indefinite marker *mo* can be explained in terms of type mismatch.

intransitive verb denotes the set of individuals that it is true of. For instance, ⟦ *dances* ⟧ can be defined as the set of people who dance. In this sense, ⟦ *person* ⟧ is the set {x: x is person} and cannot be distinguished from ⟦ *who* ⟧. Of course we could stick to the denotations of one-place predicates as functions from individuals to truth-values, but it would be more desirable to avoid any potential confusion by establishing a concrete distinction between alternative sets and ordinary sets. One way to achieve this goal is to establish a different semantic type for alternative sets as follows:

(72)   Semantic type for alternative sets (Yatsushiro 2009: 152)

For any type σ, σ/t is the type of sets of entities of type σ.

Based on the above two assumptions, denotations of some exemplary words are given below:

(73)   Denotations

a. *wh*-words

⟦ *nwukwu* ⟧^{g} = {x ∈ D$_e$: person(x)}   type: e/t

⟦ *mwe* ⟧^{g} = {x ∈ D$_e$: thing(x)}   type: e/t

b. others

⟦ *Minji* ⟧^{g} = m   type: e

⟦ *Junho* ⟧^{g} = j   type: e

⟦ *wasse* ⟧^{g} = λx.came(x)   type: <e,t>

⟦ *cohahay* ⟧^{g} = λy.λx.like(x)(y)   type: <e,<e,t>>

The rule of functional application should be modified to accommodate the new semantic type as follows:

(74)   Functional Application (based on Yatsuhiro 2009:153)

If α is a branching node and {β, γ} is the set of α's daughters,

$\llbracket α \rrbracket$ is defined as follows:

a. If $\llbracket β \rrbracket^g$ is of type $<σ,τ>$ and $\llbracket γ \rrbracket^g$ is of type σ, $\llbracket α \rrbracket^g$ is of type τ.

$\llbracket α \rrbracket^g = \llbracket β \rrbracket^g (\llbracket γ \rrbracket^g)$

b. If $\llbracket β \rrbracket^g$ is of type $<σ,τ>$ and $\llbracket γ \rrbracket^g$ is of type σ/t, $\llbracket α \rrbracket^g$ is of type τ/t.

$\llbracket α \rrbracket^g = \{\llbracket β \rrbracket^g (z): z \in \llbracket γ \rrbracket^g\}$

c. If $\llbracket β \rrbracket^g$ is of type $<σ,τ>$/t and $\llbracket γ \rrbracket^g$ is of type σ, $\llbracket α \rrbracket^g$ is of type τ/t.

$\llbracket α \rrbracket^g = \{y(\llbracket γ \rrbracket^g): y \in \llbracket β \rrbracket^g\}$

d. If $\llbracket β \rrbracket^g$ is of type $<σ,τ>$/t and $\llbracket γ \rrbracket^g$ is of type σ/t, $\llbracket α \rrbracket^g$ is of type τ/t.

$\llbracket α \rrbracket^g = \{y(z): y \in \llbracket β \rrbracket^g \text{ and } z \in \llbracket γ \rrbracket^g\}$

Now we can derive the denotation of a *wh*-question such as (75), as illustrated in (76). The thick lines in the derivational tree (77) indicate how the alternative set introduced by the *wh*-word expands to bigger constituents. It keeps expanding until the topmost level of the sentence, and consequently, questions end up having the type t/t.

(75)   *Wh*-question

민지가   누구를   좋아해?

Minji-ka   nwukwu-lul   cohahay

Minji-NOM   who-ACC   like

'Who does Minji like?'

(76)   Semantic derivation of *wh*-question[20]

    a. ⟦ *nwukwu-lul cohahay* ⟧^{g}

        = {⟦ *cohahay* ⟧^{g}(z): z ∈ ⟦ *nwukwu* ⟧^{g}}   (FA-b)

        = { λx.like(z)(x): z ∈ {x ∈ D$_e$: person(x)} }

    b. ⟦ *Minji-ka nwukwu-lul cohahay* ⟧^{g}

        = {y(⟦ *Minji* ⟧^{g}): y ∈ ⟦ *nwukwu-lul cohahay?* ⟧^{g}}   (FA-c)

        = { like(z)(m): z ∈ {x ∈ D$_e$: person(x)} }

(77)   Derivational tree for *wh*-question[21]
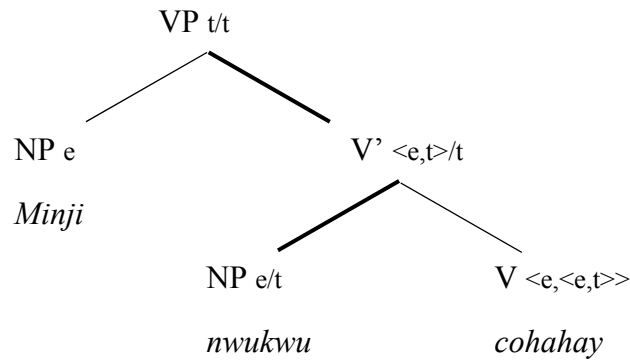
On the other hand, the denotation of assertions without *wh*-words such as (78) is derived in the conventional way, as shown in (79). As illustrated in the derivational tree in (80), assertions end up having the type t. Thus, the semantics proposed in this section clearly distinguishes questions and assertions by their types.

(78)   Assertion

    민지가   준호를   좋아해.

---

[20] For simplicity, case markers are ignored in the semantic component.
[21] I assume that the subject remains within VP in Korean.

Minji-ka   Junho-lul   cohahay

Minji-NOM   who-ACC   like

'Minji likes Junho.'

(79)   Semantic derivation of assertion

    a. ⟦ *Junho-lul cohahay* ⟧ᵍ

        = ⟦ *cohahay* ⟧ᵍ(⟦ *Junho* ⟧ᵍ)   (FA-a)

        = λx.like(j)(x)

    b. ⟦ *Minji-ka Junho-lul cohahay* ⟧ᵍ

        = ⟦ *Junho-lul cohahay* ⟧ᵍ (⟦ *Minji* ⟧ᵍ)   (FA-a)

        = like(j)(m)

(80)   Derivational tree for assertion
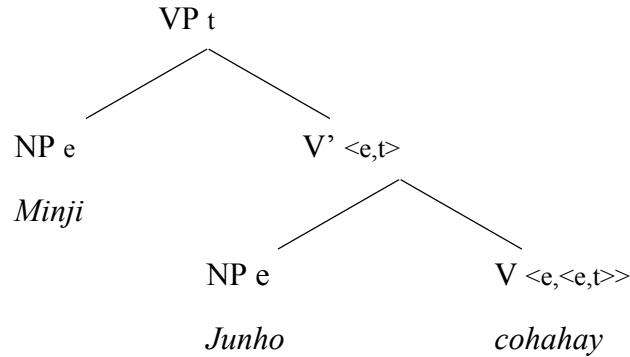
2.5.2. BWIs

Now let us turn to the major concern of this chapter, i.e. how indefinite readings of *wh-*words are derived. As suggested in previous sections, I assume that the languages that allow indefinite readings of *wh*-words introduce a certain operator that determines the

quantificational force of the *wh*-word. If the *wh*-word is not bound by an appropriate operator, it receives an interrogative reading by default.

In the case of BWIs in Korean, I assume that the relevant operator is an existential propositional quantifier (cf. Kratzer and Shimoyama 2002):

(81)   Existential propositional quantifier for alternative sets

$[\![\exists_p \alpha]\!]^g = \exists_p [p \in [\![\alpha]\!]^g]$ & p=1 if α is of type σ/t, otherwise $[\![\alpha]\!]^g$.

This existential operator is located at the VP-level and applies to an alternative set of propositions. The following illustrates how the denotation of an indicative sentence with a BWI such as (82) is derived. The dotted line in the derivational tree in (84) indicates that the existential operator blocks the alternative set from expanding further than the VP-level. Note that the *wh*-question (75) and the assertion with the BWI (82) have exactly the same form, which suggests that the application of this existential operator should be optional.

(82)   BWI

민지가   누구를   좋아해.

Minji-ka   nwukwu-lul   cohahay

Minji-NOM   who-ACC   like

'Minji likes someone.'

(83)   Semantic derivation with a BWI

$[\![\exists_p [_{VP} \textit{Minji-ka nwukwu-lul cohahay.}]]\!]^g$

   $= \exists_p [p \in \{like(z)(m): z \in \{x \in D_e: person(x)\}\}$ & p=1]

(84)   Derivational tree for BWI

```
              VP t
             /  ┄
           /       ┄
        ∃p          VP t/t
                   /      ╲
                 /          ╲
             NP e            V' <e,t>/t
                           /       ╲
            Minji        /           ╲
                     NP e/t           V <e,<e,t>>

                     nwukwu          cohahay
```
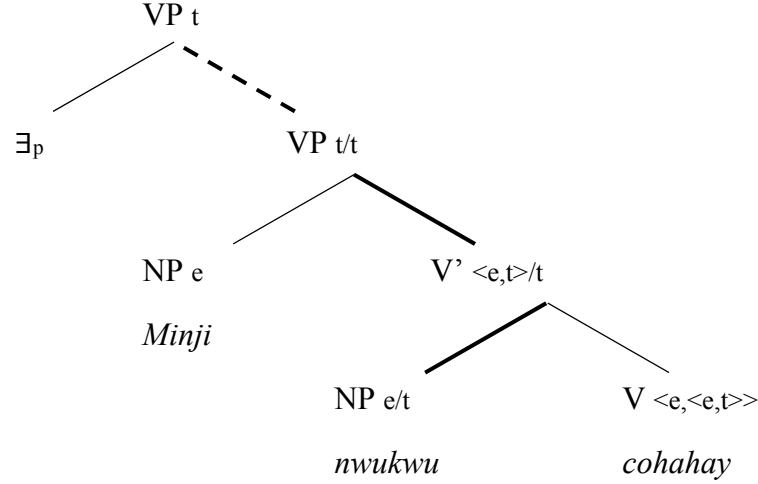
2.5.3. CWIs

In the case of CWIs in Korean, on the other hand, I assume that the additional morpheme

attached to the *wh*-word marks a choice function over the set of alternatives.   The

semantics of such a choice function is specified below:

(85)   Choice function for alternative sets

   f_{ACF} is an Alternative Choice Function if $f_{ACF}([[\alpha]]^g) \in [[\alpha]]^g$,

   for all α such that $[[\alpha]]^g \in D_{\sigma/t}$.

(86)   Indefinite marker as ACF

   $[[-(i)nka]]^g = \lambda\alpha.f_{ACF}(\alpha)$

As we have seen in Section 2.3.2, there are variations on the choice function approach

to indefinites in the literature, especially regarding how choice function variables are

bound. I basically adopt a Kratzer-style analysis that restricts the scope configuration of choice function indefinites because Korean CWIs take obligatory wide scope over negation, as already mentioned in Section 2.4.3. However, one specific assumption needs to be revised to accommodate the Korean CWIs. Kratzer argues that choice function variables remain open in the formula and their value is determined by context so that they pick an individual known to the speaker. This seems to hold for choice function indefinites in English, as illustrated in the dialogue in (87). In this dialogue, A left an anonymous comment on B's homepage. It is obvious that B certainly has a specific person in her mind such that if A is that person, she is willing to marry him.

(87)   *a certain* indefinite in English

    A: Will you marry me?

    B: Depends on who this is... if it is *a certain someone*, then yes.

On the other hand, the corresponding Korean sentence in (88) sounds strange because the CWI *nwukwunka* 'someone' involves an implication that the speaker does not know who the person is, as discussed in Section 2.4.2. The same sentence with a BWI is fine as shown in (89), since it can be rescued by a referential reading of the BWI.

(88)   CWI in Korean

#만약	이게	누군가라면	결혼하겠다.
manyak	*ikey*	***nwukwu-nka**-la-myen*	*kyelhonha-keyss-ta*
by.any.possibility	this.NOM	who-IND-DCL-if	marry-will-DCL

'#If this is someone (that I don't know), I will marry him.'

(89)   Referential BWI in Korean

만약   이게   누구라면   결혼하겠다.

manyak   *ikey*   **nwukwu**-*la-myen*   *kyelhonha-keyss-ta*

by.any.possibility   this.NOM   who-DCL-if   marry-will-DCL

'If this is the person (that I have in my mind), I will marry him.'

Therefore, I posit explicit existential closure at the highest level for the choice function variables for Korean CWIs, instead of leaving them free and counting on the speaker to provide a value for them[22]. The meaning of the sentence with a CWI in (90) can be derived as in (91). Note that the alternative set stops expanding at a very early point due to the choice function marker, as depicted in the derivational tree in (92). Since the local choice function operator blocks expansion, CWIs can never receive an interrogative reading.

(90)   CWI

민지가   누군가를   좋아해.

Minji-ka   *nwukwu-nka-lul*   *cohahay*

Minji-NOM   who-IND-ACC   like

'Minji likes someone.'

(91)   Semantic derivation with a CWI

    a. $⟦$ *nwukwu-nka-lul* $⟧^g$ = $f_{ACF}(⟦$ *nwukwu* $⟧^g)$ = $f_{ACF}(\{x \in D_e: person(x)\})$

<hr>

[22] In this sense, CWIs in Korean are similar to the indefinites in St'át'imcets discussed in Matthewson (1999). Matthewson argues that non-polarity indefinites in St'át'imcets obligatorily take wide scope and adopts a Kratzer-style analysis of indefinites such that the semantic representation of indefinites involves choice functions. Unlike Kratzer, however, she posits existential closure at topmost level because the wide-scope indefinites in St'át'imcets are not specific.

b. ⟦ *nwukwu-nka-lul cohahay* ⟧^g

   = ⟦ *cohahay* ⟧^g(⟦ *nwukwu-nka-lul* ⟧^g) (FA-a)

   = λy.like(f$_{ACF}$({x ∈ D$_e$: person(x)}))(y)

c. ⟦ *Minji-ka nwukwu-nka-lul cohahay* ⟧^g

   = ⟦ *nwukwu-nka-lul cohahay* ⟧^g (⟦ *Minji* ⟧^g) (FA-a)

   = like(f$_{ACF}$({x ∈ D$_e$: person(x)}))(m)

d. ∃$_{ACF}$ ⟦ *Minji-ka nwukwu-nka-lul cohahay* ⟧^g

   = ∃$_{ACF}$ [like(f$_{ACF}$({x ∈ D$_e$: person(x)}))(m)]

(92)   Derivational tree for CWI
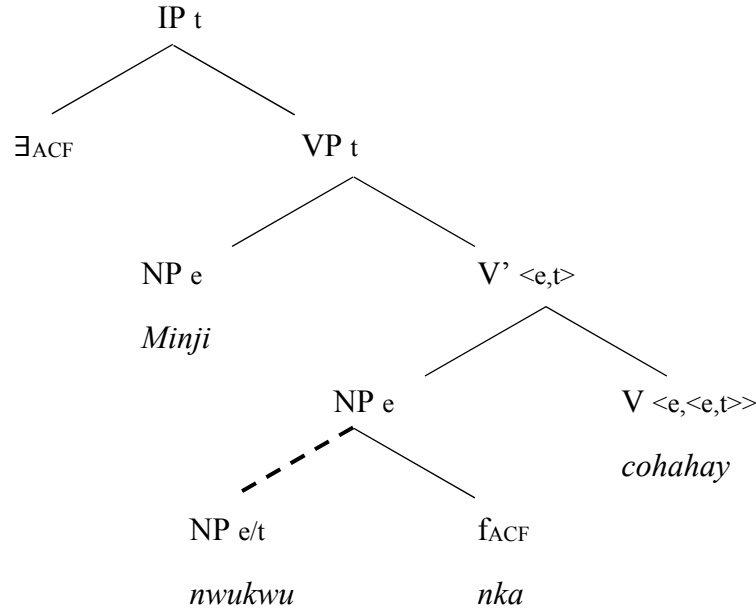
So far, we have seen the different mechanisms to derive the semantics of each type of *wh*-indefinite. This analysis can also provide an account for why in certain contexts BWIs and CWIs are not equally acceptable. For instance, let us consider the scrambled sentences in (63) and (64), repeated below:

(93)   누군가를 모든 나라가 파견했다.

       ***Nwukwu-nka**-lul*   *motun nala-ka*   *phakyenhay-ss-ta.*

       who-IND-ACC   all   country-NOM   dispatch-PST-DCL

       'Every country dispatched someone.'

(94)   *누구를 모든 나라가 파견했다.

       ****Nwukwu**-lul motun nala-ka*   *phakyenhay-ss-ta.*

       who-ACC   all   country-NOM   dispatch-PST-DCL

       'Every country dispatched someone.'

The indefinite reading of the CWI in (93) is guaranteed even in the dislocated position due to the local application of the choice function variable, which is bound by the existential closure at the topmost level as shown in (95). On the other hand, an indefinite reading is not available for (94) because the BWI outside of VP cannot be bound by the existential operator at VP, as illustrated in (96). In fact, the sentence in (94) is unacceptable because the *wh*-word fails to receive any interpretation; a *wh*-interrogative reading is excluded by the declarative sentence ending *-ta*, and a referential reading is odd in the given context.

(95)   CWI

    $[\![\exists_{ACF}$ [$_{CP}$ ***Nwukwu-nka**-lul* $\exists_{p}$ [$_{VP}$ *motun nala-ka phakyenhay-ss-ta*]] $]\!]^{g}$

(96)   BWI

    $[\![\exists_{ACF}$ [$_{CP}$ ***Nwukwu-lul*** $\exists_{p}$ [$_{VP}$ *motun nala-ka phakyenhay-ss-ta*]] $]\!]^{g}$

2.5.4. Wh-indefinite typology

Table 5 summarizes the different mechanisms for deriving the existential force of BWIs and CWIs in Korean. While both types of *wh*-indefinites involve a certain form of existential quantification over the alternative set introduced by the bare *wh*-word, BWIs receive the indefinite reading as a result of direct existential quantification over the alternative set, while CWIs do so as a result of somewhat indirect existential quantification via a choice function.

	1. Source of existential force	2. Position of existential closure	3. Obligatoriness of existental closure application
BWIs	Existential quantification for the alternative set	VP-level	optional
CWIs	Choice Function for the alternative set	topmost level	obligatory

Table 5. Semantics of *wh*-indefinites in Korean

This analysis of *wh*-indefinites in Korean can be extended to other languages. Based on the typological observations and data from previous work on individual languages presented thus far in this chapter, I propose that the sources of existential force for each type of *wh*-indefinites are universal, and that languages differ with respect to the parameters that determine the position and application of the relevant type of existential closure.

The diversity of such parameters is remarkable in the case of BWIs, as we have seen. For instance, in some languages including German and Dutch, the existential operator

for BWIs is active at the VP level. In other languages including Chinese and Russian, a similar existential operator is active at the level of certain lexical items.

It also differs from language to language whether the application of the existential operator is optional or obligatory. For example, the application of the Alternative existential quantifier seems optional in Chinese. A *wh*-interrogative reading is still available in the BWI-licensing contexts discussed in Section 2.2.2, as exemplified in (98). On the other hand, it seems obligatory in German; the sentence in (97) cannot be a *wh*-question (unless it is an echo question).

(97)   German

    *Da   kommt   **wer***

    here   come   who

    'Someone is coming.'   : possible

    'Who is coming?'   : impossible

(98)   Chinese

    *Ta <u>bu</u>   xihuan   **shenme.***

    he   not   like   what

    'He doesn't like anything.'   : possible

    'What does he not like?'   : possible

The following summarizes what we have discussed in this section.

(99)   Semantic typology of *wh*-indefinites

   a. Bare *wh*-words denote sets of alternative individuals.

b. BWIs involve existential quantification over the alternative set (cf. Kratzer &
    Shimoyama 2002, Yanovich 2005, Dong 2009).

c. CWIs involve a choice function that applies to the alternative set (cf. Ha 2004,
    Yanovich 2005, Yatsushiro 2009). The explicit indefinite marker introduces the
    choice function variable.

d. The above conditions are universal. Languages may differ on the parameters that
    determine the position and application of the relevant type of existential closure
    for BWIs and CWIs.

2.6. Conclusion

In this chapter, we have seen that *wh*-indefinites in the world's languages can be classified into two groups according to their forms, namely BWIs and CWIs, and that these two groups exhibit different syntactic/semantic properties. The morphological difference between the two groups gives rise to their different compositional semantics.

A remaining question is why BWIs are subject to more restrictions compared to CWIs cross-linguistically. Notice that BWIs are restricted not only in terms of the contexts where they can occur, but also in terms of the number of languages that allow them. Haspelmath (1997) points out that while both types of *wh*-indefinites are observed in a wide variety of languages, CWIs are more common than BWIs in the sense that the former appear in more languages. A possible explanation for the restricted use of BWIs is that BWIs are harder to process than CWIs because they are potentially ambiguous due to a possible interrogative interpretation.

Interestingly, such ambiguity in the case of bare *wh*-words can often be resolved by prosody. In many languages, *wh*-words exhibit a different prosody pattern depending on whether they are intended to be interpreted as interrogative or indefinite. The

prosodic properties of bare *wh*-words that facilitate this disambiguation in spoken language will be the topic of the next chapter.

CHAPTER 3

PERCEPTION EXPERIMENTS ON *WH*-PROSODY

3.1. Introduction

This chapter investigates the role of prosody in processing the meaning and scope configuration of *wh*-words, focusing on the case of Korean. The sentence with a *wh*-word in Korean in (1) has at least three different interpretations: i) an assertion with an indefinite pronoun, ii) a yes/no-question with an indefinite pronoun, and iii) a *wh*-question with an interrogative pronoun.

(1)   민호가   누구를   만나

         Minho-ka   *nwukwu-lul*   *mann-a*

         Minho-NOM who -ACC   meet-DCL

         i) 'Minho is seeing someone.'

         ii) 'Is Minho seeing someone?'

         iii) 'Who is Minho seeing?'

The sentence (1) is ambiguous partly because the intimate declarative sentence ending *-a* does not specify whether the function of the sentence is assertive or interrogative. The ambiguity regarding the sentence type (i.e. assertion vs. question) does not occur if we use sentence endings that specify the sentence function, such as *-ta* for assertive, and *-ni/kka/nya* for interrogative sentences. However, even if we use an interrogative ending, the sentence still remains ambiguous between a yes/no-question reading and a *wh*-question reading. Moreover, neutral sentence endings such as *-e/a* (intimate) or *-eyo/ayo* (polite) are preferred over explicitly assertive or interrogative sentence endings in

contemporary Korean, especially in colloquial speech. A corpus study (Kwon 2002) reveals that only 20% of questions involve explicit interrogative endings. Thus, resolving the ambiguity of sentences containing *wh*-words is a substantial task in Korean language processing.

Such ambiguity is, of course, resolved in the discourse when the appropriate context is given. However, native Korean speakers can interpret a sentence like (1) to a great extent even when it is uttered in isolation, with the help of prosody. In the perception study of Jun & Oh (1996), the participants were able to perceive 89% of *wh*-questions and 75% of yes/no-questions correctly when they listened to the sentences without context.

In fact, it has long been noted that prosody is an important cue for distinguishing different uses of *wh*-words and different sentence types in Korean[23]. Among the different sentence types, yes/no-questions are known to be clearly distinguished from others by the sharp rising contour at the end of the sentence (Jun & Oh 1996, I.-S. Lee & Ramsey 2000, Kwon 2002, H.-J. Hwang 2007). However, there has not been a clear-cut account of how the prosody of an assertion is different from that of a *wh*-question. While the wide-spread impressionistic observation is that some kind of phonological prominence such as high pitch on the *wh*-word signals an interrogative reading (Choe 1985, Kang 1988, Kim 2000), the production experiment in Jun & Oh (1996) shows that phonological dephrasing after the *wh*-word is the most reliable prosodic cue of *wh*-questions.

In this chapter, I demonstrate two perception experiments that suggest the importance of phonological phrasing in the perception of *wh*-words. The organization

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[23] The prosody patterns for given types of sentences are known to vary from dialect to dialect (e.g. see Jun 1993 for South Chonla Korean, H.-S. Lee (2008) for North Kyeongsang Korean, and H.-K. Hwang (2011) for South Kyeongsang Korean). In this dissertation I will limit our discussion to the Seoul dialect, which is generally regarded as standard Korean.

of this chapter is as follows: Section 3.2 reviews the prosodic factors that have been noted in the literature as relevant to the interpretation of *wh*-words. Section 3.3 introduces the motivation and design of the two perception experiments to compare those factors. Section 3.4 describes the first experiment, in which the effect of phrasing and prominence are compared. Section 3.5 describes the second experiment, in which the effect of sentence-final tone and prominence are compared. Section 3.6 discusses the typological implications of the results. Section 3.7 is the conclusion of the chapter.

3.2. Previous studies on the *wh*-prosody in Korean

Three prosodic factors have been suggested in the literature as relevant to the interpretation of sentences containing *wh*-words: i) sentence ending tone, ii) phonological prominence of the *wh*-words, and iii) phonological phrasing after the *wh*-words.

3.2.1. Sentence-final tone

A number of traditional Korean grammarians have mentioned that declarative sentences and *wh*-questions have falling intonation, while yes/no-questions have rising intonation at the end of the sentence (Martin 1951, K.-M. Lee et al. 1984, C.-S. Suh 1989, Hur 1991, I.-S. Lee & Ramsey 2000, Kwon 2002).

Such a distinction is, however, rather a general tendency than a concrete rule. H.-Y. Lee (1997:109-115) argues that the choice of intonation is influenced by the speaker's emotion or attitude. For example, he shows that yes/no-questions can be spoken with a final falling tone and other types of sentences with a final rising tone as shown in Figure 1 to Figure 3.

(2)   서울에   가네.

/səure   kane/[24]

sewul-ey   ka-ney

Seoul-DAT   go-DCL

'(I am/You are/He is...) going to Seoul.'
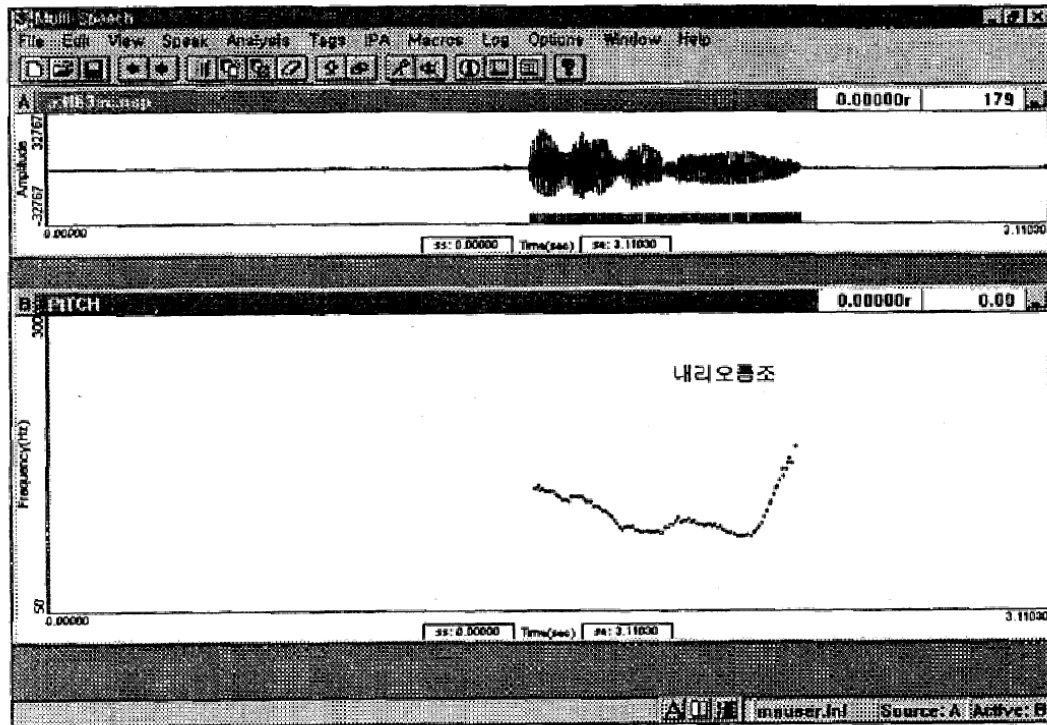
Figure 1. Declarative sentence with final rising intonation in (2) (Lee 1997: 111).

(3)   어디에   가니?

/ədie   kani/

eti-ey   ka-ni

where-DAT   go-Q

---

[24] Besides the romanized transcripts of Korean by the Yale system, the transcriptions with phonetic symbols are provided for the examples in this chapter since the former does not represent the pronunciation well.

'Where are you going?'
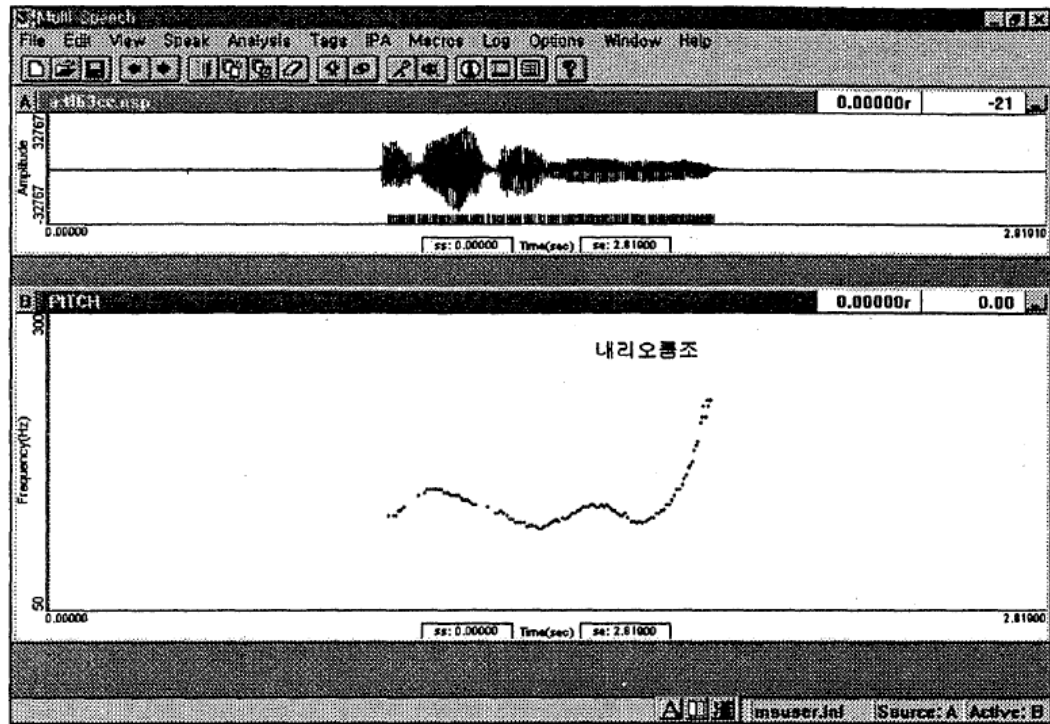
Figure 2. *Wh*-question with final rising intonation in (3) (Lee 1997: 113).

(4)   서울에   가니?

      /səure   kani/

      sewul-ey   *ka-ney*

      Seoul-DAT   go-Q

      'Are you going to Seoul?'
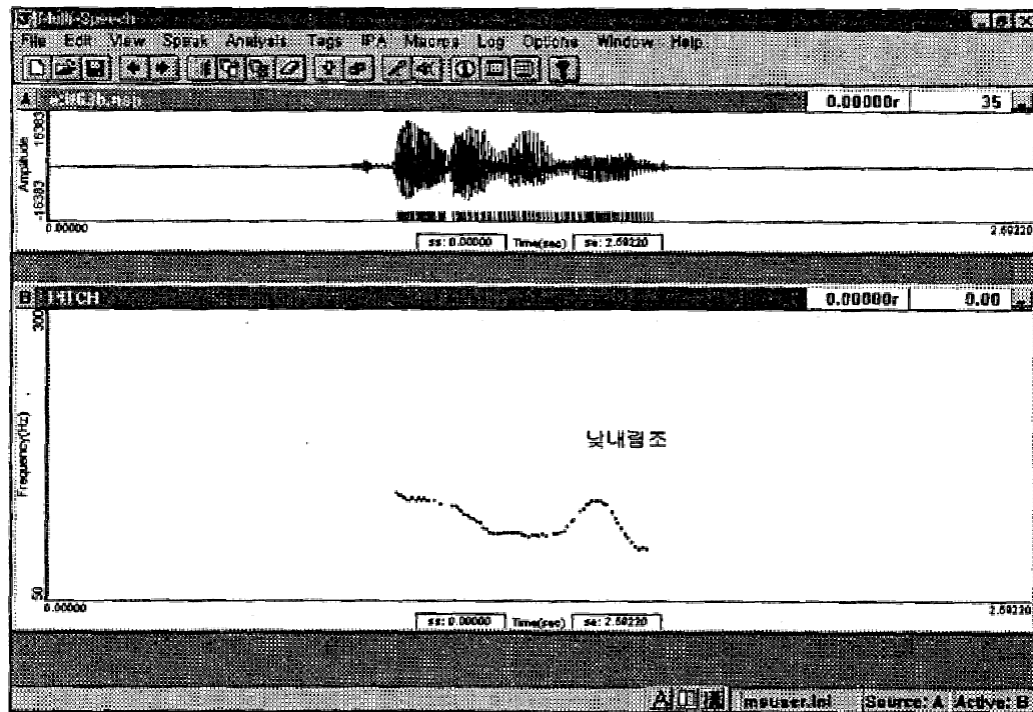
Figure 3. Yes/no-question with final falling intonation in (4) (Lee 1997: 111).

When it comes to sentences containing *wh*-words, the choice of intonation seems to be somewhat more restricted. H.-Y. Lee states that only rising tones are allowed for yes/no-questions with *wh*-indefinites, as illustrated in Figure 4. Since all the sentences of interest in this chapter contain *wh*-words, we can assume that yes/no-questions are distinguished from other types of sentences by final rising tones. However, the sentence-final tone still cannot distinguish *wh*-questions from declarative sentences, thus it cannot be a sufficient cue in deciding the meaning of *wh*-words.

(5)   어디에 가니?

        /ədie   kani/

        eti-ey   ka-ni

        where-DAT   go-Q

        'Are you going to somewhere?'
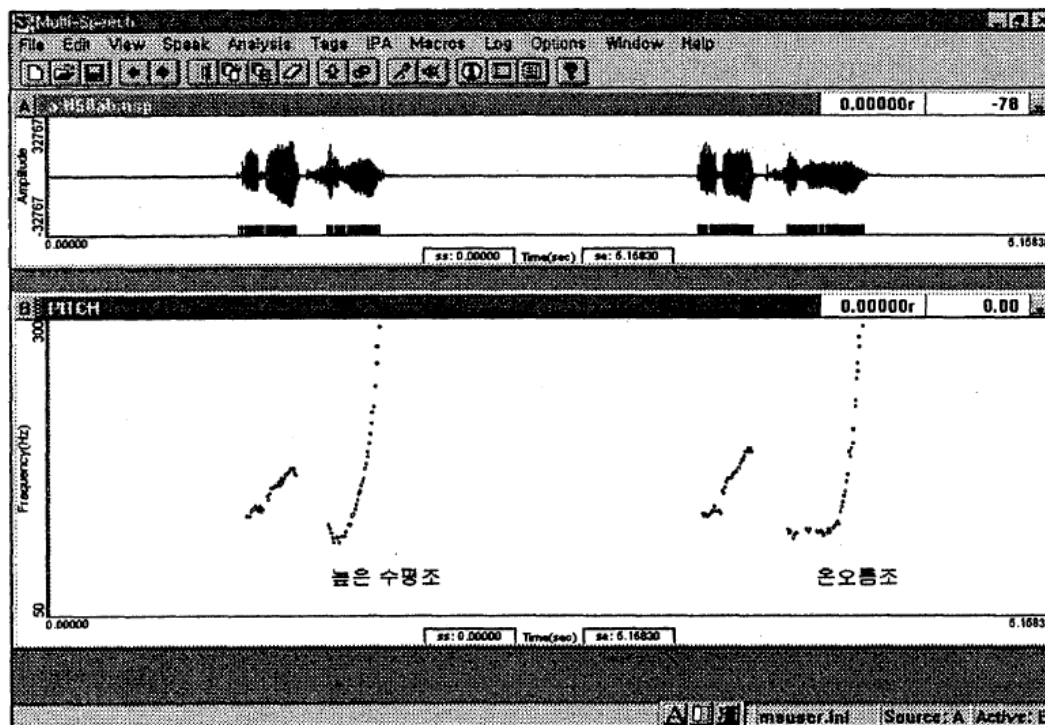
Figure 4. Final rising intonations possible for a yes/no-question with *wh*-indefinites in (5) (Lee 1997: 132).

3.2.2. Phonological prominence on the wh-word

Another prosodic factor that has been frequently mentioned by traditional Korean grammarians is the phonological prominence of *wh*-words. It has been claimed in the literature that *wh*-questions are distinguished from other types of sentences by the fact that the *wh*-word is more prominent than other elements in the sentence (Chang 1973, Choe 1985, Kang 1988, C.-S. Suh 1989, Cho 1990, A.-R. Kim 2002). However, such a claim has been based on impressionistic observations and not supported by quantitative analyses on speech data. The impressionistic nature of the claim is also reflected on the non-unified terminology among researchers to indicate 'prominence', such as "emphatic stress (Chang 1973, C.-S. Suh 1989)", "heavy stress (Kang 1988)", "pitch accent (Choe 1985)", "high pitch (Cho 1990)", "high pitch accent (A.-R. Kim 2002)".

3.2.3. Phonological phrasing after the wh-word

Among phonology/phonetics researchers, it has been noted that *wh*-interrogative words introduce changes of phonological phrasing in the sentence. Cho (1990) claims that a *wh*-interrogative word forms a single phonological phrase with the following (unaccented) word, and Jun & Oh (1996) substantiate this claim with a production study. Jun & Oh (1996) assume that the 'phonological phrase' relevant to the prosody of *wh*-words is the Accentual Phrase, based on the model of the intonation system of Korean proposed in Jun (1993). In this model, the utterances of Korean consist of Intonational Phrases (IP), which roughly correspond to clauses, and they in turn consist of Accentual Phrases (AP), which are usually as small as words.

Utterance

IP   IP

AP AP   AP AP   AP
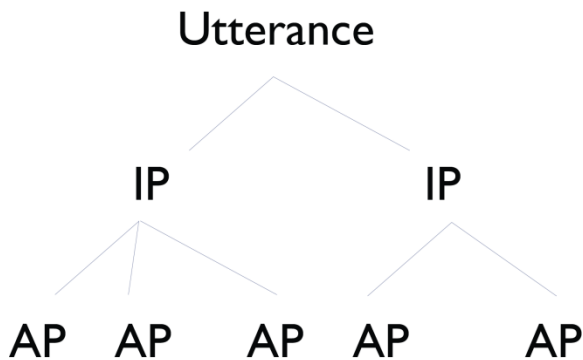
Figure 5. The intonation system of Korean (Jun 1993).

According to Jun (1993), an Accentual Phrase (AP) contains one or more phonological Words and generally consists of fewer than five syllables, and is crucially marked by a phrase-final rising tone (LH) in Seoul Korean. The basic intonational pattern of an AP is characterized as an LHLH sequence or HHLH sequence, depending on the property of the first syllable. If the first syllable in the AP starts with a tense/aspirated obstruent, the first tone is realized as High; otherwise it is Low. Figure 6 illustrates a schematic

representation of the tone patterns of APs. The figure and the examples hereafter focus on the LHLH pattern for simplicity, since it appears more frequently than the HHLH pattern. As seen in (b) and (c) in Figure 6, the tone pattern is fully realized when the AP has four or more syllables: the first two tones (Low-High) are realized on the first two syllables in the AP, and the last two tones (Low-High) on the last two syllables. If the AP consists of fewer than four syllables as in (a) in Figure 6, only the first and last tones are fully realized due to undershoot.
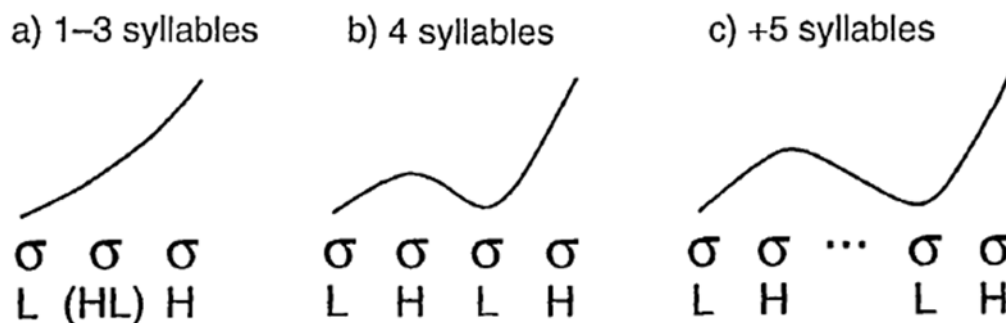
Figure 6. A schematic representation of the basic tone pattern of an Accentual Phrase in Seoul Korean (Jun & Oh 1996:40).

Jun & Oh (1996) argue that declarative sentences and *wh*-questions show different patterns in terms of APs. Figure 7 illustrates a simple declarative sentence consisting of three APs based on Jun (1993)'s model, each of which consists of more than four syllables. At the end of the sentence, the sentence-final tone overrides the Accentual Phrase boundary tone. Regarding the phonological phrasing pattern of *wh*-questions, Jun & Oh (1996) argue that the boundary between the AP containing the *wh*-word and the following AP is deleted. Figure 8 shows the typical prosody pattern of *wh*-questions based on their argument. Note that the pitch contour is smoothed out after the *wh*-phrase in the case of *wh*-questions.

Figure 7. The typical prosody pattern of declarative sentences (Jun&Oh 1996). The vertical dotted lines indicate the boundaries of Accentual Phrases.
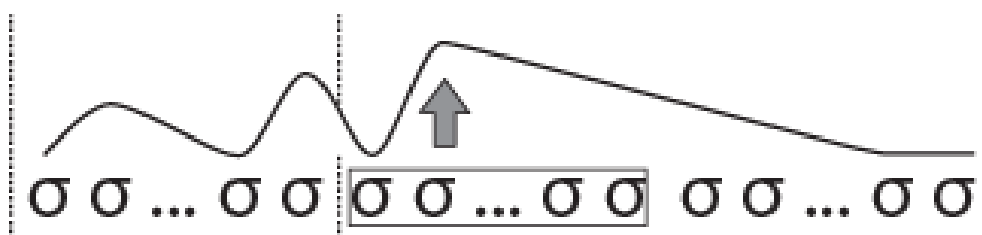
Figure 8. The typical prosody pattern of *wh*-questions (Jun&Oh 1996). The syllables enclosed in the box make up the *wh*-phrase.

Figure 9 provides actual examples of different phonological phrasing patterns depending on the sentence type, observed in the production study by Jun & Oh (1996). Note that the yes/no-question with a *wh*-indefinite (a) has three APs, while the corresponding *wh*-question (b) only has two APs because the boundary between the *wh*-word and the following word has been collapsed. Jun & Oh (1996) argue that the difference between the pitch contours associated with the two readings can be expressed quantitatively by calculating the distance between the F0 peak of the *wh*-phrase (D) and the beginning of the lowest F0 after the peak (E). Point E in a yes/no-question (a) should be on the first syllable of the post-*wh*-word where the initial L tone is assigned, whereas it should be on the penultimate syllable of the same word in a *wh*-question (b). Since point D should be the same in both cases, the distance between D and E should be longer in (b) than in (a).

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(6)   아주머니는 언제 어지러워요?

/azuməni-nɨn   ənze   əzirəwə-jo/

acwumeni-nun   encey   ecilewe-yo

madam-Top   when   dizzy-Hon

a. 'Is there any time that you feel dizzy, madam?'

b. 'When do you feel dizzy, madam?'
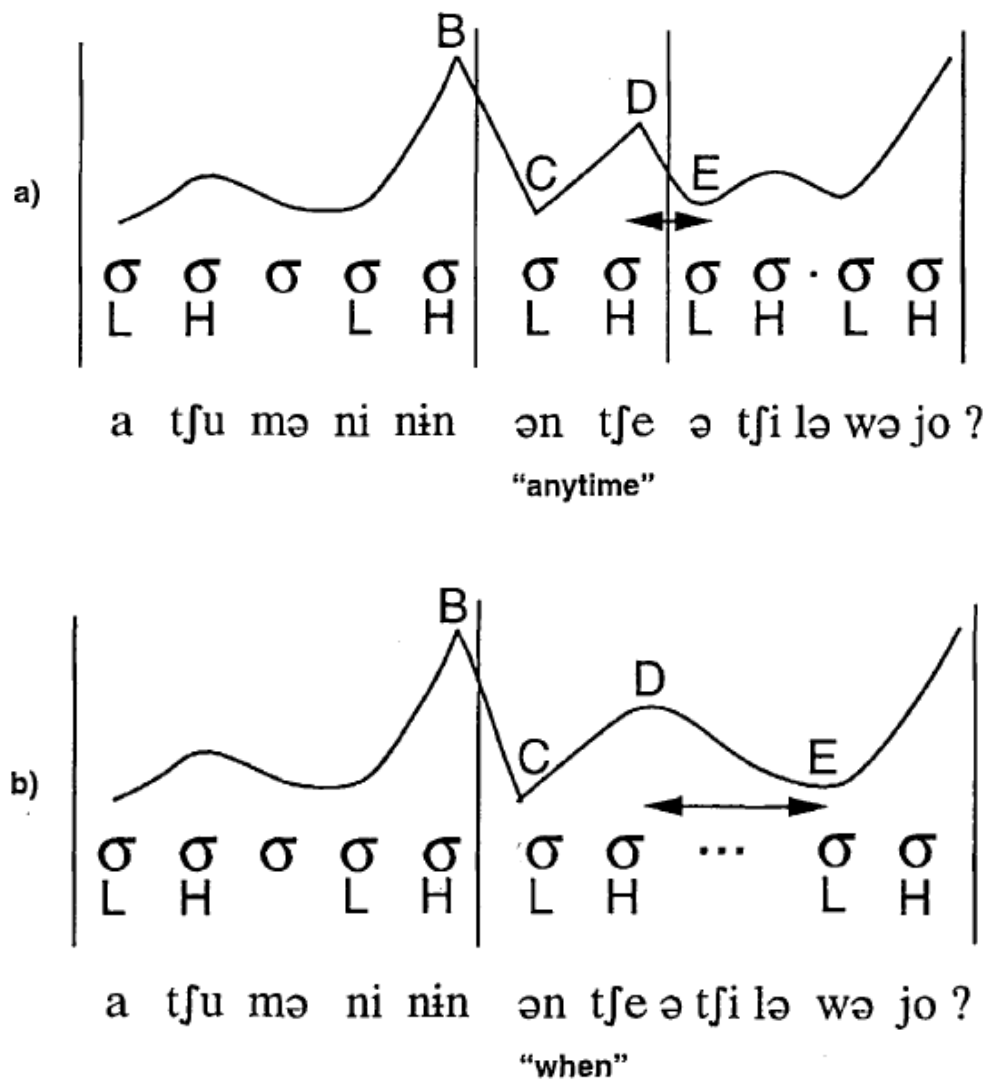
Figure 9. A schematic representation of F0 contours of *wh*-phrases of (a) a yes/no-

93

question versus (b) a *wh*-question. A vertical line marks the boundary of an Accentual Phrase. The measurement points are as follows: B: the highest F0 of the pre-*wh*-phrase, C: the lowest F0 after B, D: the peak F0 of the *wh*-phrase, the lowest F0 after D (E) (from Jun & Oh 1996: 48, Figure 5).

3.3. Overview of experiments

So far, we have seen three prosodic factors that help distinguish different readings of sentences that contain *wh*-words: i) sentence-final intonation, ii) phonological prominence, and iii) phonological phrasing. To compare the effects of those prosodic factors in processing, I conducted two perception experiments. The motivation and design of each experiment is as follows.

The correlation between the three prosodic factors and the three different readings of sentences that contain *wh*-words discussed in the previous section can be summarized in Table 6.

	DCL	YN-Q	*WH*-Q
sentence-final tone	falling	rising	falling
phonological prominence on the *wh*-word	X	X	O
phonological dephrasing after the *wh*-word	X	X	O

Table 6. Prosodic factors affecting the interpretation of sentences containing *wh*-words.

As seen in the summary in Table 6, both phonological prominence on the *wh*-word and phonological dephrasing after the *wh*-word are the factors that have been argued to distinguish *wh*-questions from other types of sentences in Korean. The first question I would like ask is which of them is a more crucial and fundamental factor in processing

wh-questions. To answer this question, the first experiment investigated the influence of phonological prominence and phrasing in the perception of *wh*-words. The design of the experiment was motivated by two hypotheses. First, it is phonological phrasing that plays a crucial role in determining the meanings of *wh*-words. Second, phonological prominence is actually related to the scope configuration of *wh*-words: when they are prominent in an utterance, they are forced to have a wide scope interpretation. To test these hypotheses, the stimuli were designed such that different scope readings of *wh*-indefinites could be tested as well. A schematic representation of the design of the stimuli in Experiment 1 is given in (7).

(7) Design of the Stimuli in Experiment 1

   a. neutral prosody

      [   ] [*wh*] [C-*wh*] [C+wh]

   b. *wh*-prominence

      [   ] [**wh**] [C-*wh*] [C+wh]

   c. *wh*-prominence & post-*wh* dephrasing

      [   ] [**wh**   C-*wh*   C+wh]

In (7), the square brackets indicate Accentual Phrase boundaries, and phonological prominence is marked in bold. The first set of stimuli (a) was prepared as a base for comparison. The set of stimuli in which the *wh*-word is phonologically prominent and the AP boundaries in the following words are erased as in (c) is supposed to be the typical intonation pattern of *wh*-questions. The crucial test case is (b), which involves

wh-prominence but not post-*wh* dephrasing. My hypotheses predict that cases as in (b) would be interpreted as wide scope indefinites rather than *wh*-interrogatives[25].

In Experiment 1, phonological phrasing was controlled by manipulating the pitch contour of the *wh*-word and the following words. As previously illustrated in Figure 7 and Figure 8, post-*wh* dephrasing causes change in pitch contour in general. The pitch manipulation was done by the speech synthesis tool provided in Praat. The details of such manipulation will be discussed in Section 3.4.2. Phonological prominence on the *wh*-word, marked in bold, was imposed by raising its pitch. The pitch-raising was also done in Praat. There are other phonetic correlates of phonological prominence, such as intensity or duration, but I limited the variable in this experiment to fundamental frequency for two reasons. First, fundamental frequency has been regarded as the major phonetic correlate of phonological prominence in the literature[26]. Second, pitch manipulation yielded the most natural result compared to the manipulation of intensity or duration. It was important to keep the manipulated sound as natural as possible in the perception experiment, because otherwise the listeners could have been distracted by

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[25] John Whitman (p.c.) pointed out that the stimuli should have included the fourth condition which involves post-*wh* dephrasing but not pitch raising of the *wh*-word itself. The motivation of the original design was to construct prosody types that most naturally correspond to different readings of *wh*-words: (a) narrow scope indefinite, (b) wide scope indefinite, and (c) *wh*-interrogative. However, it is indeed desirable to take the suggested condition into consideration for a more concrete argument. This will be reflected in the design of the follow-up experiments in the future. The consequence of the lack of such a condition in the current experiment will be discussed in Section 3.6.1.

[26] In the earliest experimental works in the perception of stress in English, Fry (1955, 1958) and Lieberman (1960) suggest that fundamental frequency is a more effective factor than duration or intensity. Since then, the importance of fundamental frequency in marking phonological prominence has been taken for granted or reiterated in the literature (Cooper et al. 1985, Rietveld & Gussenhoven 1985, Eady & Cooper 1986, Ladd 1996, Gussenhoven et al. 1997, among others). However, Kochanski et al. (2005) argue that their investigation into a large corpus of natural speech in English reveals that loudness is the best acoustic correlate of phonological prominence rather than pitch. These seemingly conflicting observations can be interpreted as suggesting that fundamental frequency is the most easily noticeable cue to prominence in perception, but not a reliable cue in production. In this chapter, I focus on the perception side and stick to the choice of fundamental frequency as the cue to prominence. The production side will be discussed in Chapter 4.

the artificial quality of the synthesized sounds, and it would have been hard to detach degraded acceptance due to unnaturalness from that due to ungrammaticality.

In Experiment 1, all factors other than phrasing and prominence were kept constant, including the sentence-final intonation. The sentence-final tone was kept as falling so as to exclude yes/no-question readings. Yet the ambiguity between declaratives and *wh*-questions was left unresolved. As shown in Table 6, the sentence-final tone alone does not distinguish indefinite and interrogative readings of *wh*-words. However, Hwang (2007) argues that when a declarative reading is excluded by context or using the question particle, the sentence-final tone plays a crucial role in distinguishing the meanings of *wh*-words: the falling tone is exclusively associated with a *wh*-question reading, and the rising tone is with a yes/no-question reading. This leads us to a question regarding the influence of sentence-final tone on processing sentences with *wh*-words. Especially, the question I would like to answer with the second experiment is whether the effect of post-*wh* dephrasing can override that of the sentence-final tone in processing. The second experiment compared the influence of phrasing and the sentence-final tone in perception of *wh*-words. A schematic representation of the design of the stimuli in Experiment 2 is given in (8).

(8)   Design of the Stimuli in Experiment 2

   a. Final falling

      [　][　*wh*　][　c]↓

   b. Final falling + post-*wh* dephrasing

      [　][　*wh*　　c]↓

   c. Final rising

      [　][　*wh*　][　c]↑

   d. Final rising + post-*wh* dephrasing

[   ] [*wh*   c] ↑

As shown in (8), the two independent variables, sentence-final tone type and post-*wh* phrasing, were manipulated in a 2 x 2 factorial design. The sentence-final tone could be either falling or rising, and post-*wh* phrasing could involve dephrasing or not. Note that the implementation method of post-*wh* dephrasing in Experiment 2 was different from that in Experiment 1. While post-*wh* dephrasing generally involves changes in the pitch contour, there are cases where the pitch contour remains the same after dephrasing. For instance, when the *wh*-word is followed by a monosyllabic predicate, any post-*wh* dephrasing effect on the predicate is obscured because the sentence-final tone is realized on the last syllable of the sentence, which is the predicate itself in this case. Another case is when both the *wh*-word and the following word consist of two syllables and the first syllable in each case receives an L tone. In this case, both the original and dephrased versions have the same LHLH tonal pattern as shown in Figure 10. A similar case is observed when the *wh*-word is monosyllabic and the following word starts with an H tone. In this case, the H tone on the first syllable of the post-*wh* word is maintained after dephrasing as in Figure 11, because the second syllable in the extended AP is supposed to receive an H tone again.

a) before dephrasing   b) after dephrasing
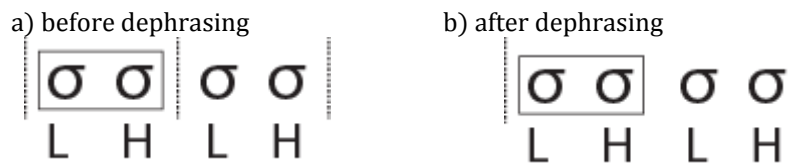
Figure 10. Example of an ambiguous pitch contour after dephrasing: a sequence of two-syllable words.

a) before dephrasing   b) after dephrasing

Figure 11. Example of an ambiguous pitch contour after dephrasing: a monosyllabic word followed by an initial H tone.

Considering these exceptional cases, I adopted another way to induce the perception of AP boundaries in Experiment 2. The relevant cue was the presence or absence of a phonological process that cannot occur across AP boundaries. Jun (1993) points out 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 the *wh*-word and the following word, that word boundary cannot coincide with an AP boundary and the two words must be in the same AP. In other words, if such phonological processes occur right after the *wh*-phrase, they can serve as indicators of post-*wh* dephrasing. Among the AP-internal processes mentioned in Jun (1993), intersonorant *h*-deletion was chosen for this experiment because the difference in the speech signal due to the existence or lack of a segment (i.e. the *h*-sound) would be more easily detectable than the results of the other processes[27].

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[27] Other AP-internal processes seem less suitable for a perception test for the following reasons:
i) Inter-vocalic voicing: The distinction of voiced/voiceless is not phonemic in Korean, thus the difference would be subtle to be detected by the ear.
ii) Post-obstruent tensing: It is hard to find the right stimuli to elicit this phenomenon because most *wh*-words in Korean end with a vowel. The only *wh*-word that ends with an obstruent is /muəs/ 'what/something', which is hardly used in spoken language. Its contracted form /mwə/, which ends with a vowel, is widely used instead.
iii) Vowel shortening: The distinction of vowel length has become obsolete in contemporary Korean.

3.4. Experiment 1: prominence vs. phrasing

The first experiment investigated the influence of phonological prominence and phrasing in the perception of *wh*-words.

3.4.1. Participants

24 native Seoul Korean speakers (12 females and 12 males) participated. All participants were in their late twenties or early thirties at the time of the experiment and had lived most of their lives in Seoul or its vicinity.

3.4.2. Materials

The test sentences were designed to have three different readings as follows. In each sentence, a *wh*-phrase was placed in a conditional clause as exemplified in (2), which makes different scope readings of the indefinites available. All the sentences ended with a neutral intimate ending *–e/a*, thus rendering the sentence type ambiguous between assertion and question. As a result, three different readings, i.e. i) wide scope indefinite, ii) narrow scope indefinite, and iii) *wh*-interrogative, were possible.

(9)   Example of stimuli in Experiment 1

	이	병은	뭐를	먹으면	나아
	/i	bjəŋɨn	mwərɨl	məgɨmjən	naa/
	i	*pyeng-un*	*mwe-lul*	*mek-umyen*	*na-a*
	this	illness-TOP	what-ACC	eat-if	cured-INT

(Lit. 'This illness will be cured if you eat [what/something].')

i)   narrow scope indefinite (if > ∃)

'This illness will be cured if you eat something.'

ii) wide scope indefinite (∃ > if)

   'There is a certain something such that this illness will be cured if you eat it.'

iii) *wh*-interrogative

   'What is the thing such that this illness will be cured if you eat it?'

Five sentences with the above structure were chosen, varying the number of syllables in the *wh*-phrase (from two to five syllables). The list of the test sentences is given in the Appendix. Each sentence was first recorded with a neutral intonation at a normal speech rate by the author, as a native speaker of Seoul Korean. By 'neutral intonation' I mean the tone expected to be employed for a declarative sentence with a non-focused proper name in place of the *wh*-phrase, as illustrated in Figure 12-(a).

Two additional groups of stimuli were obtained by manipulating the pitch contour of the first set of sentences using the PSOLA algorithm implemented in Praat (Moulines and Charpentier 1990). Instead of recording all the test materials, synthesis from the base sentences was adopted so as to avoid the potential influence of variation stemming from other irrelevant factors. In one group, the pitch of the *wh*-phrase was raised so that the highest pitch point in the sentence fell on the *wh*-phrase as in Figure 12-(b). The other group replicated the contour of *wh*-questions, with a pitch boost on the *wh*-phrase as well as subsequent dephrasing, as in Figure 12-(c). The amount of pitch raising was determined heuristically so that the change was large enough to be easily detectable but the manipulated result still sounded natural. The highest F0 value of the *wh*-phrase was controlled to be the same for the two synthesized groups. The F0 contour of the last two syllables in the sentence was not changed from the base during synthesis, so the same falling sentence-final tone was maintained for all three groups. Thus the pitch ranges of the sentences were also the same for the two synthesized groups.

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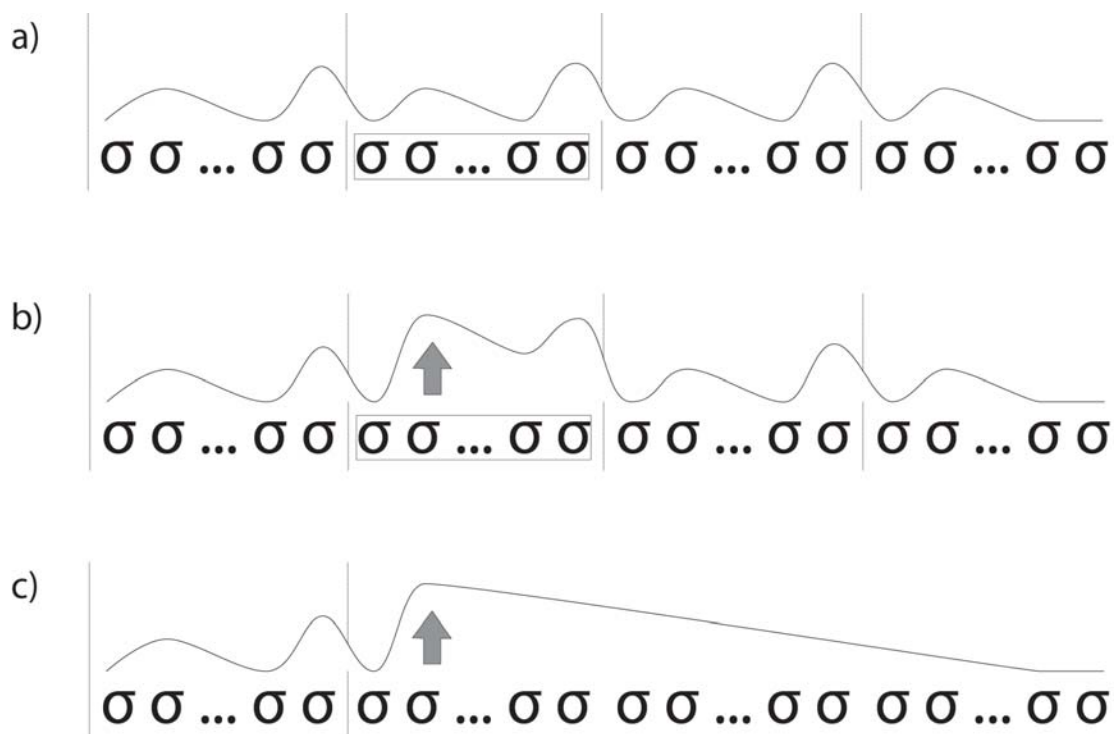
Figure 12. Schematic representations of the F0 contours of the test sentences in Experiment 1: (a) neutral; (b) F0 boost only; (c) F0 boost + dephrasing.

Figure 13 shows the actual F0 contours of the test sentence (2) with a *wh*-phrase composed of two syllables. Notice that the F0 track of the *wh*-phrase remains the same in (b) and (c). The only difference between the two lies in the shape of the F0 contour after the *wh*-phrase. Such examples are expected to simulate the effect of dephrasing correctly, minimizing the potential influence of other factors.
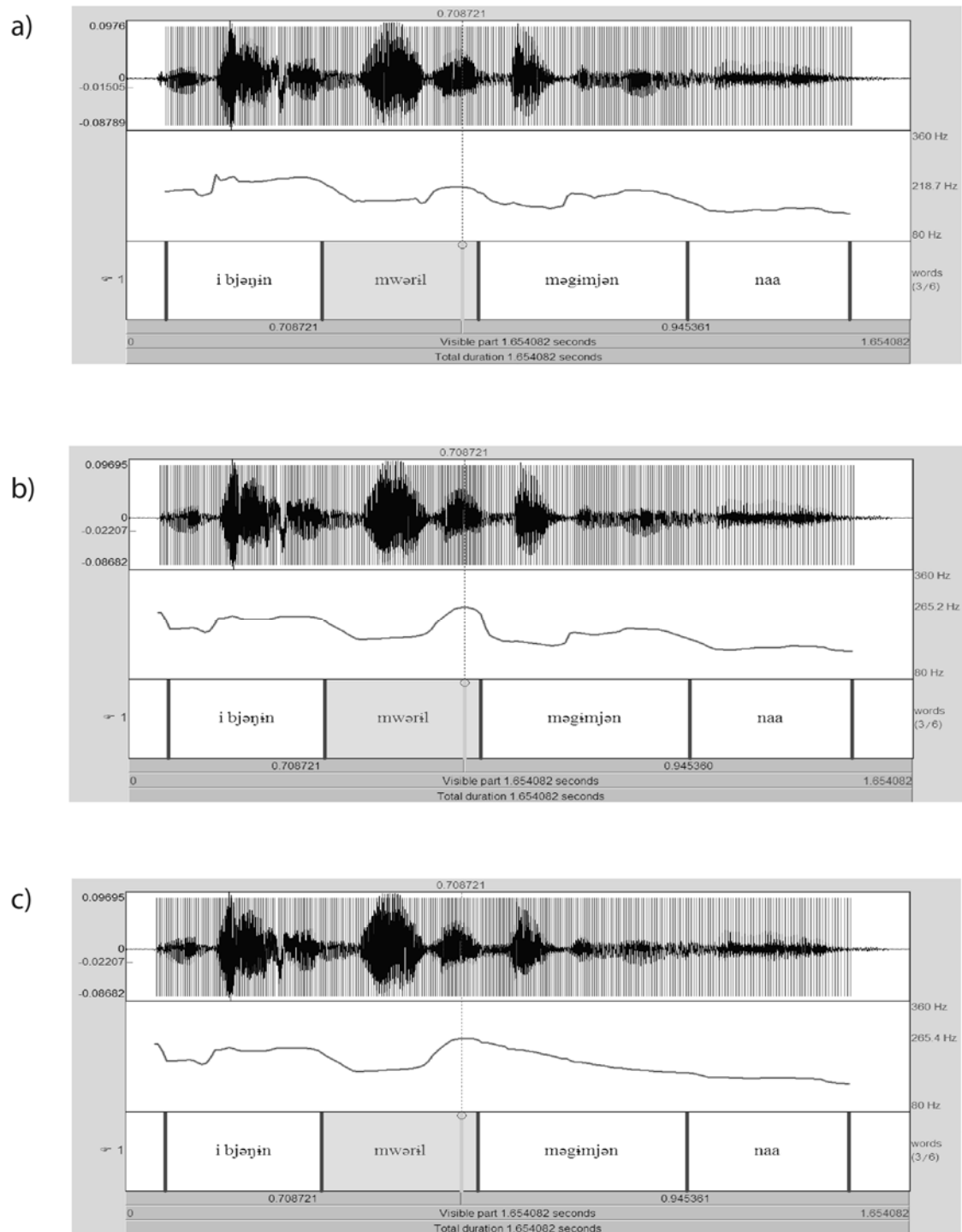
Figure 13. Examples of actual F0 tracks of test sentences in Experiment 1: (a) neutral; (b) F0 boost only; (c) F0 boost + dephrasing. The shaded part in the transcription indicates the *wh*-phrase.

3.4.3. Procedure

A web application was created 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:

(10)   Example scenarios

내가	누구하고	결혼하면	돈을	받아
/næga	nuguhago	kjəronhamjən	tonɨl	pada/
nay-ka	*nwukwu-hako*	*kyelhonha-myen*	*ton-ul*	*pat-a*
I-NOM	who-with	marry-if	money-ACC	get-INT

(Lit. 'I will receive money if I marry [who/someone].')

i) Narrow scope indefinite context

Jinyoung was in a lot of debt and desperately needed money. One day a lawyer came to see her and said that a distant relative of hers wanted to give her a lot of money as long as she got married. After listening to this, Jinyoung told her friend: "[target sentence]. So please set up blind dates for me! Any guy would be okay!" (Intended reading of the target sentence: 'I will get money if I marry someone.')

ii) Wide scope indefinite context

Jinyoung was in a lot of debt and desperately needed money. One day a lawyer came to see her and said that a distant relative of hers wanted to give her a lot of money as long as she married a certain person that the relative had in mind. After listening to this, Jinyoung told her friend: "[target sentence]. But I won't get any money if I marry someone else."

(Intended reading of the target sentence: 'There is a certain someone such that I will get money if I marry that person.')

iii) *Wh*-interrogative context

Jinyoung was in a lot of debt and desperately needed money. One day an old friend from her hometown came to see her and said that a distant relative of hers wanted to give her a lot of money as long as she married a certain person that the relative had in mind. After listening to this, Jinyoung asked the friend: "[target sentence]?" But the friend answered that he did not know who that person was. (Intended reading of the target sentence: 'Who is the person such that I will get money if I marry that person?')

The contexts and target sentences were provided in written form in Korean. The participants were instructed to read the context including the target sentence, and then to listen to the target sentence by clicking a button, and finally to assign a score from 0 to 10 depending on how natural the sentence sounded in the given context. The listeners 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, 45 context-sentence pairs (5 sentences × 3 prosody types × 3 context types) were presented in a pseudo-random order so that the same sentence did not appear twice in a row. These stimuli of interest were mixed with 63 pairs of filler materials.

3.4.4. Results

a)

neutral

b)

F0 boosting

c)

F0 boosting + dephrasing
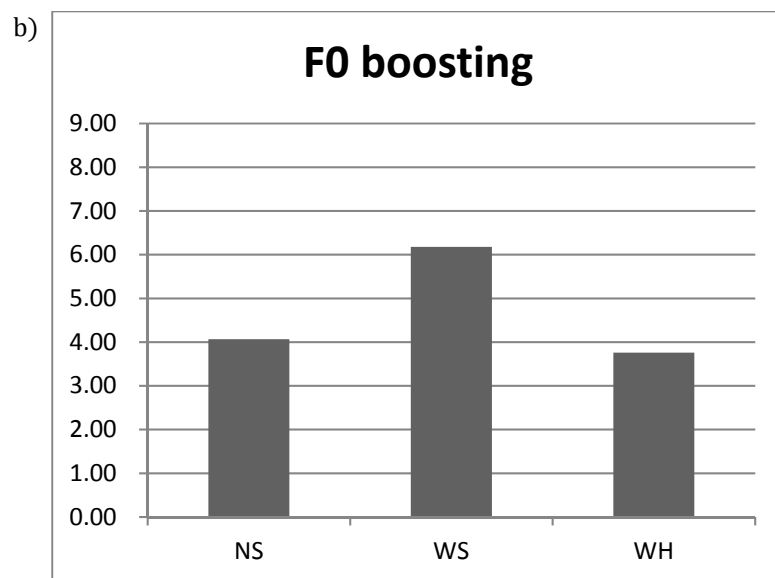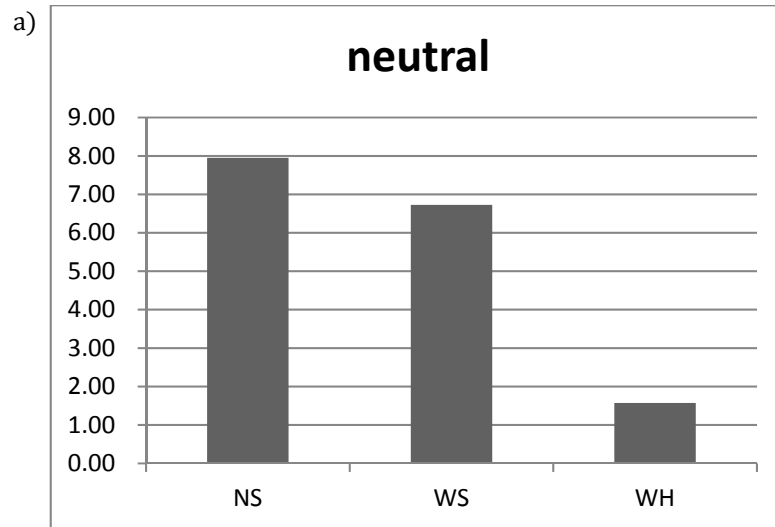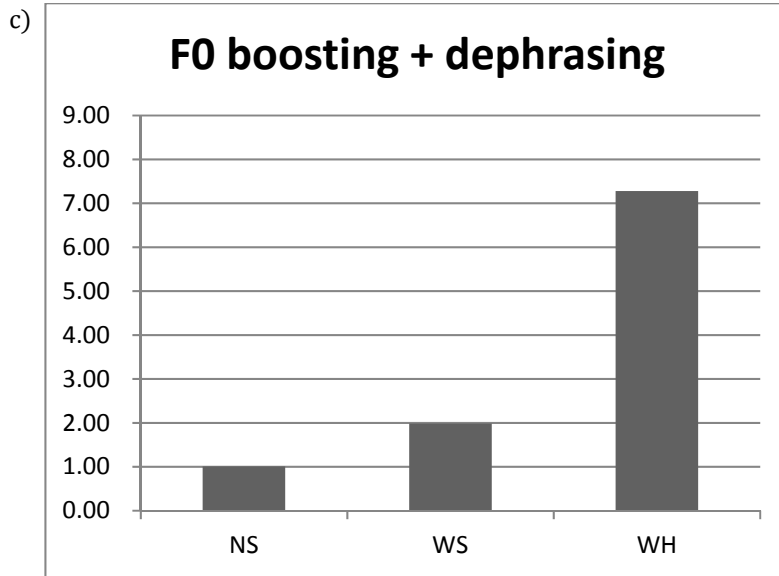
Figure 14. Acceptance rates of three different readings of *wh*-words for each prosody type (NS: narrow scope indefinite, WS: wide scope indefinite, WH: *wh*-interrogative).

Figure 14 shows the average acceptance rates of different readings of *wh*-words for each prosody type. Table 7 provides the exact values of the acceptance rates and the results of ANOVA and Tukey post-hoc tests (at the .01 level). For the sentences with the neutral prosody, a narrow scope indefinite reading is most preferred for the *wh*-word, as shown in Figure 14-(a). When the pitch of the *wh*-word is boosted but dephrasing does not follow, a wide scope indefinite reading receives the highest score as shown in Figure 14-(b). When dephrasing is added, on the other hand, the *wh*-interrogative reading is strongly preferred over the indefinite readings as shown in Figure 14-(c). Thus the high pitch of the *wh*-word alone does not constitute a decisive cue to the perception of a *wh*-question, unless dephrasing follows.

Prosody	Average ratings			Effects		
	NS	WS	WH	*d.f.*	F	Tukey
neutral	7.95	6.72	1.57	(2,353)	207.31	**NS**>WS>WH
F0 boost	4.07	6.18	3.76	(2,357)	17.39	**WS**>NS=WH
F0 boost + dephrasing	1.01	1.98	7.28	(2,356)	197.27	**WH**>NS=WS

Table 7. Mean acceptance rates and differences in Experiment 1 (all effects at p<.01).

3.5. Experiment 2: sentence-final tone vs. phrasing

The second experiment investigated the influence of phrasing and the sentence-final tone in perception of *wh*-words.

3.5.1. Participants

The same participants as in Experiment 1 (i.e. 24 native Seoul Korean speakers) participated in this test.

3.5.2. Materials

The test sentences contained a *wh*-phrase followed by an *h*-sound as illustrated below. All the sentences ended with a neutral intimate ending, thus rendering the sentence type ambiguous between assertion and question.

(11)   Example of stimuli in Experiment 2

지금　뭐　해

/cigɨm mwə   hæ/

cikum mwe   hay

now   what do

   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 test sentences were read at a normal speech rate by the author, as a native speaker of Seoul Korean in the following way. Each sentence was read four times as two factors varied in each repetition: whether the sentence-final tone 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. As such an example, Figure 15 provides the spectrogram and F0 track of the sentence in (11). The list of the all test sentences is given in the Appendix.

a)

b)
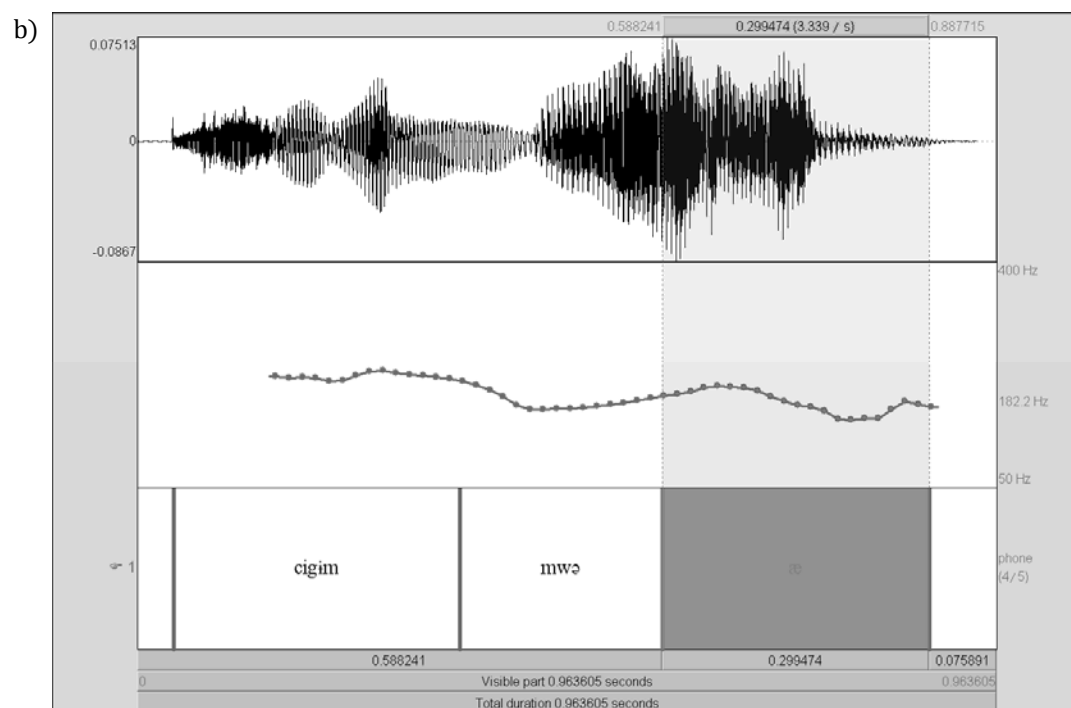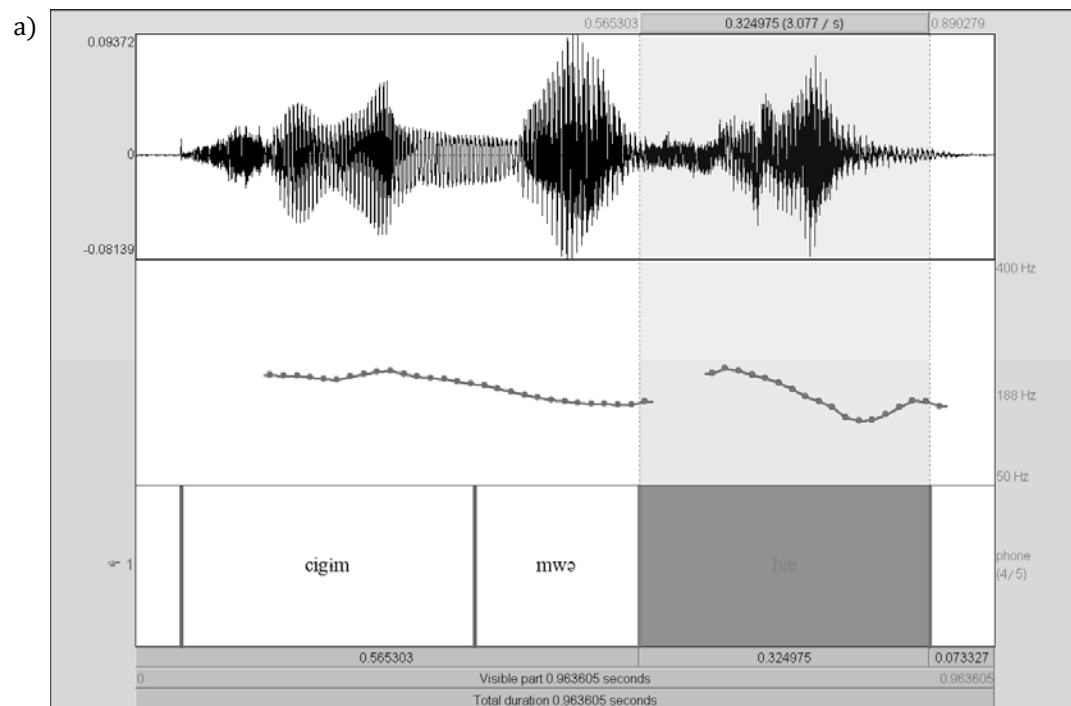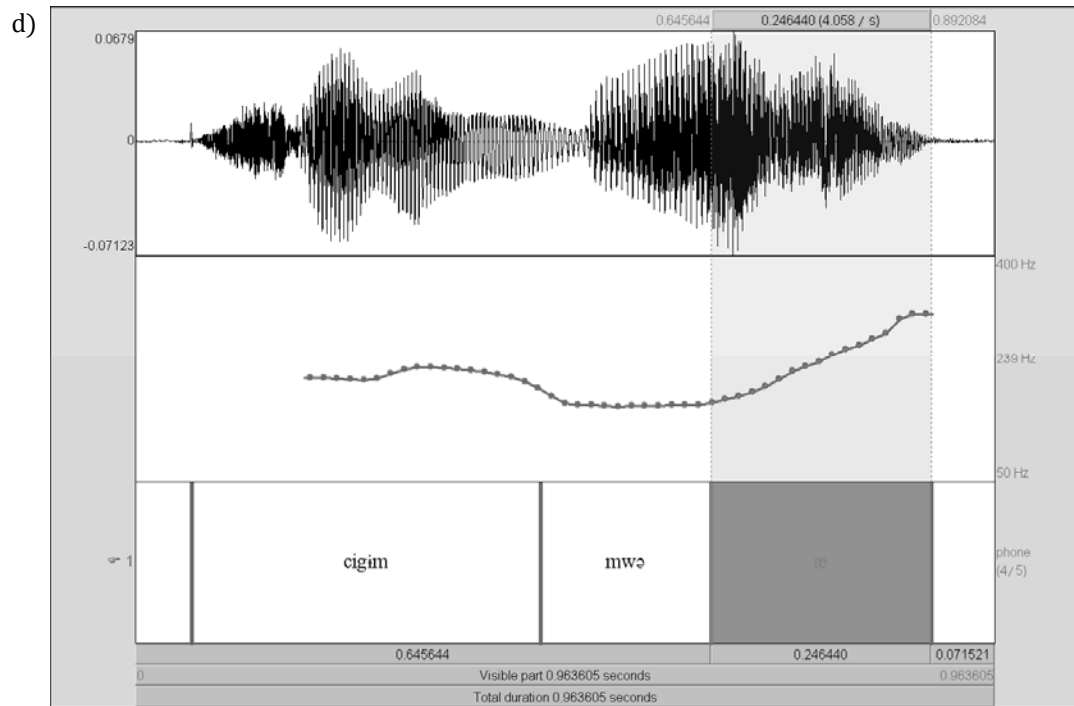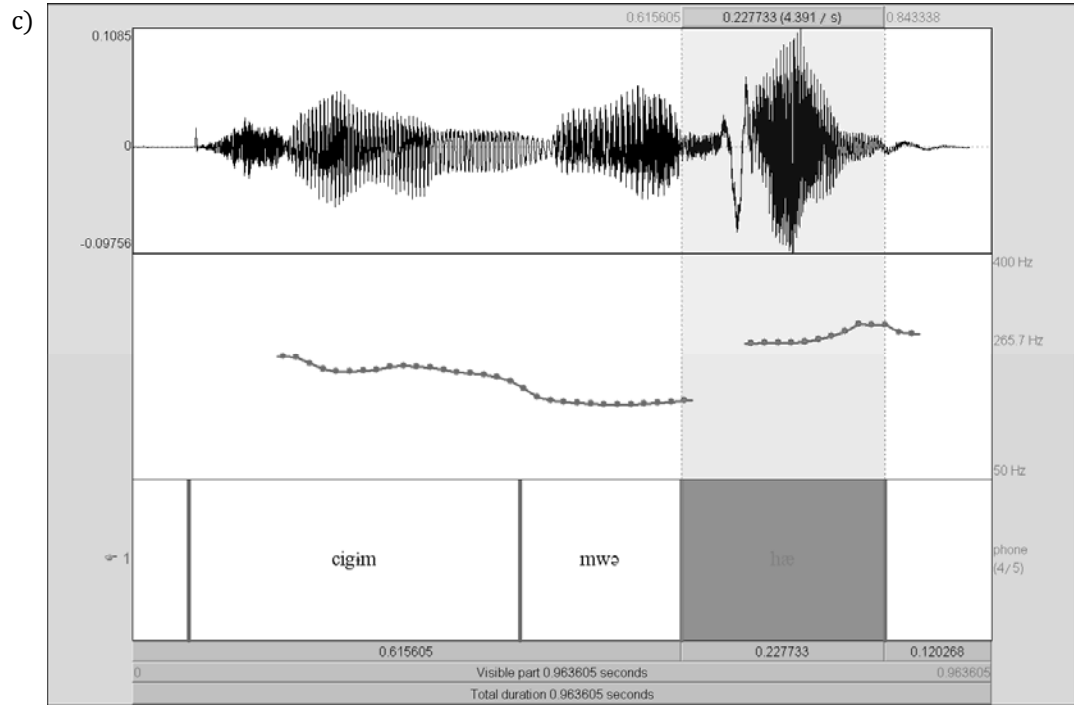
Figure 15. Examples of spectrograms and F0 tracks of test sentences in Experiment 2: (a) falling; (b) falling + *h*-deletion; (c) rising; (d) rising + *h*-deletion.

3.5.3. Procedure

The same web application built for Experiment 1 was used for this perception test. A target sentence was displayed on the screen with a short dialogue that facilitated one of the three different readings available for the target sentence. An example of such dialogues is given below:

(12)   Declarative sentence

A: 나랑 애기 좀 할래?

/naraŋ   jægi   com   hallæ/?

Nalang   yayki   com   hallay

I-with   talk   please   do

'Can I talk to you?'

B: 잠깐만. 나 지금 뭐 해.

/camk'anman.   na   **cigɨm   mwə   hæ**/.

Camkkanman.   na   cikum   mwe   hay

wait   I   now   what   do

'Wait. I'm doing something.'

(13)   Yes/no-question

A: 너 지금 뭐 해?

/nə   **cigɨm   mwə   hæ**/

Ne   cikum   mwe   hay?

you   now   what   do

'Are you doing something?

B: 아니.

112

/ani/

Ani.

no

'No.'

(14)   *Wh*-question

　　　A: 너 지금 뭐 해?

　　　　/nə **cigɨm** **mwə** **hæ**/

　　　　Ne *cikum* *mwe* *hay*?

　　　　you   now   what   do

　　　　'What are you doing?

　　　B: 숙제.

　　　　/sukc'e/

　　　　Swukcey.

　　　　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, and finally to assign a score from 0 to 10 depending on how natural the sentence sounded in the given context. The listeners 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.

3.5.4. Results

Table 8 provides 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).

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**>YN-Q=*WH*-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 8. Mean acceptance rates and differences in Experiment 2 (all effects at p<.01).

The results show sharp contrasts depending on whether the *h*-sound is maintained or deleted. When the *h*-sound is maintained, the correlation between the sentence-final tone and the sentence type is obvious, as shown in Figure 16. If the sentence ends with a falling tone, it is most naturally perceived as a declarative sentence, while with a rising tone the most natural reading is that of a yes/no-question. Note that, while the influence of the sentence-final tone is almost categorical when it comes to the acceptance of the given sentences as declarative sentences (falling: 8.77, rising: 0.41) or yes/no-questions (falling: 0.85, rising: 9.10), it is less decisive in the case of *wh*-questions (falling: 1.02, rising: 5.71).

a)

Falling

	DECL	YN-Q	WH-Q

b)

Rising

	DECL	YN-Q	WH-Q
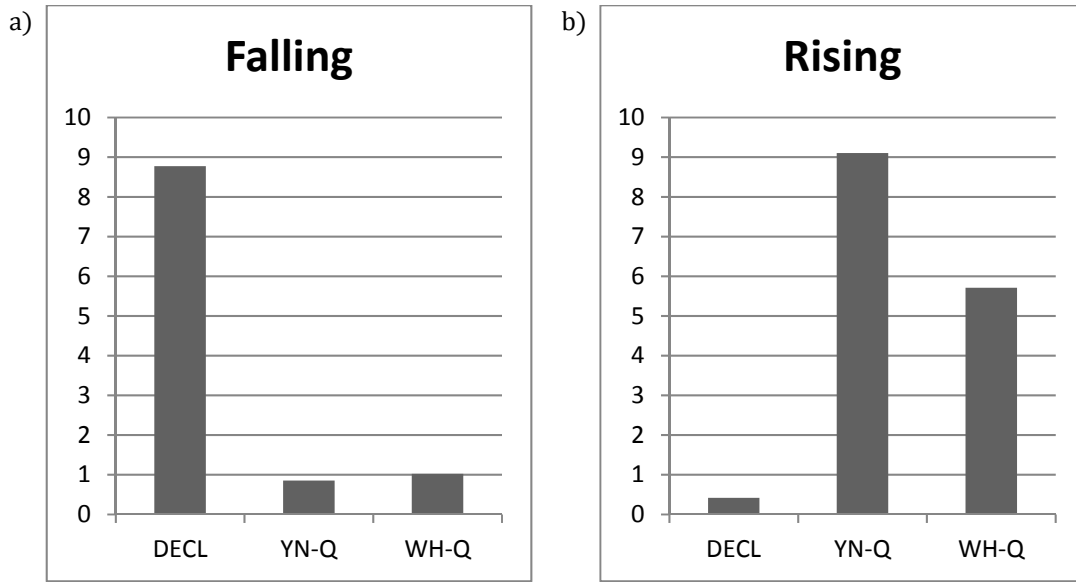
Figure 16. Average acceptance rates when *h*-deletion did not occur.

When the *h*-sound is deleted, on the other hand, the correlation between the sentence-final tone and the sentence type does not hold anymore. As illustrated in Figure 17, the most acceptable reading under *h*-deletion is a *wh-question* reading regardless of the sentence-final tone. Note that when *h*-deletion occurs, the acceptance rates for the stimuli as declarative sentences and yes/no-questions are very low even with the appropriate sentence-final intonation (falling for declarative: 1.75, rising for yes/no-question: 2.29).

a) **Falling**

b) **Rising**
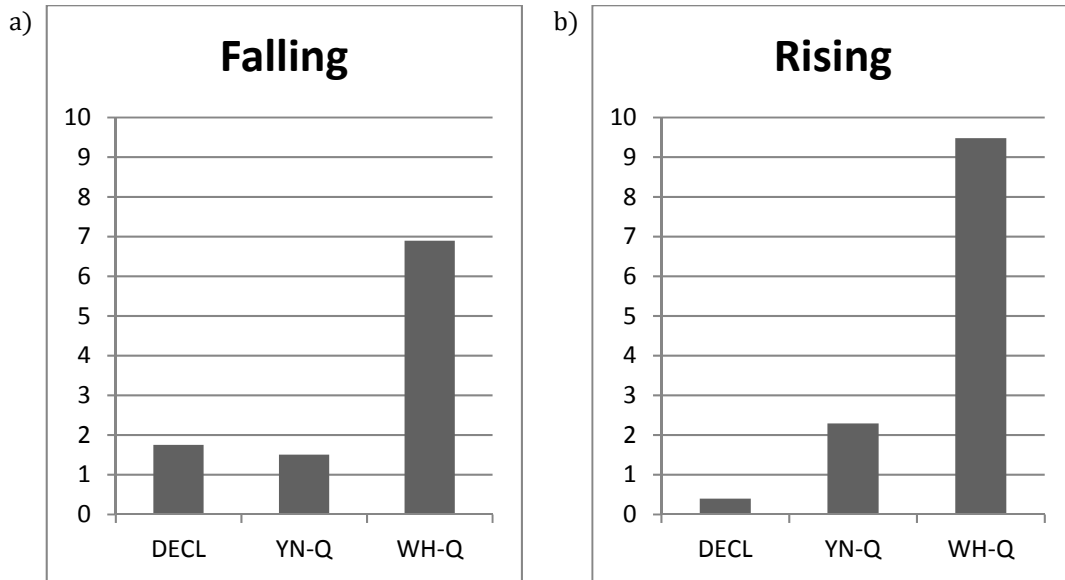
Figure 17. Average acceptance rates when *h*-deletion occurred.

3.6. Discussion

3.6.1. Dephrasing marks the scope of wh-interrogatives

The results of both experiments suggest that dephrasing is the most crucial factor in the perception of *wh*-questions in Korean. The results of Experiment 1 and 2 in combination suggest that post-*wh* dephrasing is a more crucial and effective cue than prominence on the *wh*-words for signaling *wh*-questions[28]. Also, the results of Experiment 2 suggest that post-*wh* phrasing is so effective that the influence of sentence-final intonation is obscured. The importance of dephrasing in forming *wh*-questions is also attested in other languages, as shown in the following discussion.

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[28] The results of Experiment 1 suggest that phonological prominence on the *wh*-word is not sufficient for marking *wh*-questions, but appropriate phonological phrasing is necessary. Admittedly, these results alone do not tell whether the prominence of *wh*-words is still a necessary condition in forming *wh*-questions. However, the results of Experiment 2 confirm that prominence is not necessary for *wh*-interrogatives, as the prosody of *wh*-words was kept constant across all of the stimuli, and post-*wh* dephrasing still forced a *wh*-question reading. Thus the importance of appropriate phrasing in processing *wh*-questions is attested with different settings in the two experiments.

3.6.1.1. Dephrasing of *wh*-questions in Japanese

Japanese is one of the languages whose *wh*-prosody has been extensively studied. As for *wh*-questions, it has been noted that pitch accents on words between a *wh*-word and its corresponding question particle are significantly reduced (i.e. deaccented) in Japanese (Ishihara 2002, Sugahara 2003, Kitagawa 2005 among others). Such post-*wh* deaccenting has been argued to be an instance of phonological dephrasing (Richards 2010; cf. Pierrehumbert & Beckman 1988).

One of the earliest experimental observations confirming this argument is found in Maekawa (1991). He conducted a perception experiment that demonstrates the importance of dephrasing in perceiving *wh*-questions in Tokyo Japanese. Since Japanese does not allow bare *wh*-indefinites, it is impossible to construct a pair consisting of a *wh*-question and its indefinite counterpart with exactly the same segments. Instead, he constructed a pseudo-minimal pair of *wh*-question and yes/no-question as in (15).

(15)   Japanese (Maekawa 1991:202)

    a. *wh*-question

       nani*-*ga   *mi-e-ru*?

       what-NOM   see-can-PRS

       'What can you see?'

    b. yes/no-question

       nani*-*ka   *mi-e-ru*?

       what-IND   see-can-PRS

       'What can you see?'

Figure 18 shows representative pitch tracks of the two sentences in (15). As illustrated in this figure, the *wh*-question and the yes/no-question are different in their intonation mainly with respect to two factors: i) the peak F0 value of the *wh*-phrase *nani-ga/ka* is higher in a *wh*-question than a yes/no-question, and ii) the F0 bump in the predicate *mieru* due to a lexical accent is not observed in a *wh*-question.
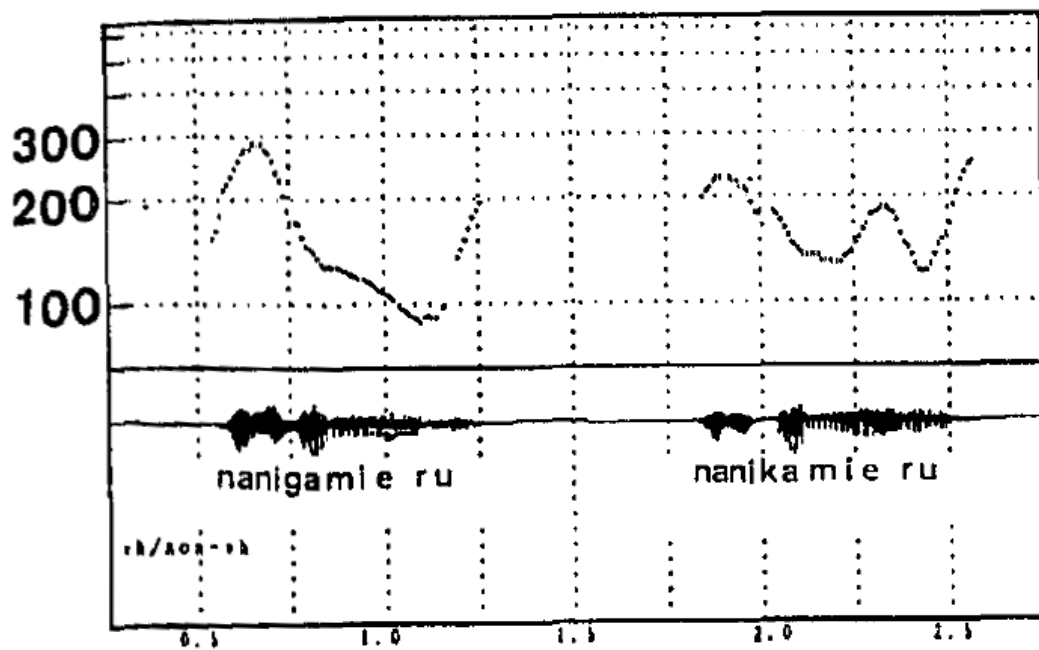
Figure 18. The F0 contours of a *wh*-question (left) and a yes/no-question (right) (Maekawa 1991:203).

To compare the relative significance of these two factors in perception, Maekawa conducted an experiment using synthesized speech in which the F0 peak values of the *wh*-word and the predicate varied while all other factors remained the same including the sentence-final rising tone[29]. The results showed that the pitch contour of the

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[29] In order to control the effect of the segmental difference, Maekawa substituted the contrasting segments (i.e. /g/ and /k/) with white noise. Erasing the segment in this way seems to have insignificant effect (if any) in perception of the entire sentence, as evidenced by his preliminary experiment with

predicate is far more important than that of the *wh*-word. If the F0 bump of the predicate at its lexical accent was retained, the stimuli were perceived mostly as yes/no-questions regardless of the value of the F0 peak on the *wh*-word. Once the F0 bump of the predicate was erased, the stimuli were perceived mostly as *wh*-questions and boosting the F0 peak on the *wh*-word led to a slight increase of the acceptance rate for the *wh*-question reading. Thus, the results of the experiment suggest that post-*wh* deaccenting rather than *wh*-prominence plays a decisive role in perceiving *wh*-questions in Tokyo Japanese.

3.6.1.2. Support for the Richards (2010) typology

Richards (2010) proposes a universal condition on *wh*-prosody that a *wh*-phrase and the corresponding complementizer must be separated by as few prosodic boundaries as possible. The prosodic unit relevant to this argument is the lowest level of phonological phrasing, or Minor Phrase, in the sense of Selkirk (1984). As a result, *wh*-questions create a prosodic domain that starts with the *wh*-phrase and ends with the complementizer. The algorithm for creating such prosodic *wh*-domains is as follows:

(16)   The algorithm for creating prosodic *wh*-domains (Richards 2010: 150)

   a. For one end of the larger Minor Phrase, use a Minor Phrase boundary that was introduced by a *wh*-phrase.

   b. For the other end of the larger Minor Phrase, use any existing Minor Phrase boundary.

---

naturally uttered stimuli in which the consonants were erased. The participants were able to identify the sentence type with a high accuracy rate (92.2% for *wh*-questions and 95.5% for yes/no-questions) solely relying on intonational differences.

He further argues that there are two ways of satisfying this universal condition: i) change the prosody so that there are no prosodic boundaries intervening between *wh* and C, or ii) move the *wh*-phrase to a position closer to the C so that *wh* and C are located in a single prosodic domain. The schematic representations of these two approaches are illustrated in (17)-b and (17)-c, respectively.

(17)   a. *wh* and C separated by prosodic boundaries

      (C)(   )(   )(wh)

    b. dephrasing

      (C   wh   )

    c. *wh*-movement

      (**wh**   C)(   )(   )(~~wh~~)

Richards argues that whether a certain language adopts dephrasing or *wh*-movement depends on two parameters: the position of the complementizer and the placement of prosodic boundaries by the syntax-phonology interface. The basic assumption of his argument is that either left or right edges of certain maximal syntactic projections (XPs) are mapped onto prosodic boundaries (Selkirk 1984). Then languages are classified into four groups as illustrated below:

	Prosodic boundaries on left of XPs	Prosodic boundaries on right of XPs
C to the right of TP	Type 1 (e.g. Japanese)	Type 2 (e.g. Basque)

C to the	Type 3	Type 4
left of TP	(e.g. Tagalog)	(e.g. Chichewa)

Table 9. Typology of *wh*-prosody (Richards 2010:189. The types have been numbered for ease of reference).

Logically, only Type 1 and Type 4 languages can create a *wh*-domain by dephrasing. Suppose that the grammar of a language allows constructing a larger phonological phrase that starts at the boundary introduced by the *wh*-phrase and ends at the end of the clause. Such a construction can eliminate the intervening prosodic boundaries between *wh* and C only if C is located on one side of the clause and prosodic boundaries are associated with the opposite side of a certain maximal projection; otherwise it does not improve the prosody to create a *wh*-domain.

This is well illustrated in the diagrams from (18) to (21)[30]. Each row indicates the schematic representation of a sentence (a), Minor Phrase boundaries that are marked by certain maximal projections (XPs) based on the language-specific parameters (b), the complete Minor Phrase boundaries (c), and the result of *wh*-domain construction (d). A successfully built *wh*-domain by prosody is marked by shading in line (d). Richards argues that if a language cannot build a *wh*-domain by dephrasing, it must employ *wh*-movement as a last resort to satisfy the universal *wh*-prosody condition.

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[30] The diagrams are adopted from Richards (2010) and modified for explanatory purposes.

(18) Type 1: Final C, Left edge marking

    a. [XP] [*wh*P] [XP] C

    b. (((

    c. (   ) **(**   ) (   )

    d. (   ) **(**   )

(19) Type 2: Final C, Right edge marking

    a. [XP] [*wh*P] [XP]   C

    b.   )   **)**   )

    c. (   ) (**)** (   ) ( )

    d. **(**   ) (   ) ( )

(20) Type 3: Initial C, Left edge marking

    a.   C   [XP] [*wh*P] [XP]

    b.   (((

    c. ( ) (   ) **(**   ) (   )

    d. ( ) (   ) **(**   **)**

(21) Type 4: Initial C, Right edge marking

    a.   C   [XP] [*wh*P] [XP]

    b.   )   **)**   )

    c. (   ) (   ) (**)** ( )

    d. **(**   ) ( )

Korean falls into the first type (i.e. Final C, left edge marking), thus the typological hypothesis in Richards (2010) predicts that dephrasing may be used to form *wh*-questions in Korean. The results of the experiments in this chapter suggest that the prediction is borne out and support the idea that *wh*-prosody in the world's languages is governed by a universal principle.

3.6.2. Prominence marks the scope of indefinites

The results of Experiment 1 also provide empirical evidence for the argument that I made in Chapter 2, i.e. a wide scope reading is possible for bare *wh*-indefinites, contrary to the argument in previous studies (cf. Postma 1994, Ha 2004, Bruening 2007). Figure 19 zooms in the relevant results. When the sentence is given with neutral prosody, both narrow and wide scope readings are possible, although the narrow scope reading is slightly more preferred (the average acceptance rate: 7.95 vs. 6.72). When the pitch of the *wh*-word is raised, a wide scope interpretation is preferred over a narrow scope interpretation (6.18 vs. 4.07). In other words, the current study shows that bare *wh*-indefinites in Korean are basically ambiguous in their scope configuration, and that the pitch boost on the *wh*-word even creates a preference for a wide scope interpretation.
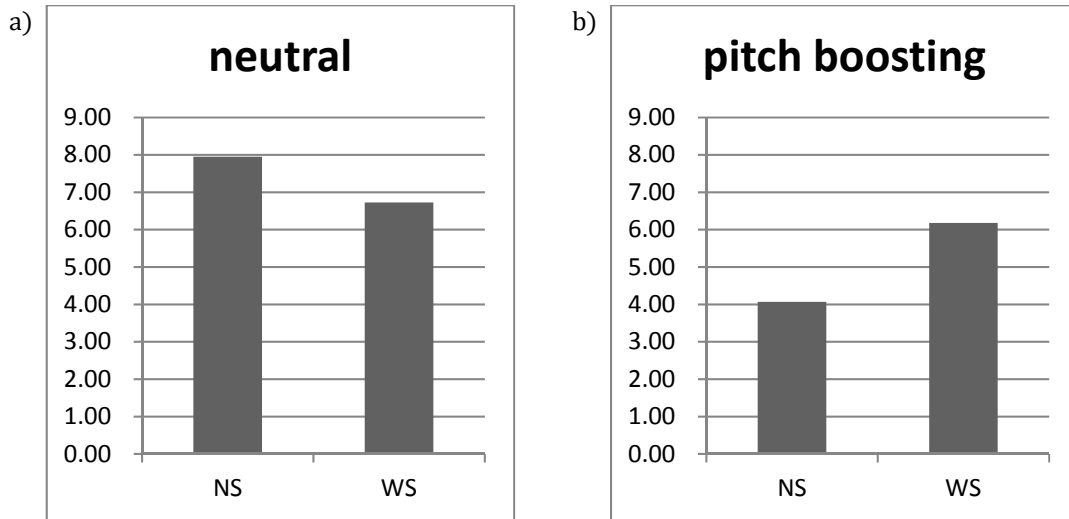
Figure 19. Acceptance rates of different scope configurations of *wh*-words (NS: narrow scope, WS: wide scope) depending on prosody types (a: neutral, b: F0 boosting on the *wh*-word).

The influence of phonological prominence in scope interpretation is also observed in the case of regular indefinite expressions such as *some* in English. It has long been noted that stressed and unstressed *some* have different semantic properties that could affect their scopal behaviors (Milsark 1974, Carlson 1977, Kratzer 1998, among others). For instance, Lohndal (2010) points out that in a cleft construction such as (22)-a, *some* must take wider scope than *every*, but the inverse scope is possible if *some* is de-stressed as in (22)-b. The reduced spelling *sm* here indicates a phonologically reduced instance of *some*.

(22) *some vs. sm* (Lohndal 2010:404)

    a. *It is **some** pig that eats **every** piece of food.* ($\exists > \forall$, * $\forall > \exists$)

    b. *It is **sm** dessert that **every** dog wants.* ($\exists > \forall$, $\forall > \exists$)

Lohndal concludes that this scopal behavior of *some* supports an analysis that stress forces a wide scope reading. Thus, it seems we can generalize that phonological

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prominence such as high pitch or stress triggers a bias toward a wide scope interpretation of indefinites, whether the indefinite involves *wh*-morphology or not.

Such a generalization leads us to another prediction regarding the typology of *wh*-indefinites. Suppose that there are languages in which bare *wh*-indefinites are restricted to a narrow scope interpretation, as argued in previous works (Bruening 2007). We can expect that bare *wh*-indefinites in those languages will never be relized as phonologically prominent. Indeed, bare *wh*-indefinites in many languages have been reported to be phonologically unmarked or reduced. For instance, Haspelmath (1997) points out that in Classical Greek, *wh*-interrogatives must be stressed while *wh*-indefinites must not, which is reflected in the spelling as in (23).

(23)   Classical Greek (Hapelmath 1997: 170)

    a.   ***tís*** 'who'

    b.   ***tis*** 'someone'

It has also been argued that *wh*-words in Mandarin Chinese are phonologically prominent only when they are interpreted as interrogative (Hu 2002, Dong 2009). Hu (2002) presents a production experiment that examines the relative prominence of *wh*-words in *wh*-questions and yes/no-questions. The relative prominence of the *wh*-word was measured in comparison with the adjacent VP. As shown in (24), the stimuli of the experiment were designed so that the position of the *wh*-word in the sentence and the relative order between the *wh*-word and the VP varied.

(24)   Stimuli for the production experiment in Hu (2002)

    a.   ***shui***   <u>*lai-le*</u>

        who   come-ASP

'(i)Who came?'

'(ii) Has someone come?'

b. *ni   kan-jian   **shui**   <u>lai-le</u>*

You watch-see   who   come-ASP

'(i) Who did you see come?'

'(ii) Did you see someone come?'

c. *zhang-san   <u>mai-le</u>   **shen-me***

Zhangsan   buy-ASP   what

'(i) What did Zhangsan buy?'

'(ii) Did Zhangsan buy something?'

When these sentences were interpreted as *wh*-questions, the highest pitch point on the *wh*-word was higher than that on the adjacent VP, and the pitch range of the *wh*-word was greater than that of the VP. When they were interpreted as yes/no-questions, on the other hand, the pattern was reversed: the F0 peak and the pitch range were greater for VPs than *wh*-words. Such patterns were observed consistently, regardless of the position of the *wh*-word in the sentence or the relative order between the *wh*-word and the VP. Thus the results of the experiments in Hu (2002) suggest that *wh*-interrogatives are more prominent than the surrounding words, whereas *wh*-indefinites are less prominent in Chinese. More evidence for the correlation between phonological prominence and scope configuration of *wh*-indefinites is expected to be found in other languages, which I leave as future work.

3.7. Conclusion

In this chapter, I have presented two perception experiments involving *wh*-prosody in Korean. The significant implications of the results of those experiments are twofold.

First, they suggest that phonological phrasing has a significant influence in disambiguating the meaning of *wh*-words. It is a more influential factor in perception of *wh*-words than other frequently mentioned factors in the literature such as sentence-final intonation or the prominence of *wh*-words. Sentential boundary tones and phonological prominence help disambiguation only if appropriate phrasing is given. Second, they provide empirical evidence for wide-scope bare *wh*-indefinites, contrary to the previous arguments in the literature that bare *wh*-indefinites cannot take wide scope. Bare *wh*-indefinites in Korean can take either narrow or wide scope with neutral prosody, and assigning phonological prominence on the *wh*-indefinite even introduces preference for a wide-scope reading.

CHAPTER 4

CORPUS STUDIES ON *WH*-PROSODY

4.1. Introduction

This chapter explores the prosodic patterns of *wh*-words in Korean manifested in a spoken corpus. Corpus studies have become an important component of phonetic analyses in recent years, substituting or complementing traditional laboratory production experiments (see Harrington 2010 for a review). Large speech corpora are rich with a variety of prosodic patterns, so findings based on them can be considered quite general. Also, once a corpus is obtained, it facilitates the rapid investigation of multiple data points, in contrast to controlled experiments with human subjects.

The organization of this chapter is as follows. Section 4.2 introduces the Korean speech corpus used for the studies in this chapter. Section 4.3 presents the automatic segmentation system that was developed to annotate the corpus and shows how its performance compares to manual annotation. Section 4.4 presents a pilot study to demonstrate that the annotated corpus is a reliable resource for research on prosody. Section 4.5 outlines the two surveys conducted on the corpus to investigate the prosodic patterns of *wh*-words. Section 4.6 describes the first survey, which examines the relative prominence of *wh*-words depending on their meaning. Section 4.7 describes the second survey, which investigates the phonological phrasing patterns after *wh*-words depending on their meaning. Section 4.8 discusses the results of the two surveys and technical issues to be considered in future studies. Section 4.9 concludes the chapter and identifies future work.

4.2. The corpus

The corpus used in this study is *the database of conversational sentences for speech synthesis* from ETRI (Electronics and Telecommunications Research Institute), published in 2006. It consists of 60 hours of speech data recorded by two professional voice actors, one male and one female. The speakers read excerpts of dialogue from Korean TV shows using Seoul Korean intonation. A similar amount of speech was recorded by each speaker, comprising 49,700 sentences in total (F: 25,400 sentences; M: 24,300 sentences). Recording was done in a soundproof booth (SNR: 40dB) with a Rode NT2 microphone and O2R 2.0 digital recording console. The recorded materials were provided by the distributor in RAW audio format (sample rate: 16kHz), and the transcriptions of the audio files (in Korean orthography) were also provided. I converted the sound files into WAV format, which is more suitable for sound analysis tools such as Praat. Due to the complexities involved in speaker- and gender-normalization, only the speech data from the male speaker were used in the current study.

4.3. Annotation

To make use of speech corpora in any phonetic analysis, annotating the corpus with phonetic transcriptions is a very basic and necessary task. However, the manual annotation of a large speech data set may not be realistic or desirable because not only does it take too much time and effort but also consistency is not always guaranteed due to the continuous nature of the speech signal. Thus I established an automatic annotation system for Korean speech corpora and evaluated its performance in comparison with manual annotation results.

4.3.1. Labeling convention

Barry and Fourcin (1992) define five levels of labeling for speech database recordings as follows.

(25) Labeling levels (Barry and Fourcin 1992)

a. *physical level*: labels are defined solely with reference to physically defined events in an utterance (e.g. periodic, noise, silence, etc.).

b. *acoustic-phonetic level*: labels describe events in the speech signal in terms of established phonetic descriptors (e.g. stop closure, release burst, aspiration, etc.).

c. *narrow-phonetic level*: labels characterize the phonetic quality of speech sounds in terms of a set of phonetic transcription symbols (e.g. IPA).

d. *phonemic level*: labels represent the functionally distinctive sound units of the language.

e. *broad-phonetic level*: labels employ speech-sound symbols that have a phonemic status, but continuous speech phenomena such as reduction and assimilation are reflected.

Among these levels, I adopted the *broad-phonetic* level of labeling for this study, as it is considered to be "the most economical level in that it maximizes phonetic information with minimal symbol complexity (Barry and Fourcin 1992: 11)." Table 10 illustrates three of the levels of labeling with the example word *aykwukca* 'patriot'. Note that while the narrow-phonetic transcription reflects both inter-sonorant voicing (/k/ → [g]) and post-obstruent tensification (/c/ → [c']), the broad-phonetic label does not indicate the former process because voiced/voiceless distinction is not phonemic in Korean. In this sense, broad-phonetic labeling is basically phonemic. However, the broad-phonetic transcription is distinguished from the actual phonemic transcription that is based on

pure citation forms in that the former display the results of phonological processes that have a phonemic status such as tense consonants.

citation	애국자
narrow-phonetic	**æguk**c'a
broad-phonetic	**ækuk**c'a
phonemic	**ækuk**ca

Table 10. Example of different levels of labeling.

The phonetic transcripts used in the actual annotation procedure were based on the Yale system to eliminate the use of special characters in transcription for ease of representation on the computer, as shown in Table 11 and Table 12. In the text of this dissertation, though, I will continue transcribing phonemes in the IPA-style script as in Table 1 and Table 2 introduced in Chapter 1 for familiarity.

		Bilabial	Alveodental	Palatal	Velar	Glottal
Stop	Lax	p	t	c	k	
	Aspirated	ph	th	ch	kh	
	Tense	pp	tt	cc	kk	
Fricative	Aspirated		s			h
	Tense		ss			
Nasal		m	n		ng	
Liquid			l			
Approximant		w		y	v	

Table 11. Symbols for Korean consonants used in the automatic annotation.

	Front	Back

	Unround	Round	Unround	Round
High	i	wi	u	wu
Mid	ey	oy	e	o
Low	ay		a	

Table 12. Symbols for Korean vowels used in the automatic annotation.

4.3.2. Automatic annotation

30 hours of read speech of a single speaker (i.e. the male speaker) from the speech corpus (ETRI 2006) was annotated in the automated procedure. The automatic annotation system consisted of the following two stages.

4.3.2.1. Labeling

The first task was labeling the speech data with phonetic transcriptions. Note that unlike languages like English whose text-to-speech principles are not highly regular, Korean pronunciation is mostly predictable from the orthography according to a relatively small number of rules. The orthographic transcripts of the corpus were available from the distributor. Thus, I first romanized the transcripts of the corpus using a PHP script that I made for this purpose, then applied a finite state model (Yun 2005) to convert the romanized transcripts into phonetic symbols by applying the pronunciation rules of Korean.

4.3.2.2. Alignment

The second task was aligning the phonetic symbols according to the corresponding speech signals. I used Prosodylab-Aligner (Gorman et al. 2011) for this purpose, which has the following technical advantages. First, it provides an end-user interface that encapsulates low-level technical details. Second, it enables a complete automated annotation, without requiring any manual annotation as training material to initialize the

automatic procedure. Third, its mechanism is independent of language-specific features, thus it is easily applicable to any language.

4.3.3. Manual annotation

To evaluate the performance of the automatic system, manual annotation was carried out for part of the corpus. 25 sentences of approximately the same length (i.e. about 20 syllables for each sentence), which comprised 1306 segments in the automatic annotation, were randomly chosen from the corpus for manual annotation.

Three human transcribers including the author participated in this task. All three were native speakers of Korean and had graduate-level training in phonetics. To facilitate a higher degree of consistency among transcribers, criteria for segmentation (cf. Cosi et al. 1991) were discussed before the task started. The principal criteria included the following: all transcribers annotated the sentences using Praat, and its environment parameters were always set to the same values. Segment boundaries were placed at the clearest acoustic events observed via visual and audio inspection of the speech material. Boundaries were placed at zero crossings whenever possible. After establishing the criteria, the actual annotation task was carried out individually.

4.3.4. Comparison

Figure 20 shows an example of segmentation results from the automatic and manual procedures. The first segmentation tier indicates the result of the automatic procedure and the rest of the tiers indicate the result of the manual procedures. The figure illustrates that the results of the automatic and manual segmentations are quite comparable. Quantitative descriptions of the discrepancies between the automatic and manual results are provided in what follows.
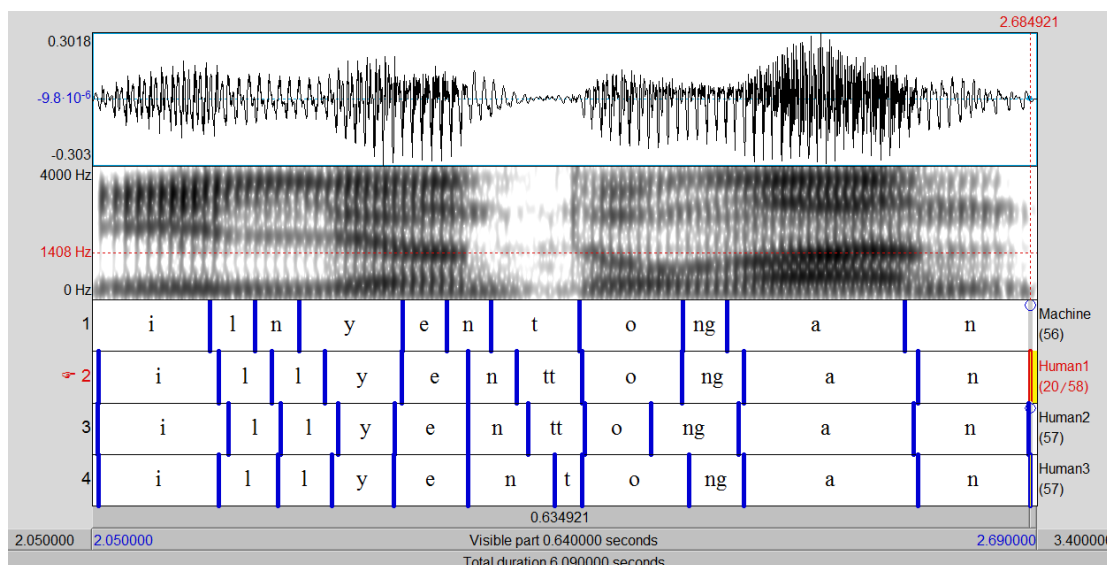
Figure 20. Example of segmentation results from the automatic and manual procedures.

4.3.4.1. Labeling

1245 segments out of the 1306 were assigned the same labels by the automatic system and all human labelers, yielding a 95% rate of agreement. Among the remaining 61 segments, only 23 were unanimously labeled by all of the human transcribers. This suggests that only 2% of the labels (23 out of 1306) can be regarded as definite errors by the automatic system. Most discrepancies between manual and automatic transcriptions were due to optional phonological processes such as inter-sonorant *h*-deletion (9 tokens) or lateralization across word boundaries (4 tokens), or lexically determined processes such as tensification (6 tokens) that are not predicted by a purely rule-based system.

4.3.4.2. Alignment

The time differences of boundaries were measured for the segments that had been identically labeled by all the human transcribers as well as the machine. The boundaries at the beginning and end of each sentence were excluded in the measurement. The

analysis of 1091 such boundaries reveals that the average deviation between machine and human results was 16 ms, whereas the average human-human deviation was 6 ms. This is comparable to results from previous studies such as Wesenick and Kipp (1996) for read German speech (automatic: 18 ms, manual: 10 ms) and Pitt et al. (2005) for spontaneous American English speech (manual only: 16 ms).

Figure 21 exhibits the average deviations of segment boundaries classified by segment type combination. It shows that both automatic-manual and manual-manual deviations were the greatest for vowel-vowel transitions, while the smallest for consonant-vowel transitions. This result suggests that the degree of difficulty in identifying boundaries as it relates to the type of boundary was parallel for humans and the automatic system, corroborating the finding reported in Wesenick and Kipp (1996).
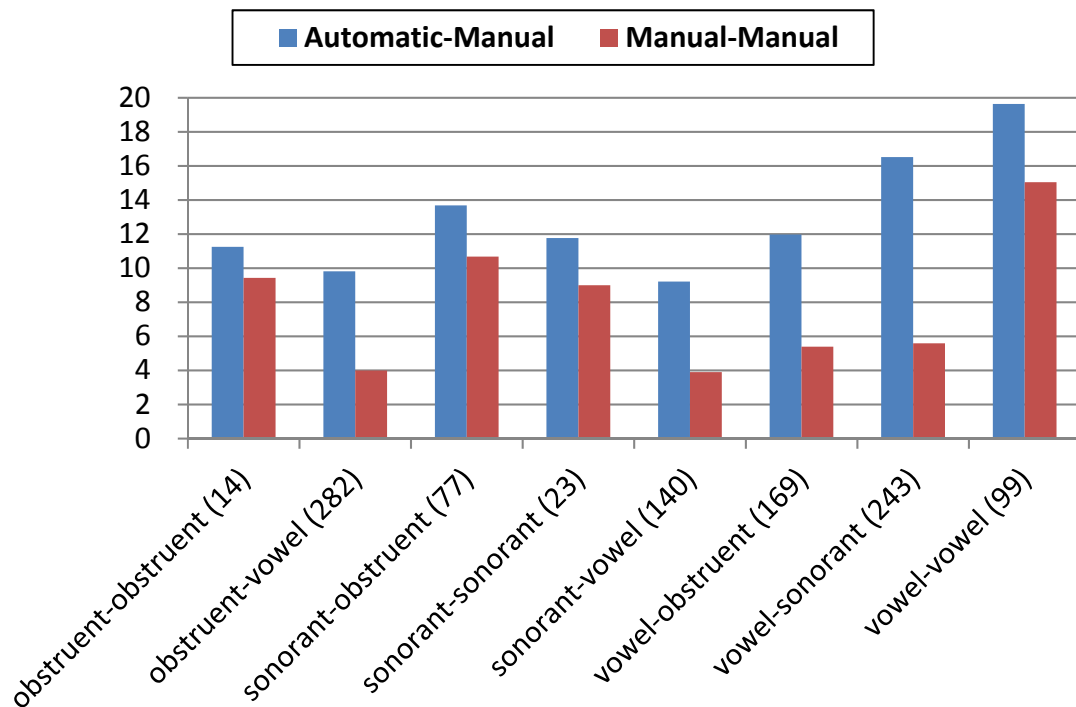
Figure 21. Average deviations of segment boundaries classified by segment type combination.

4.3.5. Conclusion

All in all, the automatic annotation system for Korean introduced above is fairly reliable compared to human transcribers or other automatic systems from previous studies. Thus the segmentation of the speech data presented in the rest of the chapter was based on the results of the automatic procedure, with a small amount of manual correction where necessary.

4.4. A pilot study: word boundary detection

Compared to laboratory speech data sampled under experimental control, the major challenge of using corpora is that it is hard to find minimal pairs of utterances in which only the target factors differ, while other factors remain the same. Even if some minimal pairs are found, whether they constitute a statistically significant amount of data is another problem. Especially in agglutinative languages like Korean, there are many varieties of conjugation forms of the same word, which makes it harder to find a set of the exact same form of the target large enough for meaningful quantitative analysis.

Thus a realistic way to employ the corpus in our research would be to retrieve data constrained by certain criteria (e.g. segmental context and sentential context) which are less strict than the criterion that the target should consist of the exactly same segments. Then the remaining question is whether the non-homogeneous data would be appropriate for validation of theoretical hypotheses. In what follows, a pilot study is carried out to demonstrate the potential of the corpus as a reliable resource for our research.[31]

Let us consider the sentence in (26), which has two completely different syntactic structures depending on the locations of the word boundaries in it. The two readings are

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[31] I thank Mats Rooth for suggesting this pilot study.

differentiated from each other by intonation. As illustrated in Figure 22, the crucial difference lies in where the turning points of the F0 contour are. A local peak is observed on the second syllable for (26)-a, but on the third syllable for (26)-b.

(26)

    a. 엄마   가방에   있다.

        əmma   *kapaŋ-e*   *it-t'a*

        mommy   bag-LOC   exist-DCL

        'It is in mommy's bag.'

    b. 엄마가   방에   있다.

        əmma-ka   *paŋ-e*   *it-t'a*

        mommy-NOM   room-LOC exist-DCL

        'Mommy is in the room.'

a) 2-3
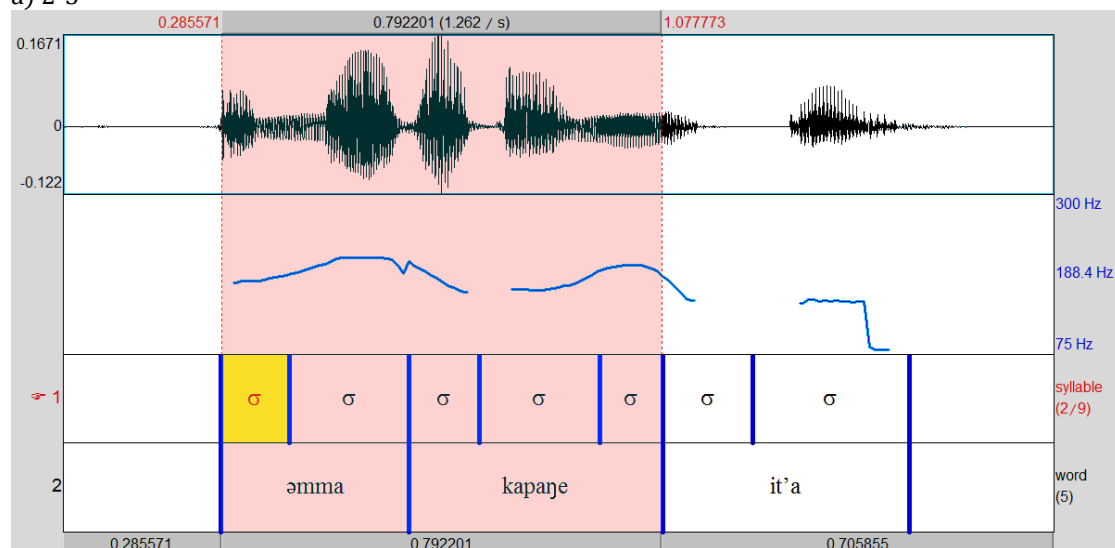
b) 3-2
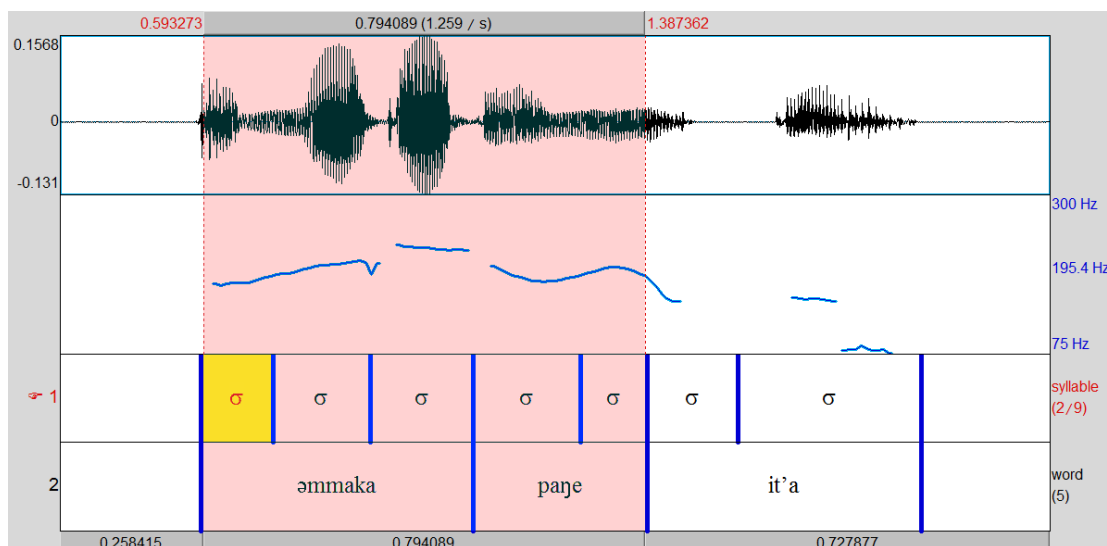
Figure 22. Pitch tracks vary depending on the location of word boundaries.

This difference is predicted by the intonation model of Jun (1993). According to this model, the intonation of a sequence of two APs varies according to the number of syllables in each AP, as illustrated in Figure 23. The perception experiment in Jeon & Nolan (2010) suggests that F0 plays a crucial role in cueing word boundaries, and that the cues are in line with the predictions of the AP model.
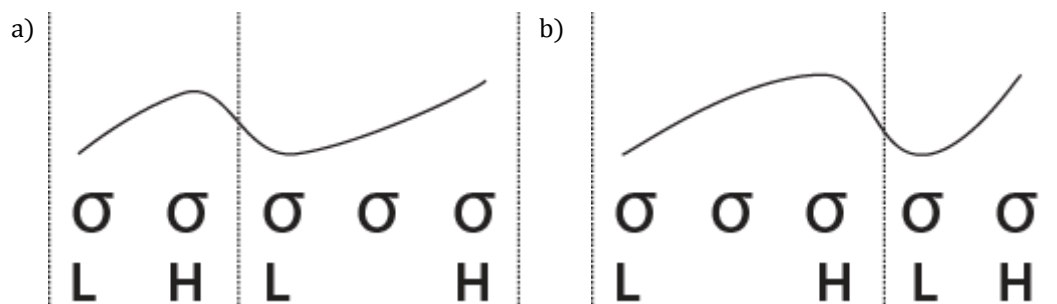
Figure 23. Intonation patterns for the sequence of (a) 2-3 and (b) 3-2.

Note that these intonation patterns are expected to hold for any sequences, regardless of their segmental makeup, as long as the number of syllables in each AP is the same as

the example. Since an AP is known to basically consist of one word in Korean[32], sequences of two words are expected to correspond roughly to sequences of two APs. Thus I ran a query for sequences of two words (excluding interjections and *wh*-words) on the transcripts of the corpus using *Geuljabi II*, a Korean text corpus search tool (Kim & Kang 2001), and extracted two groups from the results. In the first group, the first word consisted of two syllables and the second consisted of three syllables. In the second group, the first word consisted of three syllables and the second consisted of two syllables. The number of syllables in each word could be identified from the transcripts of the corpus since Korean orthography is organized into syllable blocks. The sequences in sentence-final position were excluded because the sentence-final intonational tones override the tones assigned by APs (Jun 1993).

After the target sequences were identified in the transcripts, the corresponding snippets of sound files were extracted from the corpus, based on the time-aligned annotation produced by the automatic procedure introduced in the previous section. To approximate the F0 trend in each target, the F0 value at the midpoint of the interval corresponding to the vowel in each syllable was measured in Praat. The targets were limited to the sequences that consisted of sonorant sounds to facilitate pitch measurement, resulting in 71 instances for the 2-3 group and 54 instances for the 3-2 group.

Table 13 summarizes the F0 measurements from the two groups. The numbers suggest that it is highly likely that the 'turning points' are on the second and third syllables for the 2-3 group and on the third and fourth syllables for the 3-2 group. This in turn suggests that the word boundary is between the second and third syllables for the

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[32] In the production study by Schafer and Jun (2001), one AP corresponded to one word in 90% of their production data. Also, Kim (2004) reported that in her investigation of Korean speech corpora, the average number of content words within an AP was close to one (1.14).

2-3 group and between the third and fourth syllables for the 3-2 group, according to the model in Figure 23. The F0 trends of the 2-3 group and the 3-2 group are made apparent by the boxplots in Figure 24 and Figure 25, respectively. Note that the overall F0 pattern for each group is in accordance with the theoretically predicted pattern in Figure 23.

Group	S1	S2	S3	S4	S5
2-3	138.65	**165.02**	**145.54**	153.70	162.39
	(15.02)	**(15.69)**	**(15.47)**	(12.83)	(16.87)
3-2	138.82	156.57	**167.86**	**138.09**	161.97
	(15.47)	(16.65)	**(18.12)**	**(21.25)**	(16.13)

Table 13. Mean F0 (and standard deviation) (Hz) at the midpoint of the vowel of each syllable for the 2-3 and 3-2 groups.
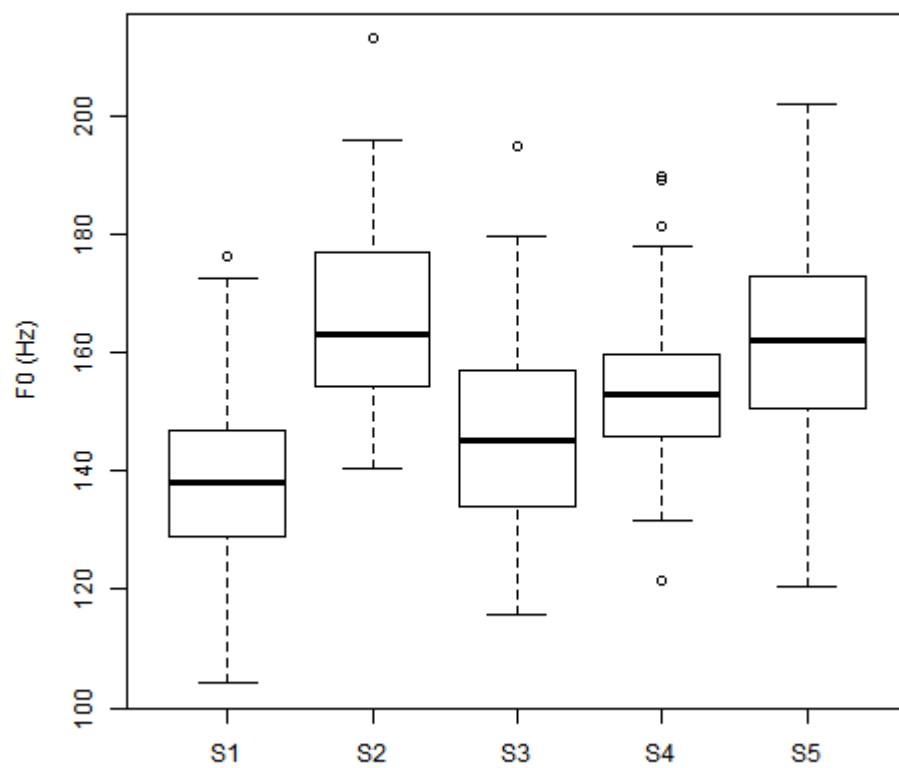
Figure 24. F0 trend for the 2-3 group.
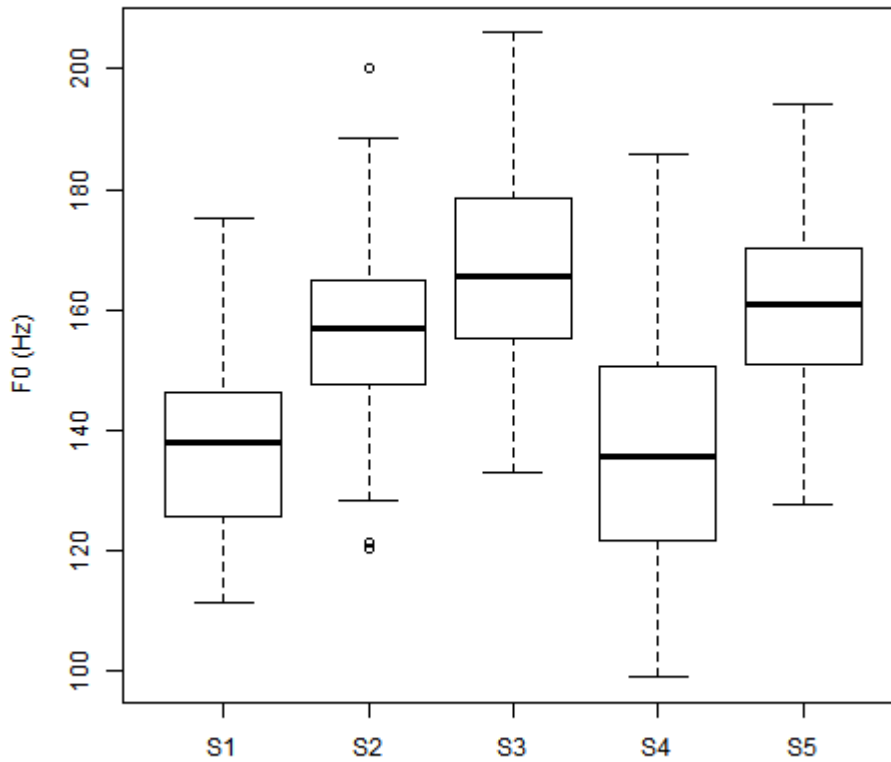
Figure 25. F0 trend for the 3-2 group.

In order to confirm the degree of adherence to this general trend on individual utterances, we can consider representing F0 movements in terms of an increase or decrease in F0 from one syllable to the next. Then we can classify the F0 trends of five-syllable sequences into sixteen possible patterns as in Figure 26. Increases and decreases in the F0 values from one syllable to the next are indicated by '+' and '−', respectively.
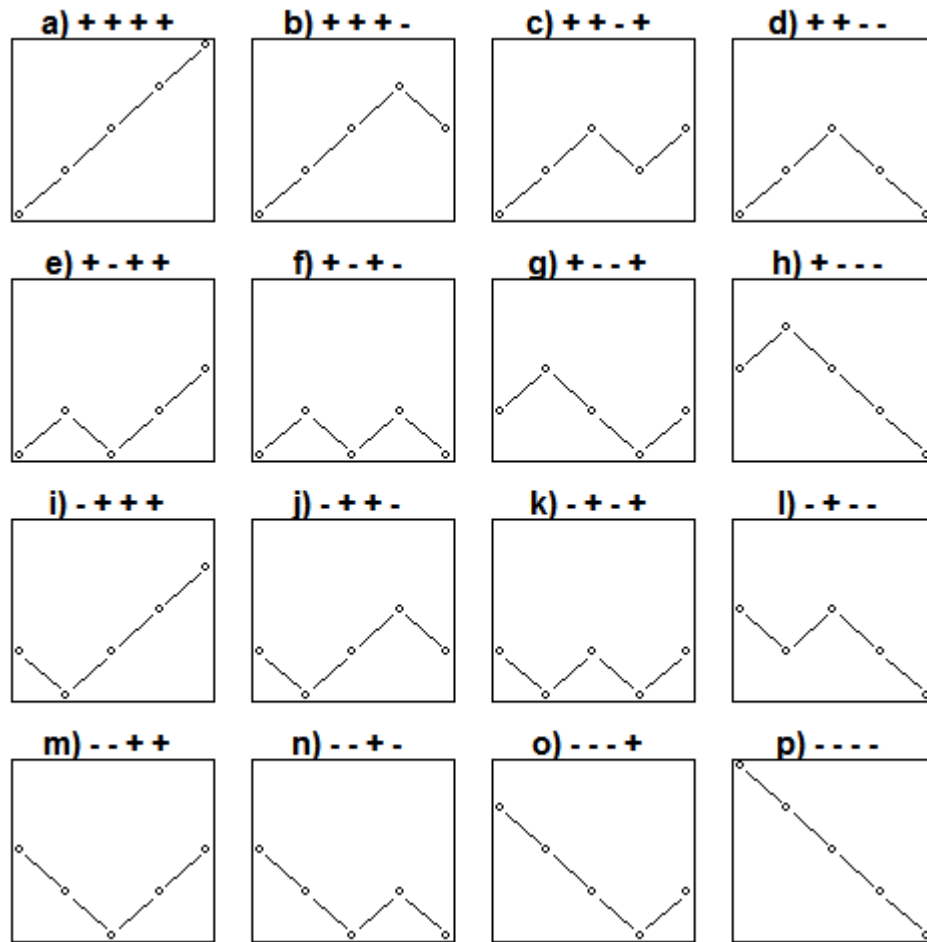
Figure 26. F0 patterns of five-syllable sequences.

Figure 27 and Figure 28 display the frequency of each pattern shown in Figure 26 for the 2-3 group and for the 3-2 group, respectively. As evident in these figures, the patterns of the data in each group are highly concentrated on one specific pattern that coincides with the theoretical prediction: the pattern (e) '$+ - + +$' for the 2-3 group and the pattern (c) '$+ + - +$' for the 3-2 group.
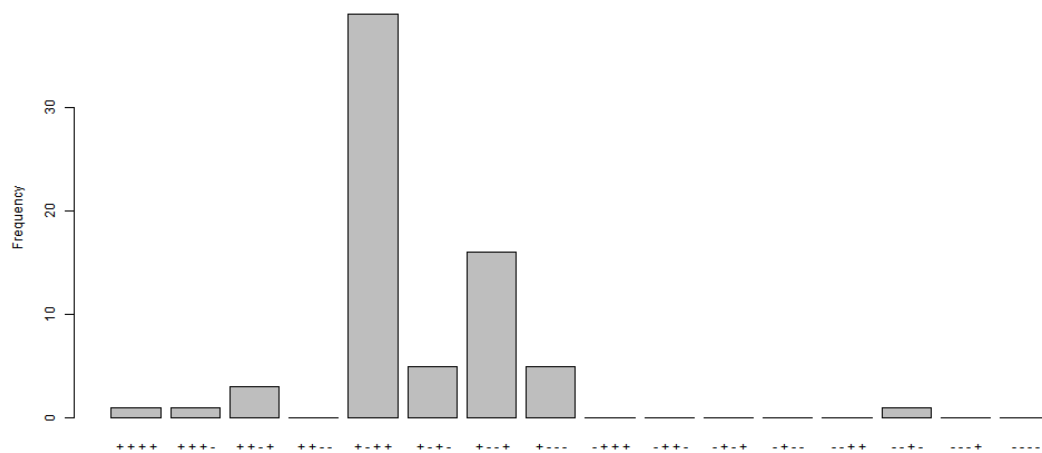
Figure 27. F0 movement patterns in the 2-3 group.
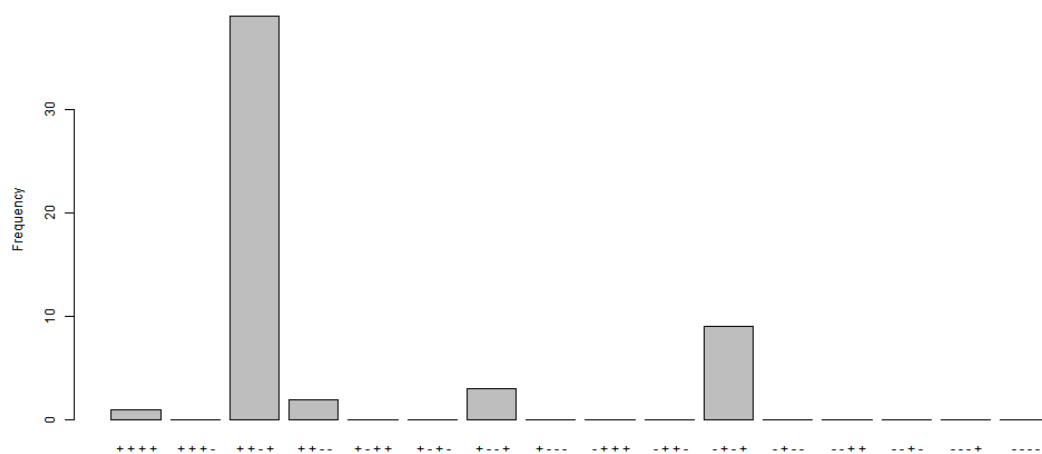
Figure 28. F0 movement patterns in the 2-3 group.

These results demonstrate that the given corpus can be a reliable resource to check the validity of theoretical hypotheses and experimental findings. In the next two sections, the corpus will be put to use to investigate questions about the interaction of *wh*-words and prosody.

4.5. Overview of surveys

Two surveys regarding *wh*-prosody were conducted on the corpus. The purpose of the surveys was to confirm that the assumptions made for the perception experiments in Chapter 3 hold for the corpus data. Recall that phonological prominence on the *wh*-word and phonological dephrasing after the *wh*-word are the factors that have been argued in the literature to distinguish *wh*-questions from other types of sentences in Korean. Thus, I investigated the prosodic effects of the semantics of *wh*-words; in the first survey I looked at their relative prominence, and in the second survey I looked at the patterns of phonological phrasing on portions of the utterance following the *wh*-words.

4.6. Survey 1: prominence of *wh*-words

The first survey concerns the effect of semantics on the relative prominence of *wh*-words.

4.6.1. Hypothesis

As mentioned in Chapter 3, a number of researchers have argued that in Korean, *wh*-interrogatives are phonologically prominent, while *wh*-indefinites are not (Chang 1973, Choe 1985, Kang 1988, C.-S. Suh 1989, Cho 1990, A.-R. Kim 2002). However, it has not been made clear in those studies about what phonetic factor would be a cue to phonological prominence. Thus all the phonetic cues commonly considered to be related to prominence, including duration, fundamental frequency, and intensity (Wagner & Watson 2010), are considered in this study. The hypothesis being tested in the survey was that some or all of those phonetic cues to prominence are measured as higher for *wh*-interrogatives than *wh*-indefinites.

4.6.2. Targets

The number of syllables in the *wh*-phrase was controlled to minimize variations irrelevant to the interest of this study. As two-syllable phrases were most frequent among the *wh*-phrases in the given corpus, I have selected *wh*-phrases consisting of two syllables as the target of investigation in Survey 1.

(27)   List of *wh*-words for Survey 1

    a. 누가 /nu.ka/ 'who/someone' (nominative)

    b. 누굴 /nu.kul/ 'who/someone' (accusative)

    c. 뭐가 /mwə.ka/ 'what/something' (nominative)

    d. 뭐를 /mwə.rɨl/ 'what/something' (accusative)

    e. 어디 /ə.ti/ 'where/somewhere'

    f. 어딜 /ə.til/ 'where/somewhere' (accusative)

    g. 언제 /ən.ce/ 'when/sometime'

The meaning of the target word (i.e. whether it is interrogative or indefinite) was determined by inspecting the context. Note that there are cases where a *wh*-word is used as neither an interrogative nor an indefinites. For instance, *mwe* /mwə/ or *eti* /əti/ can be inserted in a sentence (typically in an adverbial position) for a pragmatic purpose to attract attention. Such uses of *wh*-words as interjections were excluded from the study. Sentences with multiple occurrences of *wh*-words were also excluded. In the end, 251 tokens of *wh*-interrogatives and 100 tokens of *wh*-indefinites were selected from the transcripts of the corpus[33].

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[33] There are still a variety of factors to be controlled, such as speech rate, overall pitch range (which itself is governed by many factors, including paralinguistic factors like emotional state and attitude), and phrase/utterance position. In this study, I have assumed that the rates of variation due to all uncontrolled

(28)   Groups of targets for Survey 1

   a. *wh*: *wh*-words with a *wh*-interrogative reading

   b. *ind*: *wh*-words with an indefinite reading

(29)   Number of targets in Survey 1

	wh	ind
/nu.ka/	43	43
/nu.kul/	6	0
/mwə.ka/	89	8
/mwə.rɨl/	2	1
/ə.ti/	56	37
/ə.til/	22	2
/ən.ce/	33	9
Total	251	100

4.6.3. Procedure

For each target word found in the transcript, the corresponding sound file was extracted
from the speech corpus in the way described in Section 4.4. Four phonetic factors that
could be correlated with prominence were measured in Praat: a) peak F0 (the maximum
F0), b) pitch range (the difference between the maximum and minimum F0 values), c)
duration, and d) intensity (the maximum amplitude).

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factors will be roughly the same for the sampling of the two groups. While this assumption does not seem
to seriously undermine the validity of the surveys as discussed in Section 4.8, better controlled surveys
would be desirable in future work.

4.6.4. Results

Table 14 summarizes the measurements of each possible phonetic correlate to prominence, and the corresponding boxplot is presented in Figure 29. While F0 peak and duration were only marginally different between the two groups of targets (F0 peak: $t(151.80) = 1.74$, $p = .084$; duration: $t(153.87) = 1.94$, $p = .054$), pitch range and intensity were significantly higher for *wh*-interrogatives than for *wh*-indefinites (pitch range: $t(194.62) = 2.85$, $p < .01$; intensity: $t(174.64) = 2.87$, $p < .01$).

	Peak F0	Pitch Range	Duration	Intensity
wh	173.29	58.97	332.03	173.29
	(16.81)	(19.95)	(106.12)	(16.81)
ind	168.71	52.04	358.50	168.71
	(20.77)	(18.29)	(197.14)	(20.77)

Table 14. Mean values (and standard deviations) of phonetic correlates to prominence.
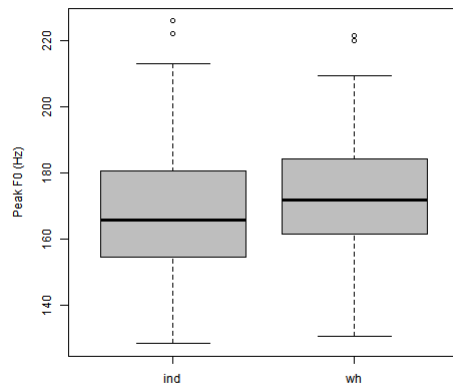
a) Peak F0   b) Pitch Range
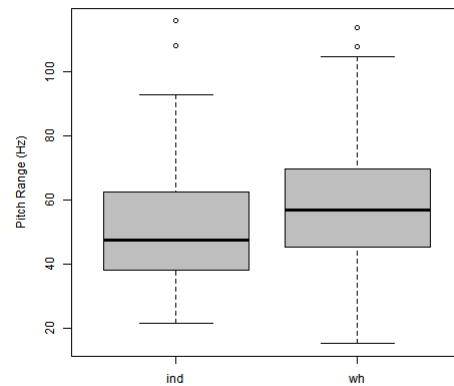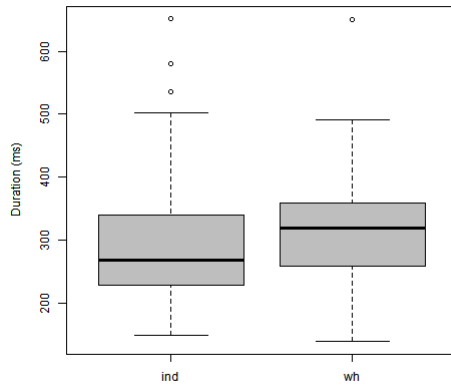
c) Duration   d) Intensity
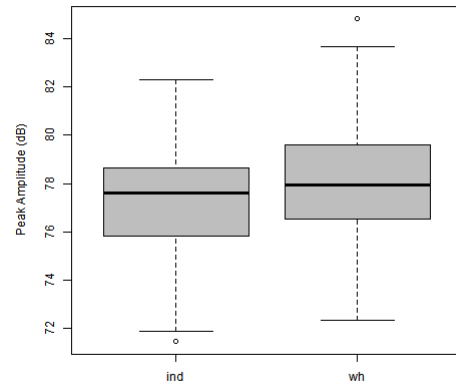
Figure 29. Measurements of phonetic correlates to prominence.

4.7. Survey 2: post-*wh* dephrasing

The second survey concerns the effect of semantics on post-*wh*-word phrasing patterns.

4.7.1. Hypothesis

In Chapter 3, I established a model for the prosody of *wh*-questions by applying the typological argument in Richards (2010) to the intonation model of Seoul Korean in Jun (1993). The basic assumptions of the model are repeated below:

(30)   Basic assumptions of the AP model in Chapter 3

    a. In *wh*-questions, the *wh*-word and the following words until the complementizer constitute a single AP (Cf. Jun & Oh 1996; Richards 2010).

    b. The basic tonal pattern of an AP is THLH (T is either L or H). The first two tones are assigned to the first two syllables of the AP, and the last two tones are assigned to the last two syllables. The pitch values of the syllables in between

the second and the penult of the AP are decided by interpolating between the H tone on the second syllable and the L tone on the penult (Jun 1993).

Based on the above assumptions, sentences with *wh*-words are expected to exhibit different prosody patterns depending on the reading of the *wh*-word, as illustrated in Figure 31. (The first tones in the APs in this illustration are chosen to be L for simplicity.) The pitch contour between the *wh*-word and the complementizer fluctuates in the case of *wh*-indefinites, whereas it is smoothed out in the case of *wh*-interrogatives.

σ σ ... σ σ σ σ ... σ σ σ σ ... σ σ σ σ ... σ σ
L H   L H L H   L H L H   L H L H   L T%
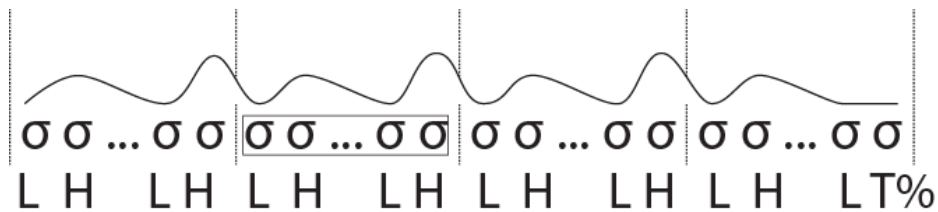
Figure 30. Representative F0 contours of *wh*-indefinites.

σ σ ... σ σ σ σ ... σ σ σ σ ... σ σ σ σ ... σ σ
L H   L H L H   L T%
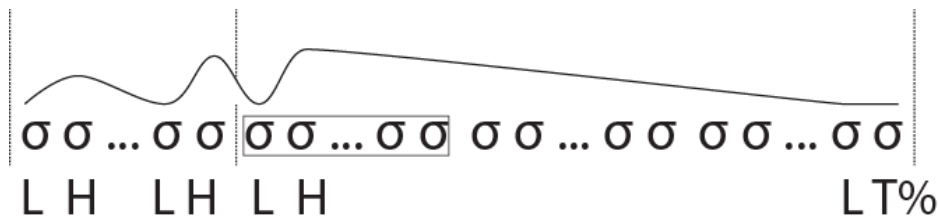
Figure 31. Representative F0 contours of *wh*-interrogatives.

According to these assumptions, the F0 contour of the area that starts with the *wh*-word and ends with the complementizer in *wh*-questions can be stylized with four points: the F0 values on the first two syllables and those on the last two syllables. The curve connecting these four points is a reasonable approximation to the F0 contour of a *wh*-question predicted by the AP model, as illustrated in Figure 32.

150
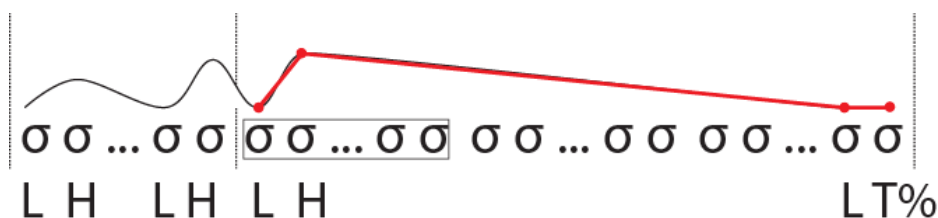
Figure 32. The four-point model superimposed with Figure 30.

On the other hand, the curve drawn in the same way for *wh*-indefinites significantly deviates from the F0 contour predicted by the AP model, as illustrated in Figure 33.
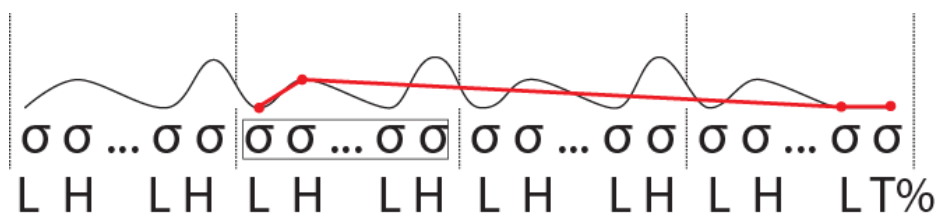
Figure 33. The four-point model superimposed with Figure 31.

If we assume that the AP model correctly predicts the actual F0 contour of the sentence, we can expect that the meaning of a sentence containing a *wh*-word can be decided depending on whether the actual F0 contour fits into the straight line model in the critical region (i.e. *wh*-word ~ complementizer). Note, however, that the actual F0 contour of *wh*-questions could deviate from the model line to some extent due to microvariations for the production of consonants and macrovariations according to the speaker's emotion and attitude. Thus, I added a third group of targets consisting of non-*wh* words for the purpose of comparison. The hypothesis to be tested in the survey is that the amount of deviation from the straight line model is significantly lower for *wh*-interrogatives, whereas it is similarly high for *wh*-indefinites and non-*wh* words.

4.7.2. Targets

The lists of *wh-* and non-*wh* words relevant to this survey are presented in (31) and (32), respectively. As in Survey 1, *wh*-phrases consisting of two syllables were chosen for this survey. Non-*wh* phrases were chosen among those syntactically and phonemically similar to the *wh*-phrases.

(31)   List of *wh*-words for Survey 2

    a. 누가 /nu.ka/ 'who/someone' (nominative)

    b. 누굴 /nu.kul/ 'who/someone' (accusative)

    c. 뭐가 /mwə.ka/ 'what/something' (nominative)

    d. 뭐를 /mwə.rɨl/ 'what/something' (accusative)

    e. 어디 /ə.ti/ 'where/somewhere'

    f. 어딜 /ə.til/ 'where/somewhere' (accusative)

    g. 언제 /ən.ce/ 'when/sometime'

(32)   List of non-*wh* words for Survey 2

    a. 내가 /næ.ka/ 'I' (nominative)

    b. 나를 /na.rɨl/ 'I' (accusative)

    c. 이게 /i.ke/ 'this' (nominative)

    d. 이걸 /i.kəl/ 'this' (accusative)

    e. 여기 /jə.ki/ 'here'

    f. 여길 /jə.kil/ 'here' (accusative)

    g. 어제 /ə.ce/ 'yesterday'

Sentences containing the above target words were collected from the corpus. Among those sentences, a subset of those sentences that satisfy the following restrictions was

selected for the survey: the target word was located in the matrix clause and the corresponding complementizer coincided with the end of the sentence so that the model line could be defined for all the sentences in the same way, in terms of the first two syllables of the target word and the last two syllables of the sentence. Also, the post-target portion of the sentence contained more than two syllables so that there were one or more syllables between the second and penultimate syllables.

The selected sentences were classified into three groups according to the type of the target words as shown in (33). The meaning of each *wh*-word was decided by inspecting the context, as in Survey 1. The number of target sentences selected from the transcript of the corpus in the end is given in (34).

(33)   Groups of targets for Survey 2

   a. *wh*: *wh*-words with a *wh*-interrogative reading

   b. *ind*: *wh*-words with an indefinite reading

   c. *reg*: non-*wh* words

(34)   Number of targets in Survey 2

	wh	ind		reg
/nu.ka/	23	18	/næ.ka/	245
/nu.kul/	3	0	/na.rɨl/	10
/mwə.ka/	65	4	/i.ke/	45
/mwə.rɨl/	0	0	/i.kəl/	10
/ə.ti/	27	15	/jə.ki/	59
/ə.til/	11	1	/jə.kil/	3
/ən.ce/	20	6	/ə.ce/	11
	149	44		383

4.7.3. Procedure

Figure 34 illustrates the actual F0 contour of an arbitrary target sentence (indicated by the blue line) and the F0 contour predicted by the AP model in the case that the sentence is a *wh*-question (indicated by the black line). The crucial task of the survey was to measure the deviation of the blue line from the black line. To approximate such a measurement, I stylized the F0 contour of target sentences as a series of points that correspond to the F0 values at the midpoint of the vowel of each syllable, as in the pilot study described in Section 4.4. Thus, the problem can be reduced to measuring the amount of deviation by those points from the model. As the first two and last two points must coincide with the model by definition, measurements were taken only for the third through the antepenultimate points, as indicated by red dotted lines in Figure 34. The method for measurement is described in detail in (35).
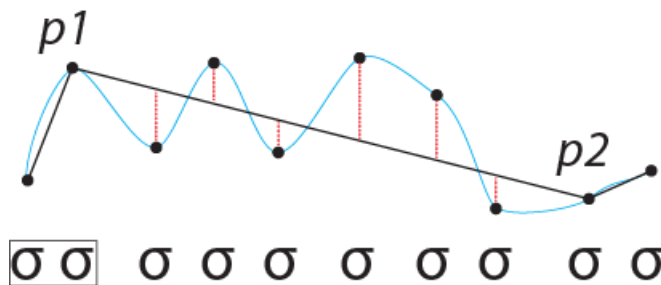
Figure 34. The four-point model of the F0 contour of *wh*-questions.

(35)   Method of measurement for Survey 2

   a.   Take a sequence of words from the *wh*-word to the complementizer of the clause that contains the *wh*-word.

   b.   Take the second (s1) and the penultimate (s2) syllables from the sequence.

   c.   Draw a straight line between p1= (x1,y1) and p2 = (x2, y2) such that

          x1: time at the midpoint of the vowel of the s1,

y1: F0 at x1,

x2: time at the midpoint of the vowel of the s2, and

y2: F0 at x2.

d. For the syllables in between s1 and s2, measure the difference between the F0 value on the p1-p2 line and the actual F0 value. Calculate the root-mean-square deviation (RMSD) of the model for those syllables.[34]

During the procedure, the points at which F0 measurement failed ('--undefined--' in Praat) were excluded from the calculation of the RMSD. If F0 measurement failed on the second or penultimate syllable, the entire sentence was excluded from the survey because the model could not be established. In the end, the RMSD of the model was calculated for 147 sentences containing *wh*-interrogatives, 38 sentences containing *wh*-indefinites, and 344 sentences containing non-*wh* words were selected from the transcript of the corpus.

4.7.4. Results

Table 13 summarizes the RMSD of the AP model for each sentence, and the corresponding boxplot is presented in Figure 35. A one-way ANOVA test showed that there was a significant effect of the target type on deviation ($F(2, 526) = 50.43$, $p < .001$), and post-hoc comparisons using the Tukey HSD test indicated that the average deviation was significantly lower for the *wh* group than the other two groups *ind* or *reg* ($p < .001$),

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[34] Root-mean-square deviation (RMSD) is a widely used statistical measure to describe how close the values predicted by a model are to the observed values. If the values predicted by the model is $\hat{t}_1, \hat{t}_2, \ldots, \hat{t}_n$ and the observed values are $t_1, t_2, \ldots, t_n$, the RMSD of the model is calculated in the following way:

$$\text{RMSD} = \sqrt{\frac{\sum_{i=1}^{n}(t_i - \hat{t}_i)^2}{n}}$$

whereas there was no significant difference found between the *ind* and *reg* groups (p = .786).

wh	ind	reg
10.76	21.05	19.97
(7.60)	(8.94)	(10.36)

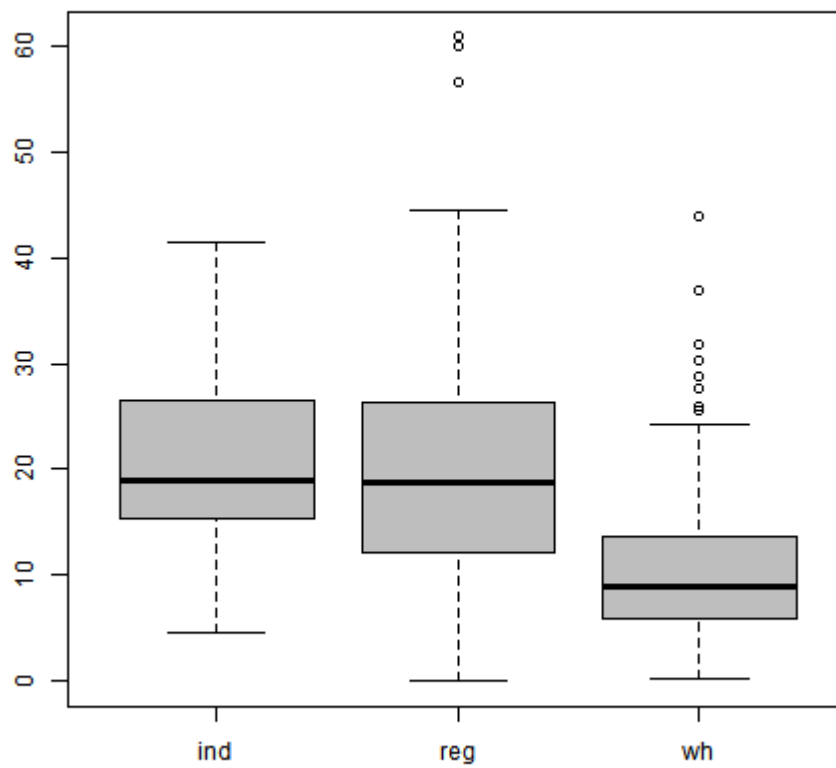Table 15. Mean (and standard deviations) of RMSD of the AP model.

Figure 35. RMSD of the AP model for each group in Survey 2.

4.8. Discussion

The results of the two surveys on the speech corpus are in accordance with the assumption about the prosodic characteristics of *wh*-questions made for the perception experiments in Chapter 3, namely prominence on the *wh*-word and dephrasing after the *wh*-word. The results of Survey 1 suggest that *wh*-interrogatives are more prominent than *wh*-indefinites in terms of pitch range and intensity, and the results of Survey 2 suggest pitch movement after *wh*-interrogatives shows less fluctuation than that for *wh*-indefinites, which indicates the loss of the L or H tones assigned by AP phrasing.

I should note at this moment that the data set for Survey 2 was not quite homogeneous in nature because arbitrary sequences of words following the target words were the object of study in Survey 2. Ideally, various factors regarding the post-target materials should be controlled, such as the number of words and syllables after the target. Unfortunately, the current data set, especially the *ind* group, is not large enough for meaningful quantitative analyses if they are further divided according to more controlled conditions. While I leave it to future research to investigate an expanded data set, for the moment I will show a representative subset of the given data to demonstrate the potential of the current methodology and to find out what should be considered in future studies.

Table 16 shows the distribution of the number of words after the target word in each of the sentences investigated in Survey 2. As shown in the table, the most frequent pattern was that the target word was followed by two words. Among the sentences with this pattern (52 *wh*, 17 *ind*, and 106 *reg*), I selected for visual inspection those in which the number of syllables after the target was between five and nine. There were exactly twelve sentences in the *ind* group that satisfied this condition, and the first twelve occurrences of this condition were selected from both the *wh* group and the *reg* group for comparison. The stylized F0 contours of those selected sentences from the *wh*, *ind*,

and *reg* groups are presented in Figure 36, Figure 37, and Figure 38, respectively. In these figures, the dots indicate the F0 value at the midpoint of each vowel. The sequence of black lines connecting the dots is presented to help visualize the fluctuation of the F0 contour[35]. The red line connecting the F0 values at the second and the penultimate syllables in the target region indicates the contour predicted by the model.

Number of words	1	**2**	3	4	5	6	7	8	9	10
Frequency	152	**175**	98	76	41	19	7	2	2	2

Table 16. Number of the words after the target word in sentences for Survey 2.

---

[35] Note that the actual F0 trend could deviate from the sequence of those lines connecting dots to some extent because i) the points at which F0 measurement failed in Praat were excluded from the plot, ii) there could be non-linear pitch movement within a syllable that causes local minimum or maximum to appear somewhere other than in the midpoint of the vowel.
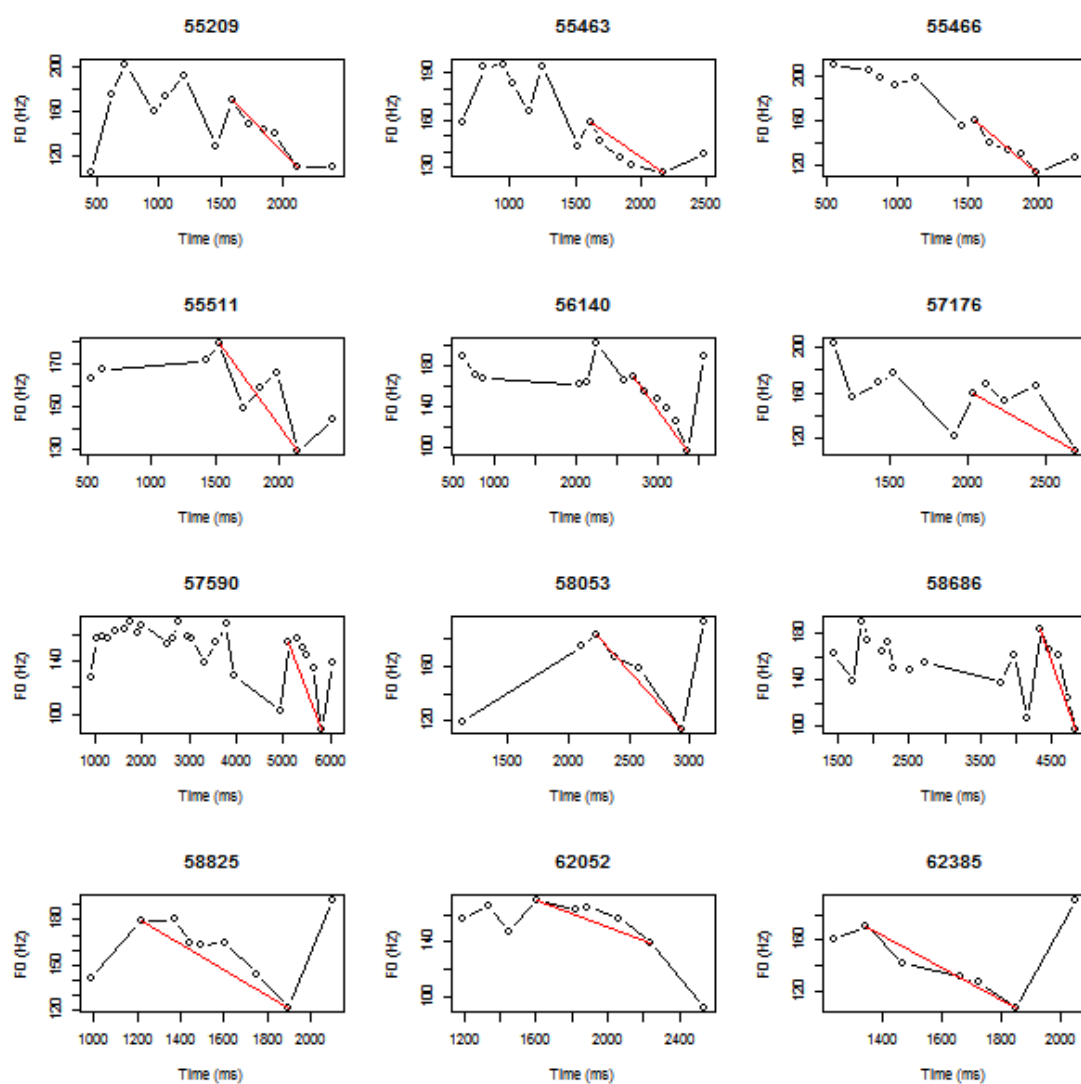
Figure 36. Examples of stylized F0 contours from the *wh* group.
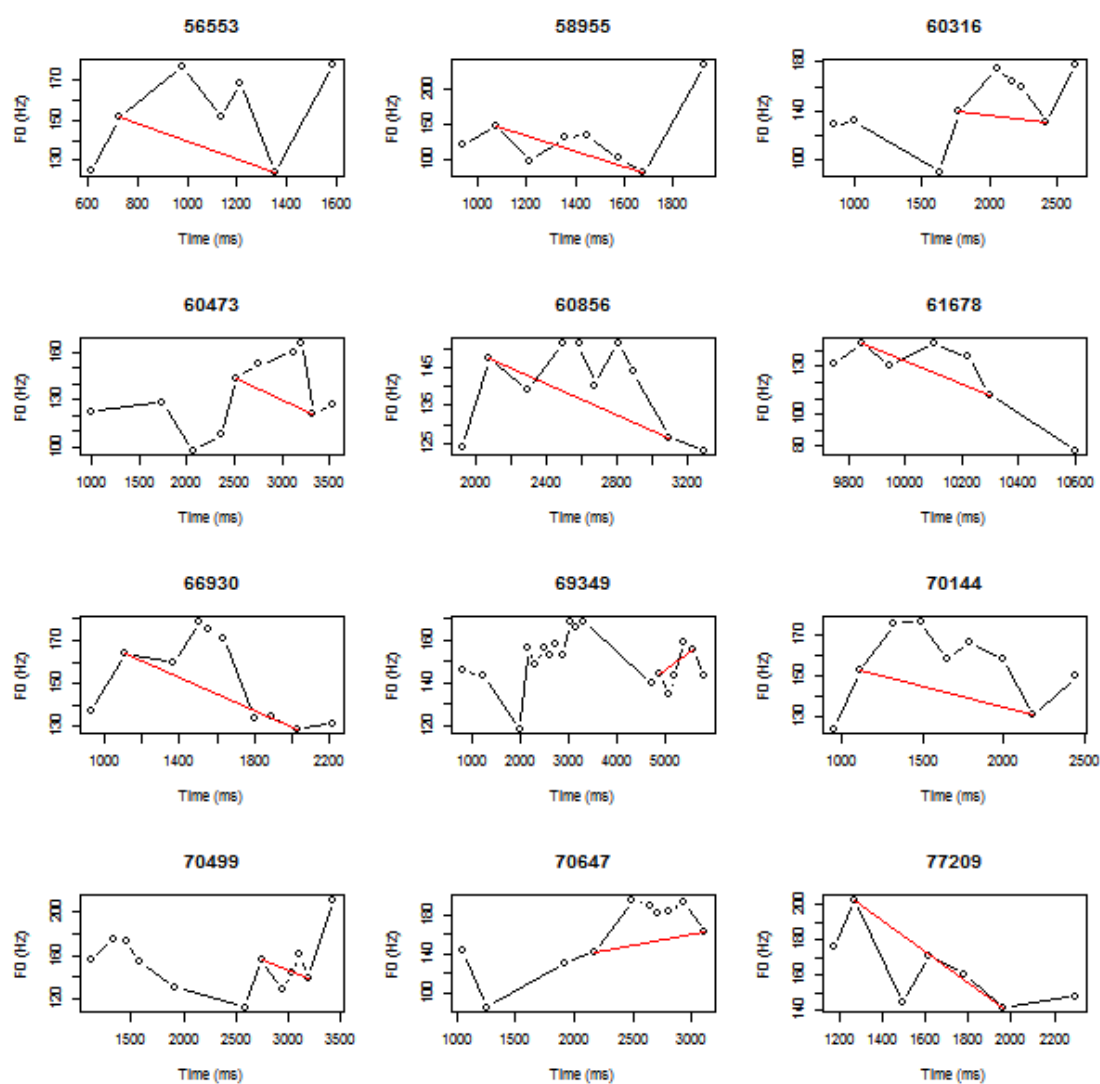
Figure 37. Examples of stylized F0 contours from the *ind* group.
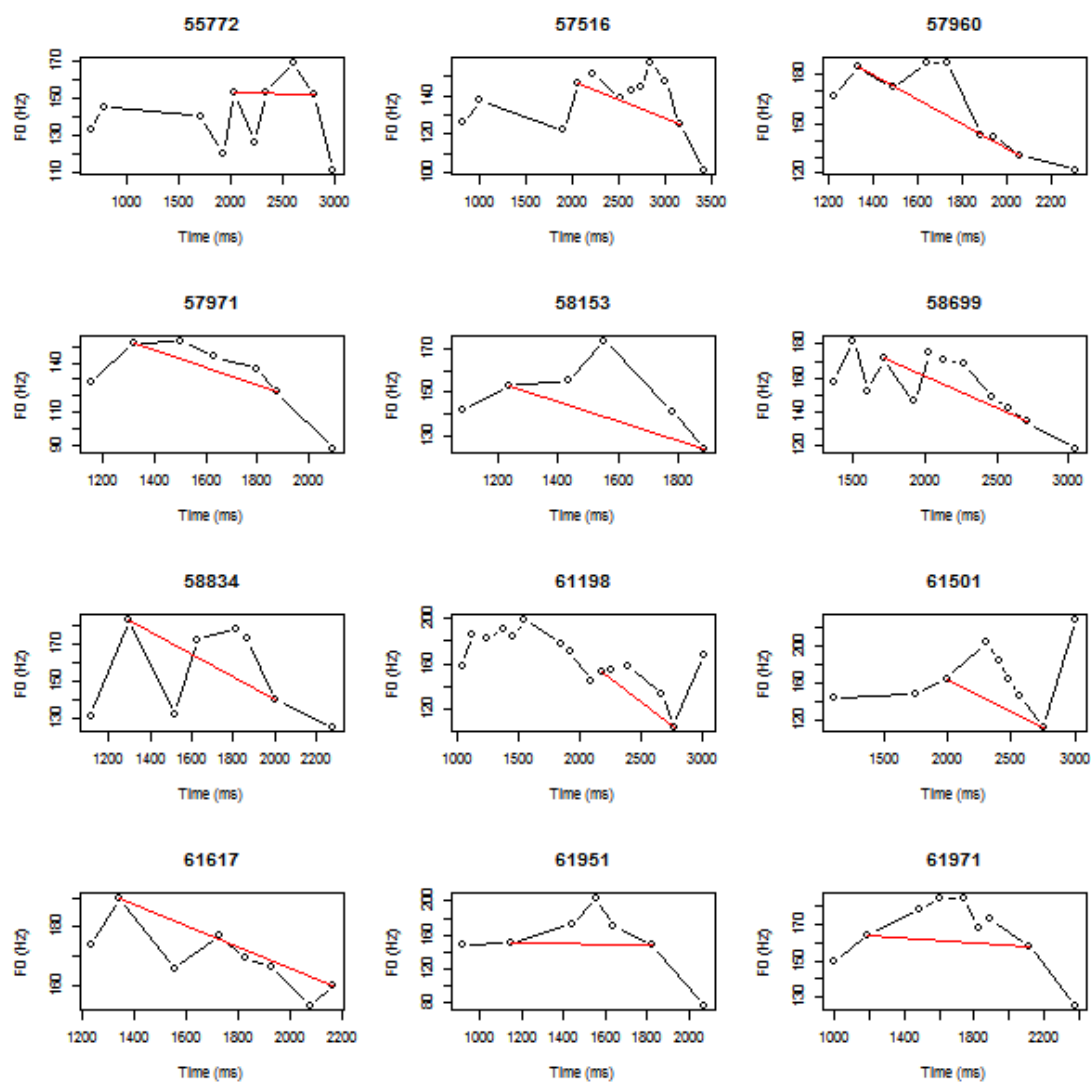
Figure 38. Examples of stylized F0 contours from the *reg* group.

Although the sampling size is small, the plots in the above figures exhibit the general trend that the stylized F0 contour is closer to the model (red line) in the case of the *wh* group than it is in the case of the *ind* or *reg* groups. This trend observed in the more controlled subset of the data coincides with the trend implied by the statistical measurement (i.e. RMSD) over the entire data set, as shown in Figure 35. Thus, though the entire data set was not quite homogeneous, it seems more likely that the statistical results we saw in the previous section reflected a consistent tendency rather than a biased pattern due to external factors or outliers.

Further inspection of apparent exceptions to the trend in the samples suggests what should be considered in designing a future study. Let us take a look at two examples that demonstrate a relatively high degree of deviation from the model in the *wh* group in Figure 36: the sentences numbered 57176 (RMSD=23.33) and 55511 (RMSD=16.02). First, the apparent major fluctuation of the pitch track of sentence 57176 in (36) is mainly due to the fact that the F0-tracking algorithm in Praat was unable to accurately measure the fundamental frequency of high vowels that were preceded by /pʰ/ or /s/ because they contained a high degree of noise. Future studies would benefit from controlling for this type of measuring error.

(36)　　57176

　　　어디　가고　싶으신데요

　　　/ə.ti　ka.ko　si.pʰɨ.sin.te.jo/

　　　eti　　kako　　siphusinteyyo

　　　where　go　　want

　　　'Where do you want to go?'
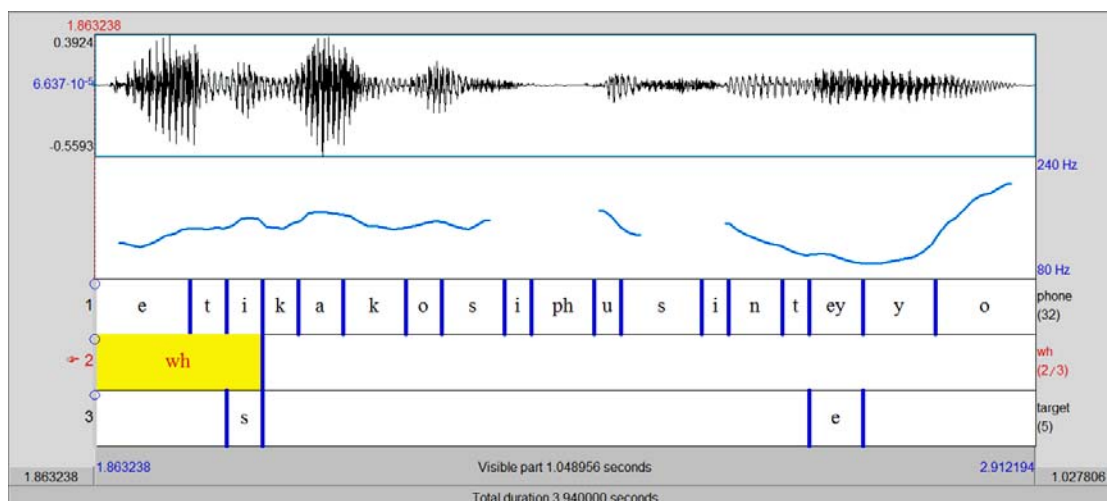
Figure 39. Pitch track for sentence 57176.

On the other hand, the fluctuation in the stylized F0 contour of sentence 55511 in (37) does appear to be associated with the tones assigned by APs. In the pitch track for this sentence, shown in Figure 40, a local valley is observed at the beginning of the post-*wh* word, which suggests that the L tone on the first syllable of the post-*wh* word was maintained and that dephrasing did not occur after the *wh*-word even though the sentence was a *wh*-question. Is this a counterexample to post-*wh* dephrasing in *wh*-questions? To answer this, let us compare this sentence with a sentence that contains a *wh*-indefinite found in the corpus that provides us a pseudo-minimal pair, as shown in (38). Note that the 'local valley' at the beginning of the post-*wh* word is more extreme in the *wh*-indefinite sentence, as shown in the pitch track in Figure 41. Thus, it might be the case that *wh*-questions do not always involve complete post-*wh* dephrasing in production, although a certain degree of pitch-smoothing still does occur after the *wh*-word. If this is actually the case, how should it be interpreted? There are two possible explanations. It might be the case that 'post-*wh* pitch smoothing' in Seoul Korean is independent of phonological phrasing, similarly to what has been argued for Tokyo Japanese by Ishihara (2007). In Tokyo Japanese, the pitch range of post-*wh* words is

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compressed but major phrase boundaries are still considered to be present after the *wh*-word as the accents of post-*wh* words are maintained. Thus, Ishihara argued that post-*wh* pitch compression in Tokyo Japanese is independent of phonological phrasing. Alternatively, it might be the case that persistent AP boundaries in *wh*-questions observed in the corpus data were due to irregularity in production rather than some real phonological property. If this is the case, incomplete post-*wh* dephrasing should lead to a degraded rate of acceptability as *wh*-questions in perception. In fact, my own impression upon listening to the sound file of the sentence in (37) is that it is not impossible to interpret this sentence as a *yes/no*-question instead of a *wh*-question. For clarification on this issue, a perception study on the corpus data should be included in future work.

(37)   55511

뭐가   잘못된   걸까

/mwə.ka   cal.mot.'tøn   kəl.k'a/

Mwe-ka   *calmostoy-n*   *ke-l-kka*

what-NOM   wrong-ADN   fact-PRS-Q

'What is wrong?'
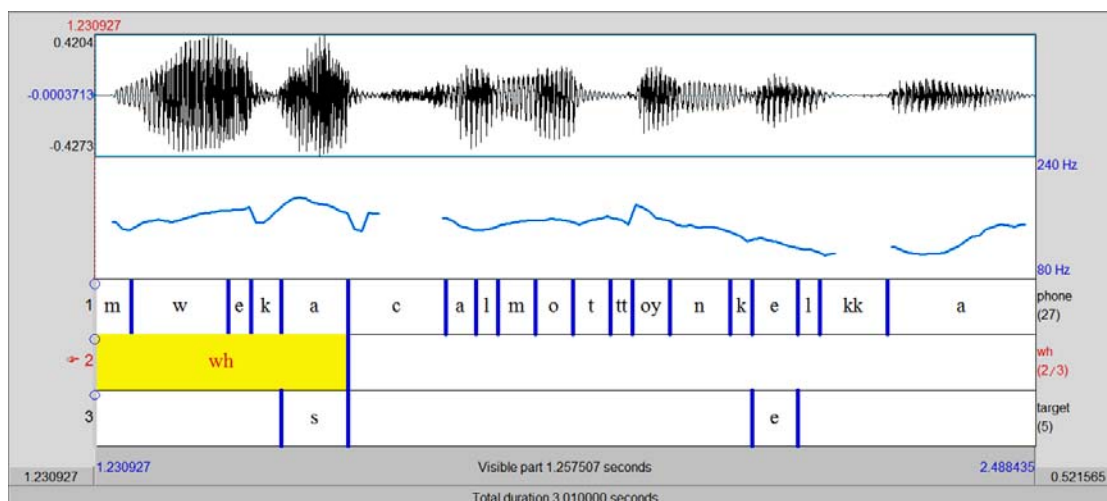
Figure 40. Pitch track for sentence 55511.

(38) 77209

뭐가 잘못됐겠지

/mwə.ka cal.mot.t'wæt.k'et.c'i/

Mwe-ka calmostway-ss-keyss-ci

what-NOM wrong-PST-may-INT

'There may be something wrong.'
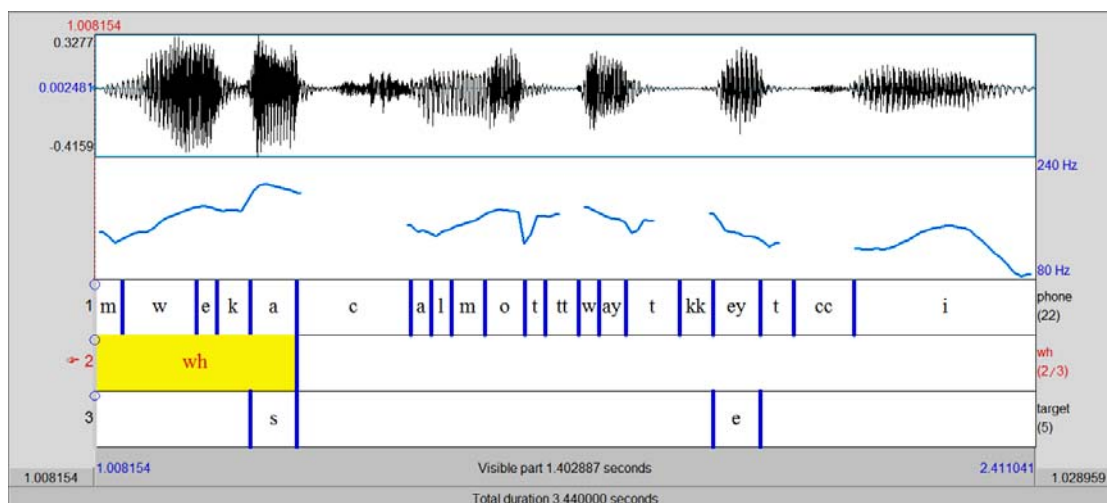
Figure 41. Pitch track for sentence 77209.

4.9. Conclusion

In this chapter, I used a Korean speech corpus to investigate the prosodic patterns of *wh*-words in production. The first survey showed that *wh*-interrogatives were associated with greater pitch range and higher peak amplitude compared to *wh*-indefinites, and the second survey showed that a smoother F0 contour was observed between the target word and the sentence-final complementizer when the target was a *wh*-interrogative, compared to the cases where the target was a *wh*-indefinite or a non-*wh* word. The findings from the two surveys in this chapter coincide with the theoretical assumptions regarding *wh*-prosody made in Chapter 3 that *wh*-words are marked with prominence and followed by dephrasing in the case of *wh*-questions but not in cases where the *wh*-words are indefinites.

Preliminary as it is, what has been shown in this chapter seems promising for testing models of the semantics-prosody interface. Once a larger, better-controlled data set is obtained, a possible topic for future research is the statistical classification of *wh*-interrogatives and *wh*-indefinites based on the acoustic properties examined in this chapter, using machine learning techniques such as Linear discriminant analysis (LDA) (Fisher 1936) or Support vector machines (SVMs) (Boser, Guyon & Vapnik 1992). Observing which property makes a more reliable contribution to the classification would provide a clue to which of the strategies (i.e. assigning prominence on the *wh*-word or dephrasing post-*wh* words) is more consistently employed by the speaker to express the intended readings of *wh*-words.

CHAPTER 5

CONCLUSION

The dissertation has explored the semantics and prosody of *wh*-indefinites and the interplay between them. The following highlights the central findings of the dissertation.

Chapter 2 investigated the semantics of bare and complex *wh*-indefinites. It identified a cross-linguistic pattern that bare *wh*-indefinites (BWIs) appear in more restricted environments than complex *wh*-indefinites (CWIs) and proposed that while a bare *wh*-word must be licensed properly to receive an indefinite reading, the additional morphology in a CWI functions as an internal licenser and thus they can freely appear in any environment. It also brought to attention the previously unnoticed issue of the apparent ability of Korean BWIs to bear wide-scope readings.

Chapter 3 investigated the effect of prosody on the perception of *wh*-indefinites and *wh*-interrogatives. The results of perception experiments in Korean presented in this chapter suggest that dephrasing after the *wh*-word is more influential than prominence on the *wh*-word or sentence-final intonation when it comes to deciding whether the *wh*-word is an indefinite or an interrogative. The experimental results also demonstrated that a wide-scope interpretation of a *wh*-indefinite is fostered by phonological prominence on the *wh*-word.

Chapter 4 investigated the prosodic patterns of *wh*-indefinites and *wh*-interrogatives in production. The results of surveys on a Korean speech corpus presented in this chapter suggest that *wh*-interrogatives are more prominent than *wh*-indefinites, as the former were associated with greater pitch range and higher peak amplitude, and that *wh*-interrogatives involve post-*wh* dephrasing in that the F0 contour after the *wh*-word was smoothed.

Many of the findings in this dissertation are still preliminary, and as such they call for a substantial amount of future work. The generalization on the semantics of *wh*-indefinites made in Chapter 2 is based on only a subset of the languages that have *wh*-indefinites, and it needs to be verified against the entire set of such languages. Also, the possibility of exceptional wide-scope BWIs, including the placeholder use of bare *wh*-expressions, should be further explored in more languages.

In Chapter 3, only phonetic correlates of phonological prominence along the dimension of fundamental frequency were considered; other acoustic factors such as intensity should be taken into consideration in future studies. Also, while the perception study in this chapter suggests that phonological prominence promotes a wide-scope interpretation of *wh*-indefinites, it has yet to be shown whether wide-scope BWIs are systematically realized with prominence in production. Finally, sentences that contain multiple *wh*-words are also a topic for future research; questions to be answered regarding this topic include if both indefinite and interrogative *wh*-words can appear in the same sentence and, if so, what the possible prosodic patterns of such sentences are.

In the corpus study in Chapter 4, many factors including speech rate, overall pitch range, and phrase/utterance position remained uncontrolled due to the limited size of the data set. A more refined study on a larger corpus data is needed to confirm the findings in this chapter. Another topic for future study is the statistical classification of *wh*-words based on the acoustic properties correlated to *wh*-prominence and post-*wh* dephrasing. It would provide some clues to which of the properties is more consistently present in production.

The transcripts of stimuli in the perception experiments in Chapter 3 are listed below. Note that in most cases pronouns are covert and their interpretation is derived from the context.

Experiment 1

1. 윤아는 누가 오라고 하면 올 거 같아

   Yuna-nun   nwu-ka   o-lako ha-myen   o-l ke kath-a

   Yuna-TOP   who-NOM   come-tell-if   come-might-INT

   (Lit. 'Yuna might come if [who/someone] tells her to come')

   i)   'Yuna might come if anyone tells her to come.'

   ii) 'There is someone such that Yuna might come if that person tells her to come.'

   iii) 'Who is the person such that Yuna might come if that person tells her to come?'

2. 인터넷에서 누구를 욕하면 잡혀가

   Intheneys-eyse   nwukwu-lul   yokha-myen   caphyeka

   Internet-on   who-ACC   badmouth-if   arrested.INT

   (Lit. '[*pro*] will be arrested if [*pro*] speaks ill of [who/someone] on the Internet')

   i)   'You will be arrested if you speak ill of someone on the Internet.'

   ii) 'There is someone such that you will be arrested if you speak ill of that person on the Internet.'

   iii) 'Who is the person such that I will be arrested if I speak ill of that person on the Internet?'

3. 내가 누구하고 결혼하면 돈을 받아

Nay-ka   nwukwu-hako kyelhonha-myen   ton-ul   pat-a

I-NOM   who-with   marry-if   money-ACC   get-INT

(Lit. '[*pro*] will receive money if I marry [who/someone].')

i) 'I will receive money if I marry someone.'

ii) 'There is someone such that I will receive money if I marry that person.'

iii) 'Who is the person such that I will receive money if I marry that person?'

4. 이 문제는 누구한테서 도움을 받으면 풀 수 있겠어

I mwuncey-nun   nwukwu-hantheyse   towum-ul   pat-umyen

this problem-TOP   who-from   help-ACC   receive-if

phwu-l swu iss-keyss-e

solve-can-might-INT

(Lit. '[*pro*] will be able to solve this problem if [*pro*] gets help from

  [who/someone]')

i) 'You will be able to solve this problem if you get help from someone.'

ii) 'There is someone such that you will be able to solve this problem

    if you get help from that person.'

iii) 'Who is the person such that I will be able to solve this problem

    if I get help from that person?'

5. 이 병은 뭐를 먹으면 나아

I   pyeng-un   mwe-lul   mek-umyen   na-a

this   illness-TOP   what-ACC   eat-if   cured-INT

(Lit. 'This illness will be cured if [*pro*] eats [what/something].')

i) 'This illness will be cured if you eat something.'

ii) 'There is something such that this illness will be cured if you eat it.'

iii) 'What is the thing such that this illness will be cured if I eat it?'

Experiment 2

1. 지금 뭐 해

   cigɨm   mwə   hæ

   now   what   do.INT

   i)   'I'm doing something now.'

   ii) 'Are you doing something now?

   iii) 'What are you doing now?'

2. 내일 뭐 할 거야

   nayil   mwe   ha-l ke-ya

   tomorrow   what   do-FUT-INT

   i)   'I'm going to do something tomorrow.'

   ii) 'Are you going to do something tomorrow?

   iii) 'What are you going to do tomorrow?'

APPENDIX B

The transcripts of the selected corpus data in Survey 2 in Chapter 4 are given below.

1. *wh*-interrogatives

55209 어머님 지갑을 [누가] 가져간 거야

ə.mə.nim ci.ka.pɨl [nu.ka] ka.cjə.kan kə.ja

55463 지가 하는 일이 [뭐가] 있다고 피곤해

ci.ka ha.nɨn i.ri [mwə.ka] it.t'a.ko pʰi.kon.hæ

55466 상 차리는 게 [뭐가] 일이라 그래

saŋ cʰa.ri.nɨn ke [mwə.ka] i.ri.ra kɨ.ræ

55511 도대체 [뭐가] 잘못된 걸까

to.tæ.cʰe [mwə.ka] cal.mot.t'øn kəl.k'a

56140 그건 그렇구, 거기선 [뭐가] 또 좋았는데요

kɨ.kən kɨ.rə.kʰu, kə.ki.sən [mwə.ka] t'o co.an.nɨn.te.jo

57176 그럼 엄마는 [어디] 가고 싶으신데요

kɨ.rəm əm.ma.nɨn [ə.ti] ka.ko si.pʰɨ.sin.te.jo

57590 [어딜] 가자구 졸라요

[ə.til] ka.ca.ku col.la.jo

58053 엄마, [뭐가] 드시고 싶는데요

əm.ma, [mwə.ka] tɨ.si.ko sim.nɨn.te.jo

58686   다들 [어디] 가신 거예요

ta.tɨl [ə.ti] ka.sin kə.je.jo

58825   [언제] 들어오실 건데요

[ən.ce] tɨ.rə.o.sil kən.te.jo

62052   내가 [언제] 스트레스를 줬냐

næ.ka [ən.ce] sɨ.tʰi.re.sɨ.rɨl cwən.nja

62385   [뭐가] 맞는다는 거야

[mwə.ka] man.nɨn.ta.nɨn kə.ja

2. *wh*-indefinites

56553   [누가] 그걸 모르나요

[nu.ka] kɨ.kəl mo.rɨ.na.jo

58955   [누가] 애기를 낳았니

[nu.ka] æ.ki.rɨl na.an.ni

60316   내 말에 [어디] 틀린데 있어요

næ ma.re [ə.ti] tʰɨl.lin.te i.s'ə.jo

60473   어제 둘이 [어딜] 막 가더라구요

ə.ce tu.ri [ə.tɨl] mak ka.tə.la.ku.jo

60856   치, [누가] 범생이 아니랄까봐

cʰi, [nu.ka] pəm.sæŋ.i a.ni.lal.k'a.pwa

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61678   [어디] 아픈데 없구

        [ə.ti] a.pʰin.te əp.k'u

66930   [어디] 다녀오는 길이세요

        [ə.ti] ta.njə.o.nɨn ki.ri.se.jo

69349   아유, 남의 원단이나 베끼던 솜씨라 [뭐가] 잘 안되네요

        a.ju, na.mɰi wən.ta.ni.na pe.k'i.tən som.s'i.ra [mwə.ka] cal an.tø.ne.jo

70144   [누가] 까딱까딱 졸래요

        [nu.ka] k'a.t'ak.k'a.t'ak col.læ.jo

70499   천천히 마셔, [누가] 잡으러 오니

        cʰən.cʰə.ni ma.sjə, [nu.ka] ca.pɨ.rə o.ni

70647   어머, [누가] 청탁이나 했어요

        ə.mə, [nu.ka] cʰəŋ.tʰa.ki.na hæ.s'ə.jo

77209   [뭐가] 잘못 됐겠지

        [mwə.ka] cal.mos twæt.k'et.c'i

3. non-*wh* words

55772   아이구 이거 [내가] 제일 꼴찌네

        a.i.ku i.kə [næ.ka] ce.il k'ol.c'i.ne

57516   만약에 [내가] 백사만원을 긁었다

        ma.nja.ke [næ.ka] pæk.sa.ma.nwə.nɨl kɨl.kət.t'a

57960   [여기] 동전이 보이잖아

            [jə.ki] toŋ.cə.ni po.i.ca.na

57971   [내가] 빼 볼테니까

            [næ.ka] p'æ pol.tʰe.ni.k'a

58153   [내가] 적극 권했어

            [næ.ka] cək.k'ɨk kwə.næ.s'ə

58699   그래서 [내가] 잘못했다 그러잖아요

            kɨ.ræ.sə [næ.ka] cal.mo.tʰæ.t'a kɨ.rə.ca.na.jo

58834   [이게] 눈에 띠어서요

            [i.ke] nu.ne t'ɰi.ə.sə.jo

61198   보람 할머니는 꼬옥 [여기] 와서 드시구요

            po.ram hal.mə.ni.nɨn k'o.ok [jə.ki] wa.sə tɨ.si.ku.jo

61501   아니, [이게] 천원이란 말야

            a.ni, [i.ke] cʰə.nwə.ni.ran ma.rja

61617   [여기] 곰장어 왔습니다

            [jə.ki] kom.caŋ.ə wat.s'ɨm.ni.ta

61951   [여기] 돈이 있구요

            [jə.ki] to.ni it.k'u.jo

61971   [여기] 검은색으로 신어요

            [jə.ki] kə.mɨn.sæ.kɨ.ro si.nə.jo

REFERENCES

Abusch, Dorit. 1994. The Scope of Indefinites. *Natural Language Semantics* 2.83-135.

Aldridge, Edith. 2007. *Wh*-indefinites and their relation to *wh*-in-situ. *Proceedings of the Annual Meeting of the Chicago Linguistics Society* 43.139-53.

Barry, W. J. & A. J. Fourcin. 1992. Levels of labelling. *Computer Speech and Language* 6.1-14.

Boser, Bernhard E, Isabelle M Guyon & Vladimir N Vapnik. 1992. A training algorithm for optimal margin classifiers. In *Proceedings of the fifth annual workshop on Computational learning theory*. 144-152.

Bruening, Benjamin. 2007. *Wh*-in-Situ does not correlate with *wh*-Indefinites or question particles. *Linguistic Inquiry* 38.139-66.

Carlson, Greg N. 1977. *Reference to kinds in English*. PhD Dissertation. University of Massachusetts, Amherst.

Chang, Suk-Jin. 1973. A generative study of discourse: pragmatic aspects of Korean with reference to English. *Ehak yenkwu* [Language Research] 9.2 (supplement).

Cheng, Lisa Lai-Shen Cheng. 1991. *On the Typology of Wh-Questions*. MIT dissertation.

Cheung, Yam-Leung. 2011. Uttering the unutterable with *wh*-placeholders. Paper presented at the *85th annual meeting of Linguistic Society of America*, Pittsburgh, Pennsylvania.

Cho, Young-mee Yu. 1990. Syntax and phrasing in Korean. *The phonology-syntax connection*, 47-62.

Choe, Jae-Woong. 1985. Pitch-accent and *q/wh* words in Korean. *Harvard studies in Korean linguistics* 1.113-23.

Chung, Dae-Ho. 1996. *On the representation and licensing of Q and Q-dependency*. PhD Dissertation. University of Southern California.

Cooper, William E., Stephen J. Eady & Pamela R. Mueller. 1985. Acoustical aspects of contrastive stress in question–answer contexts. *The Journal of the Acoustical Society of America* 77.2142-56.

Cosi, Piero, Daniele Falavigna & Maurizio Omologo. 1991. A preliminary statistical evaluation of manual and automatic segmentation discrepancies. *Proceedings of Eurospeech 91*.

Dong, Hongyuan. 2009. *Issues in the semantics of Mandarin questions.* PhD Dissertation. Cornell University.

Eady, Stephen J. & William E. Cooper. 1986. Speech intonation and focus location in matched statements and questions. *The Journal of the Acoustical Society of America* 80.402.

Fisher, Ronald A. 1936. The use of multiple measurements in taxonomic problems. *Annals of eugenics* 7.179-88.

Fodor, Janet Dean & Ivan A. Sag. 1982. Referential and quantificational indefinites. *Linguistics and Philosophy* 5.355-98.

Fry, Dennis B. 1955. Duration and intensity as physical correlates of linguistic stress. *The Journal of the Acoustical Society of America* 27.765-68.

Fry, Dennis B. 1958. Experiments in the perception of stress. *Language and Speech* 1.126-52.

Ganenkov, Dmitry, Yury Lander & Timur Maisak. 2010. From interrogatives to placeholders in Udi and Agul spontaneous narratives. In *Fillers, Pauses, and Placeholders*: John Benjamins Publishing Company.

Ha, Seungwan. 2004. The existential reading of *wh*-words and their scope relations. *Proceedings of the Annual Meeting of the Chicago Linguistics Society* 40.83-95.

Hagstrom, Paul Alan. 1998. *Decomposing Questions*. PhD Dissertation. MIT.

Harrington, Jonathan. 2010. *Phonetic analysis of speech corpora*. Wiley-Blackwell.

Haspelmath, Martin. 1997. *Indefinite Pronouns*: Oxford University Press.

Heim, Irene. 1982. *The Semantics of Definite and Indefinite Noun Phrases*. PhD Dissertation. University of Massachusetts, Amherst.

Hintikka, Jaakko. 1986. The semantics of *a certain*. *Linguistic Inquiry* 17.331-36.

Howell, Jonathan & Mats Rooth. 2009. Web harvest of minimal intonational pairs. *Proceedings of the Fifth Web as Corpus Workshop*. 45-52.

Hu, Fang. 2002. A prosodic analysis of *wh*-words in Standard Chinese. Paper presented to the *Speech Prosody 2002*, Aix-en-Provence, France, 2002.

Hur, Woong. 1991. *Kwukeumwunhak* [Korean Phonology]. Saym Mwunhwasa: Seoul.

Hwang, Heeju. 2007. *Wh*-Phrase Questions and Prosody in Korean. *Proceedings of the 17th Japanese/Korean Linguistics Conference*. 295-310.

Im, Hong-Bin. 1998. *An in-depth analysis of Korean grammar* 3 [in Korean]: Payhaksa, Seoul, Korea.

Ionin, Tania. 2010. The scope of indefinites: an experimental investigation. *Natural Language Semantics* 18.295-350.

Ishihara, Shinichiro. 2002. Invisible but audible *wh*-scope marking: *Wh*-constructions and deaccenting in Japanese. *Proceedings of the 21st West Coast Conference*.180-93.

Ishihara, Shinichiro. 2007. Major phrase, focus intonation, multiple spell-out (MaP, FI, MSO). *The Linguistic Review* 24.137-67.

Jang, Youngjun. 1999. Two types of question and existential quantification. *Linguistics* 37.847-69.

Jeon, Hae-Sung & Francis Nolan. 2010. Segmentation of the Accentual Phrase in Seoul Korean. Paper presented to *the Speech Prosody 2010*.

Jun, Sun-Ah. 1993. *The phonetics and phonology of Korean prosody*. PhD Dissertation. University of California, Los Angeles.

Jun, Sun-Ah & Mira Oh. 1996. A prosodic analysis of three types of *wh*-phrases in Korean. *Language and Speech* 39.37-61.

Kang, Myung-Yoon. 1988. *Topics in Korean syntax: Phrase structure, variable binding and movement*. PhD Dissertation. MIT.

Kim, Ae-Ryung. 2000. *A Derivational Quantification of "WH-Phrase"*. PhD Dissertation. Indiana University.

Kim, Hung-gyu and Beom-mo Kang. 2001. 21st Century Sejong Project - Compiling Korean Corpora. In *Proceedings of the 19th International Conference on Computer Processing of Oriental Languages*.

Kim, Sahyang. 2004. *The role of prosodic phrasing in Korean word segmentation*. PhD Dissertation. University of California, Los Angeles.

Kitagawa, Yoshihisa. 2005. *Wh*-scope puzzles. *Proceedings from the 35th Annual Meeting of the North Eastern Linguistic Society (NELS 35)*.

Kochanski, Greg, Esther Grabe, John Coleman & Burton Rosner. 2005. Loudness predicts prominence: Fundamental frequency lends little. *The Journal of the Acoustical Society of America* 118.1038-54.

Kratzer, Angelika. 1998. Scope or pseudoscope? Are there wide-scope indefinites? *Events and grammar*, 163-96: Kluwer Academic Publishers.

Kratzer, Angelika & Junko Shimoyama. 2002. Indeterminate pronouns: The view from Japanese. Paper presented to the *3rd Tokyo Conference on Psycholinguistics*, 2002.

Kuroda, Sige-Yuki. 1965. *Generative grammatical studies in the Japanese language*. PhD Dissertation. MIT.

Kwon, Jae-Il. 2002. Korean interrogative sentences in spoken discourse [in Korean]. *Hangeul* 257.167-200.

Ladd, D. Robert. 1996. *Intonational phonology*: Cambridge University Press.

Lee, Iksop & S. Robert Ramsey. 2000. *The Korean Language*: State University of New York Press.

Lee, Ho-Young. 1990. *Kwukewunyullon* [Korean Prosody]: Hankwukyenkwuwen [Korean Study Institute].

Lee, Ki Moon & Chin-Wu Kim & Sang Oak Lee. 1984. *Kwukeumwunlon* [Korean Phonology]: Hakyensa, Seoul, Korea.

Li, Yen-Hui Audrey. 1992. Indefinite *Wh* in Mandarin Chinese. *Journal of East Asian Linguistics* 1. 125-155.

Lieberman, Philip. 1960. Some acoustic correlates of word stress in American English. *The Journal of the Acoustical Society of America* 32.451-54.

Lin, Jo-Wang. 1998. On existential polarity *wh*-phrases in Chinese. *Journal of East Asian Linguistics* 7. 219-55.

Lohndal, Terje. 2010. More on Scope Illusions. *Journal of Semantics* 27.399-407.

Martin, Samuel E. 1951. Korean Phonemics. *Language* 27.519-33.

Martin, Samuel E. 1992. *A reference grammar of Korean: A complete guide to the grammar and history of the Korean language*: Tuttle Publishing.

Matthewson, Lisa. 1999. On the interpretation of wide-scope indefinites. *Natural Language Semantics* 7.79-134.

Milsark, Gary Lee. 1974. *Existential sentences in English*. PhD Dissertation. MIT.

Moulines, Eric & Francis Charpentier. 1990. Pitch-synchronous waveform processing techniques for text-to-speech synthesis using diphones. *Speech Communication* 9.453-67.

Pierrehumbert, Janet & Mary Beckman. 1988. *Japanese tone structure*: The MIT press.

Pitt, Mark A., Keith Johnson, Elizabeth Hume, Scott Kiesling & William Raymond. 2005. The Buckeye corpus of conversational speech: labeling conventions and a test of transcriber reliability. *Speech Communication* 45.89-95.

Postma, Gertjan. 1994. The indefinite reading of WH. *Linguistics in the Netherlands* 1994.187-98.

Ramchand, Gillian Catriona. 1997. Questions, polarity and alternative semantics. Paper presented to *NELS 27*.

Reinhart, Tanya. 1997. Quantifier scope: how labor is divided between QR and choice functions. *Linguistics and Philosophy* 20.335-97.

Rodman, Robert. 1976. Scope phenomena, 'movement transformations', and relative clauses. *Montague grammar*, 165-76. New York: Academic Press.

Richards, Norvin. 2010. *Uttering trees*: The MIT Press.

Rooth, Mats. 1985. *Association with focus*. PhD Dissertation. University of Massachusetts, Amherst.

Ross, John R. 1967. *Constraints on variables in syntax*. PhD Dissertation. MIT.

Selkirk, Elisabeth. 1984. *Phonology and syntax: The relation between sound and structure*. Cambridge, MA: MIT Press.

Sells, Peter. 2001. Three aspects of negation in Korean. *Journal of Linguistic Studies* 6.1-15.

Schafer, Amy & Sun-Ah Jun. 2002. Effects of accentual phrasing on adjective interpretation in Korean. *East Asian Language Processing,* Stanford, CSLI. 223-55.

Shimoyama, Junko. 2006. Indeterminate phrase quantification in Japanese. *Natural Language Semantics* 14.139-73.

Sugahara, Mariko. 2003. *Downtrends and post-focus intonation in Tokyo Japanese*. PhD Dissertation. University of Massachusetts, Amherst.

Suh, Cheong-Soo. 1989. Interrogatives and indefinite words in Korean: with reference to Japanese. *Harvard Studies in Korean Linguistics* 3.329-40.

Wagner, Michael & Duane G. Watson. 2010. Experimental and theoretical advances in prosody: A review. *Language and cognitive processes* 25. 905-45.

Wesenick, Maria-Barbara & Andreas Kipp. 1996. Estimating the quality of phonetic transcriptions and segmentations of speech signals. Paper presented to the *ICSLP 96 (Fourth International Conference on Spoken Language)*.

Winter, Yoad. 1997. Choice functions and the scopal semantics of indefinites. *Linguistics and Philosophy* 20.399-467.

Yanovich, Igor. 2005. Choice-functional series of indefinites and Hamblin semantics. Paper presented at the *SALT XV*, Ithaca, NY.

Yatsushiro, Kazuko. 2009. The distribution of quantificational suffixes in Japanese. *Natural Language Semantics* 17.141-73.

Yi, Sun-Woong. 2000. On the indefinite expression of "interrogative pronoun+(*i*)+-*nka*" [in Korean]. *Hankwukehak* [Korean Linguistics] 36.191-219.

Yoon, Jeong-Me. 2005. Two historical changes in *wh*-constructions in Korean and their implications. *Studies in Generative Grammar* 15.457-87.

Yun, Jiwon. 2005. A finite state model for predicting Korean pronunciation. Unpublished manuscript, Cornell University.