

Prosodic licensing in Korean wh-questions: De-phrasing and pitch reduction*

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Chung, Heeryun and Jungu Kang. 2023. Prosodic licensing in Korean wh-questions: De-phrasing and pitch reduction. Linguistic Research 40(3): 607-646. This paper discusses the prosody of Korean wh-questions and prosodic grouping accompanied by de-phrasing and pitch reduction. Our findings show that Jun and Oh's (1996) observation on the wh-phrasing needs to be clarified. While they proposed a phonological condition of a wh-word forming an AP with the following word, Experiment 1 reveals wh-elements tend to be grouped with an IP boundary, ignoring any elements situated between them. Experiment 2 further clarifies that, instead of just an IP boundary, Korean wh-phrasing actually reacts to the Q-features. This can be inferred from the empirical data showing that the embedded C head of *that*-clause is prosodically not realized while that of *if*-clause is realized. Specifically, the elements between the wh-element and its licensor are prosodically reduced/deleted, indicating a possible prosodic grouping in Seoul Korean wh-questions. To explain this phenomenon, we adopt Richards' (2016) Generalized Contiguity Theory and its notion of agreeing/selecting elements being dominated by a single prosodic node. We propose that in Korean, wh-element must also agree with its licensor by forming a unified prosodic unit, which we term *Basin* formation. (Sogang University • The Chinese University of Hong Kong)

Keywords Contiguity Theory, feature licensing, Generalized Contiguity, Match Theory, pitch reduction, prosody, *wh*-questions

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1. Introduction

The licensing of *wh*-elements in various languages, particularly when movement is not required, has long been a topic of scrutiny. Researchers in Minimalist Program traditionally determine whether a language exhibits overt *wh*-movement based on the presence/absence of Q-feature (Chomsky 1995). However, there is growing skepticism towards the use of stipulated diacritic features that lack empirical detectability. Instead, researchers propose considering other observable features of natural language to account for the motivation behind movement (Deguchi and Kitagawa 2002; Smith 2011; Breiss and Hayes 2020). Contiguity Theory, developed by Richards (2010, 2016, 2018) and Branan (2018), claims that grammatical phenomena and effects, previously attributed to syntax, can be adequately accounted for on phonological grounds and that we may attribute the motivation for *wh*-movement by prosodic grouping with Q-feature.

While there have been numerous studies examining the syntactic status of *wh*-elements and their prosodic features, there is a lack of research on how Seoul Korean prosodically groups *wh*-elements with their licensors. To address this gap, this study investigates the phrasing of *wh*-questions in Seoul Korean. We propose a condition for the grouping between the *wh*-element and its licensor, along with an intonational variation to accommodate this grouping. Drawing on the idea that syntactic operations can incorporate phonological information (Richards 2016), our proposal suggests that the *wh*-phrasing effect occurs when the *wh*-element and C head satisfy a Generalized Contiguity condition. The prosodic structure proposed in (1) represents the prosodic structures observed in Seoul Korean for *wh*-phrasings, specifically for sentences involving the *if*-clause (1a) and *that*-clause (1b).

- (1) Prosodic *wh*-phrasing in Seoul Korean ({ }: Phonological boundaries)
 - a. $[_{CP} X \{ [_{CP} wh \cdots C_{[+Q]}] \} C_{[-Q]}]$

Mina-nun {nwu-ka mwun-ul ye-nunci} molu-n-ta. Mina-TOP who-NOM door-ACC open-*if* doesn't know-PRS-DEC 'Mina does not know who opens the door.'

b. [CP X {[CP wh ··· C[-Q]] C[+Q]]}
Mina-nun {nwu-ka mwun-ul ye-n-tako mit-nun-ke-ni?}
Mina-TOP who-NOM door-ACC open-PRS-*that* believe-PRS-NML-Q
'Who does Mina believe opens the door?'

We provide two lines of evidence in support for the structures in (1) via the two conducted experiments. Experiment 1 focuses on elucidating the factors involved in *wh*-clustering and *wh*-phrasing. The former '*wh*-clustering' regards *wh*-element's preference in native speakers to group together adjacent to the verb observed in Lee and Chung (2020). On the other hand, the latter '*wh*-phrasing' refers to an observation by Jun and Oh (1996), where *wh*-elements form a phonological phrase with its following word. Experiment 1 demonstrates that Lee and Chung's *wh*-clustering effect is limited to word-order task and does not occur phonologically, while Jun and Oh's *wh*-phrasing effect is observed as a genuine phenomenon, deviating slightly from their proposal. It is found that the *wh*-element not only influences AP formation but also the IP boundary tone plays a crucial role in *wh*-phrasing.

Experiment 2 investigates the potential impact of IP boundaries on the wh-phrasing effect by examining sentences as presented in (1). The results show that the wh-phrasing effect occurs between the wh-element and the C head, regardless of intervening elements. Even when the intervening element includes a C head, every word in-between undergoes significant pitch compression, resulting in a minimal, flat contour. Therefore, we conclude that wh-phrasing is sensitive to the syntactic Q-feature rather than simple proximity to a C head.

To explain the observed prosodic grouping pattern in Seoul Korean, we adopt Richards' (2016) Generalized Contiguity, which posits that elements that agree with or select another element must be included in a single prosodic domain (i.e., phonological phrase, ϕ). Our observation confirms that *wh*-phrasing in Seoul Korean occurs under the condition where the *wh*-element agrees with a C head with [+Q], and this agreement is reflected in the prosodic grouping by forming an overarching phonological domain encompassing both elements. Additionally, the element located at the phonological edges can be realized as a high tone (H), while the remaining elements within the *wh*-phrasing undergo pitch compression. This empirical evidence supports the claim that syntactic representations can incorporate phonological information (Richards 2016).

The rest of the paper is organized as follows. Section 2 of the paper provides relevant information regarding Korean *wh*-phrasing, including phonological domains, characteristics of Korean interrogatives, and previous studies, which served as precursors to this research. Section 3 provides an overview of Experiment 1, along with the experimental design, materials, and research questions guiding the study. The section also

presents the results and interim discussion derived from the experiments. Section 4 handles Experiment 2, starting from its design to the results, in a similar fashion to Experiment 1. Our proposal derived from the two experiments is presented in Section 5 and endeavors to further the understanding of Korean syntax and prosody by proposing a newly observed pattern that signals the correspondence between the *wh*-element and the licensing C head. Finally, in Section 6, the paper concludes by discussing the potential implications of the experiment for the syntax-phonology interface and the refinement of *wh*-phrasing conditions within existing theories.

2. Background

Human speech, or utterances, are considered to consist of various prosodic domains organized into a hierarchy, with each level in the hierarchy sensitive to certain phonological effects. There are various methods of defining such domains, including a syntax-oriented approach such as Match Theory (Selkirk 2009, 2011; Elfner 2015) and a purely phonological approach such as the Intonational Approach (Jun 1993, 1998).

Match Theory proposes that a prosodic structure is derived by a family of syntax-prosody match constraints, with the original constraints proposing a direct correspondence between syntactic categories and prosodic ones. More recent studies, a reductionist perspective on the syntax-prosody interface, suggest that prosodic domains instead correspond to phases (Kratzer and Selkirk 2007; Compton and Pittman 2010; Newell and Piggott 2014; Newell et al. 2017; Weber 2020, 2022). The Intonational Approach (Jun 1993, 1998) defines the phonological domains and classifies Korean speech into three domains: phonological word (PW), accentual phrase (AP), and intonational phrase (IP). In general terms, a phonological word in Korean equates to a lexical item followed by case markers or postpositions, an accentual phrase as a domain higher than the phonological word, and an intonational phrase as the highest domain. Accordingly, Jun (1998) defines AP and IP to be the phonological domains in Korean where prosodic features are encoded and realized; AP for the word-level prosody and IP for encoding the sentence-level prosodic features such as sentential forces including declaratives and interrogatives.¹ With regard to the perspectives on prosodic domains, (2)

¹ It should be noted that AP can have one or more words, in which cases an AP may not always strictly correspond to a word-level prosody.

introduces the prosodic domains proposed by Match Theory and the Intonational Approach.

(2)	Match Theory	Intonational Approach		
	Intonational phrase, ι (CP)	Intonational phrase, IP		
	Phonological phrase, ϕ (XP)	Accentual phrase, AP		
	Phonological word, $\omega(X)$	Phonological word, PW		

Whether one AP boundary is formed or not is defined in Jun (2000). The default Korean AP is composed of alternating H(igh) and L(ow) tones, represented as THLH. The variable tone (T) depends on the laryngeal features of the onset segment. If the onset consonant is aspirated or fortis, the T tone is realized as high (H), while in other cases, it is realized as low (L). Diagram (3) illustrates this grouping.

(3) Intonational structure of Seoul Korean (Jun 2000)



An AP can have one or more PW, and in Korean, If the phrase has one to three syllables, the middle H tone or middle L tone is compressed due to undershoot, as in (4a).² The standard example of a Korean AP with four syllables is shown in (4b). If the phrase has more than four syllables, in contrast, the first H tone is realized on the second syllable of the phrase and the second L tone is realized on the penultimate, resulting in

² For example if LHL is uttered over a long phrase, the H might be quite high. If LHL is uttered over a very short phrase, then the H might not be very high because there is not time to reach the H target.

one AP (4c). We refer the reader to Jun's K-ToBI (2000) for further details on how the AP for Seoul Korean is defined.

(4) Korean prosodic contours by the number of syllables (Jun and Oh 1996) a. 1-3 syllables b. 4 syllables c. +5 syllables σ σ σσσ σ σ σ σ σσ L (HL) H L Н L Н L Н L н

2.1 Characteristics of wh-elements in Korean

Korean is a *wh*-in-situ language. In addition to this feature, Korean also allows for scrambling of its sentence elements, which leads to relative freedom in the placement of the *wh*-element in a sentence without resulting in any ungrammaticality as presented in (5).³

(5) a. acwumeni-nun encey ecilewe-yo? madam-TOP when dizzy-Q
'When do you feel dizzy?'
b. encey acwumeni-nun ecilewe-yo? when madam-TOP dizzy-Q
'When do you feel dizzy?'

Example (5a) shows the *wh*-adjunct *encey* (when) in the middle of the sentence, which is its base-generated position if we surmise this adjunct as merging into the structure at vP. In contrast, (5b) shows the case where the *wh*-element in Korean can be placed in front of the sentence without any difference in meaning. Moreover, in cases where multiple *wh*-elements are included in interrogative sentences, they can be freely positioned in front of the verb. The examples in (6) illustrate this point.

³ Particle '-yo' can also be understood as a politeness marker, as it also appears in statements. In this paper, however, we gloss the particle as a Q-marker since this is what is relevant to the focus of the paper.

(6)	a.	Yengi-ka	encey	etis	e	wul-	ess-ni?
		Yengi-NO	M when	whe	ere	cry-F	PST-Q
		'When an	nd where	did Y	engi	cry?'	
	b.	encey	etise	Yeng	gi-ka	W	ul-ess-ni?
		when	where	Yeng	gi-NOM	1 01	ry-PST-Q
	c.	encey	Yengi-ka	e	etise	W	ul-ess-ni?
		when	Yengi-NO	M V	where	CI	ry-PST-Q

As such, Korean is considered to have no particular restriction in terms of the distribution of *wh*-elements. However, Lee and Chung (2020) observe that there is a noticeable tendency in preferred positions of *wh*-phrases: i) preference of *wh*-phrases in preverbal position and ii) preference for *wh*-phrases to be adjacent to each other. Based on the observations, they argue that preference of shortest linear distance at PF between the *wh*-element and the Q-marker makes the *wh*-element adjacent to the verb with the Q-marker: the farther the distance, the lower the preference. They also make the phonological assumption that a single rhythmic unit can be formed at PF when *wh*-elements are adjacent to each other (i.e., PF agreement between the *wh*-element and the Q-marker, see Lee and Chung (2020) for further details). However, their experiment was a word order task, which leaves the phonological assumptions as assumptions that require further verification.⁴

2.2 Previous analyses

We review here four previous analyses. One is a phonological analysis of prosody in three different types of Korean *wh*-questions (*wh*-question, *yes/no*-question, and incredulity question) based on the Accentual Phrase approach (Jun 1993, 1998).⁵ The

⁴ Lee and Chung (2020) conducted the experiment with 55 native Korean speakers. The participants were asked to conduct a sentence completion task aimed at identifying the preferred position of [±wh] adjuncts in Korean. Participants completed 24 interrogative sentences and 18 declarative sentences by incorporating given adjunct expressions, such as [-wh] onul achimey (in this morning) and [+wh] encey (when). Three different locations were provided within each sentence, consequently, six types of [±wh] adjuncts (e.g., [±wh.time], [±wh.place], [±wh.reason]) were examined. The distributional patterns of [±wh] adjuncts observed in Lee and Chung (2020) are as follows. First, [+wh] adjuncts prefer the 'wh-in-front-of-V' position (average ratio: 72.0%) rather than the other positions (average ratio: 37.6%). Second, 'wh-adjacency' between [+wh] adjuncts in Korean proved to be relatively high, with average ranging from 46.4 % to 65.5%.

⁵ Incredulity question is a term used in Oh and Lee (1993) to refer to a kind of echo question with an

others regard the explanation of the prosody through Contiguity Theory, examining cases from Japanese and the Busan dialect of Korean. We note some crucial differences between our findings and theirs and conclude that the facts presented here are best explained through Richards' (2016) approach.

2.2.1 Phonological analysis of *wh*-phrasing (Jun and Oh 1996)

Jun and Oh (1996) investigated the difference in phonological realization between three types of interrogatives in Korean: polarity questions, *wh*-questions, and incredulity questions. One of the major differences they noted between polarity questions and *wh*-questions was the number of APs in given sentences; for polarity questions, each AP boundary matched the word boundaries in Korean, while for *wh*-questions and incredulity questions, the *wh*-element tended to form one AP with the following word. The pronounced difference between incredulity questions and *wh*-questions was the difference in how high the final pitch signaling the interrogative force was raised to. An example from Jun and Oh (1996) is given in (7):

 (7) Example of a single AP including a *wh*-element (Jun and Oh 1996) a_Lcwu^Hmeni_L-nun^H [en_Lcey^H ecilewe_L-yo^H]_{AP}? madam-TOP when dizzy-Q 'When do you feel dizzy?'



In (7), we observe the *wh*-phrasing effect in action; although morphologically the sentence consists of three words, it is only parsed into two sections. The distance between

incredulity reading. For instance, an incredulity question */nuka wajo/*? would mean "WHO did you say is coming? (= I can't believe that X is coming. (and the speaker knows who X is.))."

the H tone of the *wh*-element and the point of the following lowest F0 is longer when both the *wh*-element and the following word belong to the same AP than when they belong to different APs. Based on this, Jun and Oh (1996) analyze the *wh*-element and the following word as forming one AP when the peak of the H appears on the last syllable of the *wh*-element and the following L is realized on the penultimate of the following word. Jun and Oh (1996) thus propose that, in Korean, the *wh*-element forms a prosodic unit with the following word.

While Jun and Oh (1996) provide important groundwork for furthering the understanding of intonation features of Korean *wh*-questions, the scope of their research was limited. As they only tested preverbal positions for the *wh*-elements, this obfuscates whether it is the *wh*-element that has the feature of creating one AP with the following word, or the IP right-edge boundary tone that triggers the *wh*-phrasing effect. Or, it is also possible that the effect is caused by both the *wh*-element and the IP boundary tone through some unclarified interaction between the two factors.

2.2.2 Contiguity Theory: pitch reduction (Richards 2016; Kawahara et al. 2022)

Contiguity Theory seeks to explain the differences in overt movement patterns seen across languages by considering phonological, morphological, and syntactic factors. It proposes that these variations are the result of the interaction between universal syntactic principles and language-specific phonological and morphological properties. In contrast to the Minimalist Program's view of strict segregation between syntax and phonology, Contiguity Theory suggests that the building of certain aspects of prosodic structure begins in the narrow syntax phase, and syntactic representations can incorporate phonological information. It argues that the apparent syntactic distinctions between languages stem from more fundamental phonological and morphological parameters, alongside a syntactic system that remains consistent across different languages. One aspect of Contiguity Theory is Generalized Contiguity, which explains the analysis of *wh*-movement by stating that agreeing or selecting elements must be dominated by a single prosodic node.

According to Richards, Generalized Contiguity plays a crucial role in determining whether a language undergoes *wh*-movement or is *wh*-in-situ:

(8) Generalized Contiguity (Richards 2016: 146) If a either Agrees with or selects β, a and β must be dominated by a single prosodic node, within which β is Contiguity-prominent.

In other words, β is considered Contiguity-prominent within ϕ if it is adjacent to a prosodically active edge of ϕ . To satisfy the requirements of Generalized Contiguity, two operations are available: Grouping and Contiguity-adjunction. The grouping operation involves taking a pair of prosodic nodes α and β and creating a ϕ that encompasses both of them. Contiguity-adjunction entails selecting a pair of adjacent prosodic nodes and designating one of them as a daughter node of the other. The variation observed in *wh*-movement across languages can be attributed to the specific edge of ϕ that is prosodically active. Consequently, the grammar of a given language utilizes either Grouping or Contiguity-adjunction to establish Contiguity.

In languages where the prosodically active edges of phonological phrases are on the opposite side of the *wh*-phrase from the complementizer, which in effect puts the two elements under one ϕ , the *wh*-phrase remains in its original position and forms a contiguous structure with C through Grouping. This pattern is observed in C-final languages like Japanese.⁶ For example, in Japanese, the sentence (9) is analyzed with syntactic structure (10).

- (9) Naoya-ga nani-o nomiya-de non-da no?
 Naoya-NOM what-ACC bar-at drink-PST-Q
 'What did Naoya drink at the bar?' (Richards 2016: 81)
- (10) [$_{CP}$ [$_{TP}$ [$_{KP}$ [$_{NP}$ Naoya] ga] [$_{T'}$ [$_{\nu P}$ [$_{KP}$ [$_{NP}$ nani] o] [$_{VP}$ [$_{PP}$ [$_{NP}$ nomiya] de] nonda] ν] T]] C]

In (10), prior to the merger of C, the TP of (10) is mapped onto prosodic structure (11), with prosodically activated left edges marked by parentheses.⁷ In structure (11), the

⁶ In languages such as English and Tagalog, on the other hand, where the left edges of maximal projections exhibit prosodic activity, *wh*-phrases must undergo overt *wh*-movement to the left periphery of a clause, as exemplified in (16). This movement ensures that both the *wh*-phrase and C are encompassed within the dominating \$1, thereby satisfying Generalized Contiguity. Notably, Richards presents a novel perspective by proposing that English displays prosodic activity at its left edges.

⁷ The Japanese nominal is represented as KP, with K being headed by the case morpheme, while DP is omitted. The presence or absence of the Q particle *-no* is idiosyncratic and not indicated in (13) within the narrow

wh-phrase *nani* (what) occupies the largest ϕ (ϕ 3), and upon merging and agreement with the *wh*-phrase, the Grouping operation is applied, resulting in the revised structure (12).

(11) $[(_{\phi1} \ [(_{\phi2} \ Naoya-ga] \ [(_{\phi3} \ [(_{\phi4} \ nani-o] \ [(_{\phi5} \ [(_{\phi6} \ nomiya-de] \ non-da]]]]$

(Richards 2016: 82)

(12) $[(_{\phi b} \ [(_{\phi 2} \ Naoya-ga] \ [(_{\phi a} \ [(_{\phi 3} \ [(_{\phi 4} \ nani-o] \ [(_{\phi 5} \ [(_{\phi 6} \ nomiya-de] \ nonda]]] \ C]$ (Richards 2016: 83)

In this revised structure, a new ϕ (ϕ_a) is created, dominating both C and ϕ_3 . The *wh*-phrase is positioned adjacent to the prosodically active edge of ϕ_a , satisfying Generalized Contiguity between C and the *wh*-phrase. Finally, a new ϕ (ϕ_b) is formed, dominating both ϕ_2 and ϕ_a .⁸ We adopt this proposal in analyzing Korean *wh*-in-situ characteristics by showing how the licensor and the *wh*-element show a consistent tendency to be grouped together under one phonological phrase.

Within this theory, Kawahara et al. (2022) raise a question as to whether each syntactic derivation is checked against its prosodic realization or if the mechanism that enables *wh*-in-situ is a more abstract feature. To this end, they tested recorded utterances of *wh*-questions in Japanese to see if their prosodic patterns show evidence of prosodic grouping between *wh*-elements and their licensors. They conducted a comparison between *wh*-questions, where the *wh*-element occupies the second position in the sentence, and declarative sentences with an identical structure, except for the absence of the *wh*-element in the same position as presented in (13) (Kawahara et al. 2022: 8).

(13) a. Declarative sentence (control)

Maruyama-wa erumesu-no erimaki-ni nomimono-o koboshi mashi-ta. NAME-TOP Hermes-GEN scarf-DAT drink-ACC spill POL-PST 'Maruyama spilled the drink over Hermes scarf.'

b. Wh-question sentence (test)

Maruyama-wa donohito-no erimaki-ni nomimono-o koboshi

syntax (see Richards 2016 for more details). Match Theory and Japanese prosody propose that each XP corresponds to a phonological phrase ϕ (Selkirk and Tateishi 1988: 71).

⁸ Conversely, in C-final languages like Georgian and Basque, where the right edges of ϕ are prosodically active, *wh*-phrases should be positioned as far right in a clause as possible to fulfill the requirement of Generalized Contiguity.

NAME-TOP whose scarf-DAT drink-ACC spill mashi'ta-ka? POL-PAST-Q 'What type of scarf did Maruyama spill the drink over?'

As the default phrasal prosodic contour combined with a lexical accent in Japanese is LH^*+L (%LH followed by H*+L), they assumed that declarative (13a) would retain the full contour for the third and the fourth word (*erimaki-ni*, *nomimono-o*), while *wh*-sentence (13b) the prosody would be reduced or deleted for the corresponding words.

They observe that, while the general result concurs with Richards' theory, the same syntactic derivation sometimes resulted in different prosodic structures. Specifically, the results reveal that, for most speakers, %LH*+L tones are eradicated/reduced between the *wh*-element and its licensor in *wh*-questions, supporting the proposed prosodic structure. However, this pitch eradication/reduction was sometimes not realized, with the target words retaining full prosody. Kawahara et al. (2022) conclude from this variation in the prosodic realization that what enables Japanese *wh*-in-situ is more abstract in nature, and that it is the capacity to be grouped together that is more important in the *wh*-licensing than the absolute matching in all cases.

2.2.3 The direct feature reference approach (Jung 2012, 2014)

As mentioned in the previous section, Richards' analysis implies that the syntactic operation of *wh*-movement is primarily motivated by the universal condition on *wh*-prosody and the way syntactic structure is mapped onto prosody. However, Jung (2014) claims that the nature of *wh*-prosody and *wh*-domains in Korean goes beyond the predictions of Richards' proposal of *wh*-movement based on Contiguity relations. Under Jung's (2010, 2012, 2014) proposal, the prosodic interpretations in *wh*-questions are initiated by agreement-related syntactic features. After syntax licenses the agreement features of a *wh*-phrase and a C head, phonology then interprets these syntactic features according to a set of constraints set in (14).

- (14) Conditions on wh-prosody (Jung 2014: 124):
 - a. The valued feature of a *wh*-word is interpreted as a prosodic free morpheme, so it can initiate *wh*-prosody freely.

b. The valued feature of a C head is interpreted as a prosodic affix, so it must be attached to its prosodic host.

Examples (15a) and (15b) serve as evidence in favor of Jung's argument. Jung argues that, due to how Richards' theory relies on prosodic phrasing, an account based purely on prosodic phrasing cannot explain the difference in the prosodic grouping between (15a) and (15b) in Busan Korean (Jung 2012: 425). The contour of (15a) cuts off at the embedded C, while (15b) extends up to the matrix C as indicated in parentheses.

- (15) a. Nwuna-nun [CP nay-ka (nwukwu-l kongwon-eyse manna-ess-nun-ci)] sister-TOP I-NOM who-ACC park-in meet-PST-*if*_{Q[+wh]} emma-hantey yaykiha-ess-na?
 mother-DAT tell-PST-Q
 'Did you (sister) tell Mom [who I met t in the park]?' (Jung 2014: 113(8))
 - b. [CP Nwuna-nun [CP nay-ka (nwukwu-l kongwon-eyse manna-ess-tako)] sister-TOP I-NOM who-ACC park-in meet-PST-DEC emma-hantey yaykiha-ess-no)]?
 mother-DAT tell-PST-Q[+wh]
 'Who did you (sister) tell Mom that I met *t* in the park?' (Jung 2014: 119(16))

While this observation is valid (as results in this paper will clarify), one point worth clarifying is how this phenomenon does not invalidate Richards' account of prosodic *wh*-licensing. Richards' (2016) more recent theory, Generalized Contiguity, introduces two types of relations concerning the *wh*-phrase: one driven by Agree (Probe-Goal Contiguity) and the other by selection (Selectional Contiguity). Agreeing or selecting elements is postulated to be dominated by a single prosodic node. Notably, in the context of Selectional Contiguity, adjacency is always a requirement, whereas Probe-Goal Contiguity is more lax in this restriction (only requires adjacency in certain cases). In this framework, which is based on feature checking and involves a Probe-Goal relation for *wh*-licensing, it is not surprising to find an embedded *wh*-element agreeing with the C head that possesses the *wh*-feature (see also Section 2.2.2).

Given this theoretical background, we examine data on the prosodic structure of *wh*-questions in Seoul Korean, providing evidence in support of Richards' Generalized Contiguity Theory (2016). Our analysis begins with an exploration of the research

questions and subsequently delves into the experimental design and findings.

2.2.3 Research questions

As discussed, there have been various studies trying to identify the pattern of Seoul Korean interrogatives and the correlation between the *wh*-element and the licensor (Jun and Oh 1996; Richards 2010, 2016; Jung 2012, 2014; Lee and Chung 2020; Kawahara et al. 2022). To our knowledge, however, no other works examine the tonal contour of multiple *wh*-questions in Seoul dialect. The first research question and its subsequent Experiment 1 will show that there are critical syntactic conditions to form a phonological boundary in Seoul Korean multiple *wh*-questions. The first research question is as follows.

Research Question 1

In multiple wh-questions,

- i) Does the wh-cluster form one AP boundary?
- ii) What factors determine the wh-phrasing effect? (wh vs. IP% vs. both)

Experiment 1 aims to ascertain whether Jun and Oh's (1996) analysis of *wh*-phrasing in which the *wh*-element plus its following word (FW) form a single AP (hereafter, [*wh* + FW]AP) is correctly analyzed as *wh*-phrasing, and then clarify whether it is the *wh*-element or the IP boundary tone (or both) that causes this phrasing effect.

Given Research Question 1, the following hypotheses can be surmised. First, if the *wh*-element is the factor of the *wh*-phrasing effect, the FW of the *wh*-element must be a part of the *wh*-phrasing regardless of its distance from the sentence-final position (IP boundary), as illustrated in (16a). Second, if the IP boundary tone is required for *wh*-phrasing, the *wh*-phrasing will attempt to persist even in the presence of intervening elements between the IP boundary and the *wh*-elements, as shown in (16b).

(16) Two possible cases of prosodic phrasing ({ }: Phonological boundaries)a. If only *wh*-element decides *wh*-phrasing:

 $\{wh FW\}_{AP}$ ··· IP%

b. If IP boundary tone is also required: $\{wh \ FW \ \cdots \ IP\%\}_{AP}$ The second research question expands upon the second possibility of the IP boundary tone being the factor determining the prosodic phrasing in *wh*-questions. To be specific, given the previous research on *wh*-in-situ languages allowing licensing via prosodic grouping of the *wh*-elements and its licensor (Richards 2010, 2016; Kawahara et al. 2022), we aim to clarify whether the effect is purely phonological (i.e., IP boundary tone) or syntactic (i.e., *wh*-licensing via prosodic grouping). To this end, we put forth the following Research Question 2.

Research Question 2

Clarifying the type of clauses wh-phrasing takes place:

- i) Does the type of C head ([+Q] vs. [-Q]) influence the phonological phrasing?
- ii) Does the location of the C head (embedded vs. matrix) influence the phonological phrasing?

Experiment 2, based on these research questions, is designed to answer the following questions. If it is strictly the C head (i.e., the IP boundary) that determines the domain of *wh*-phrasing, the outcome will consistently demonstrate the grouping with the closest C head regardless of the feature carried by the nearest C ([-Q] vs. [+Q]), as in (17). On the other hand, if the Q-feature is the crucial factor for *wh*-phrasing, the prosodic grouping will always attempt to align itself with the nearest corresponding C head with [+Q] regardless of the distance, as in (18).

(17) Possibilities of grouping if the only factor is the proximity of the C head
a. [CP X {[CP wh ··· C[-Q]]} C[+Q]]
b. [CP X {[CP wh ··· C[+Q]]} C[-Q]]
(18) Possibilities of grouping if Q-feature is the factor

a. $[_{CP} X \{ [_{CP} wh \cdots C[-Q]] C[+Q] \} \}$

b. $[_{CP} X \{ [_{CP} wh \cdots C[+Q]] \} C[-Q]]$

3. Experiment 1: wh-phrasing effect in Korean multiple wh-questions

The experiments detailed in this section examined the recordings of individuals who

are native speakers of Korean, focusing on *wh*-questions. The objective of these experiments was to investigate the presence of the *wh*-phrasing effect as proposed by Jun and Oh (1996), as well as the occurrence of pitch reduction as observed by Kawahara et al. (2022). Specifically, the experiments explored the aforementioned effects in two scenarios: when the *wh*-questions contained multiple *wh*-elements (Experiment 1) and when they involved embedded clauses (Experiment 2).

3.1 Factorial design and materials

In order to verify Jun and Oh's (1996) observation on *wh*-phrasing and additionally examine the phonological realization of Lee and Chung's (2020) findings (Section 2.1 and see also Lee and Chung (2020) for more details), Experiment 1 uses multiple *wh*-questions as the target sentences. These sentences are compared to declarative sentences containing [-wh]s (NPs) to analyze their tonal patterns. The experimental design for Experiment 1 is shown in (19).

(19) Experimental Design

a. WH (2): [+wh] vs. [-wh]
b. LOCATION (2): i) FRONT: wh wh [x + V%]
ii) BACK: x wh [wh + V%]

The first factor of this experiment involves comparing the tonal contour between the two *wh*-elements and the tonal patterns exhibited by two [-*wh*]s (19a). The specific focus of this investigation, as outlined in *Research Question* 1-(i), is to determine whether the adjacent two *wh*-elements constitute a single AP or two independent APs. The second factor (19b) is LOCATION of two adjacent *wh*-elements: i) FRONT, where the *wh*-cluster and the IP boundary with the intonation (V%) are separated by an intervening element x, resulting in [x + v]%, and ii) BACK, where the *wh*-cluster is located in the immediate preverbal position, resulting in [wh + V%]. If the IP boundary tone is the only factor (Jun and Oh 1996), the two *wh*-elements would form a single AP only if located adjacent to the IP boundary (back). In contrast, if the *wh*-element itself influences the AP formation, there would be a contrast between the tonal patterns of [wh + v%] and [x + v%]. By comparing these tonal patterns, it is possible to verify the role of the

wh-element in AP formation. Example (20) is a sample of the multiple *wh*-questions tested in Experiment 1 (see also Appendix A).

(20)	A sample of the multiple wh-questions						
	a. FRONT/[+wh]					
	[nwu-ka	nwukwu-lul]	wh-cluster ocen-ey	manna-ss-ni?			
	who-NOM	whom-ACC	morning-PRT	meet-PST-Q			
	'Who met						
	b. васк/[+ <i>wh</i>]						
	ocen-ey	[nwu-ka	nwukwu-lul] _{wh-cluster}	manna-ss-ni?			
	morning-PR	who-NOM	whom-ACC	meet-PST-Q			
	c. FRONT/[-wh]						
	Mina-ka	Minswu-lul	ocen-ey	manna-ss-ni?			
	Mina-NOM	Minswu-ACC	morning-PRT	cry-PST-Q			
	'Did Mina meet Minswu this morning?'						
	d. BACK/[-wh]						
	ocen-ey	Mina-ka	Minswu-lul	manna-ss-ni?			
	morning-PR	Mina-NOM	Minswu-ACC	cry-PST-Q			

The examples in (20a) and (20b) are multiple *wh*-questions, with the only difference being the location of *wh*-elements within each sentence. In (20a), the *wh*-cluster is positioned at the beginning of the question, while in (20b), it is placed before the verb. By comparing these two examples, we can examine the impact of location on the tonal patterns observed. Additionally, (20c) and (20d) demonstrate a similar comparison, but in this case, the [+wh] elements are replaced with [-wh] elements. This allows us to clarify the effect of *wh*-elements on the tonal contours.

3.2 Procedures, methods, and guiding principles

The participants were given target sentences with context. The experiment in this study was conducted in the order of 'Understanding the context' followed by 'Reading the sentences'. The former step is set up for participants to read the context projected on a monitor before they read the target *wh*-questions, in order to avoid misinterpreting *wh*-questions as *yes/no*-questions (see Appendix A). The recordings were conducted in a soundproofed linguistic laboratory at Sogang University. The equipment used consisted

of a Sennheiser dynamic microphone e 835-S, a Focusrite external PC amplifier, and a Scarlett Solo 3rd Gen. For recording purposes, the software Praat 6.2.14 (Boersma and Weenink 2018) was utilized, with a sampling rate of 22 kHz and a bit rate of 16 bits. The recorded audio data was saved as WAV files.

Before discussing the results, it is important to briefly mention the guiding principle we employed to analyze the number of APs realized in a *wh*-question, as previously discussed in Section 2.2.1.

- (21) The principles of forming one AP (adopted from Jun and Oh (1996))
 - a. Three syllables or less: The middle H tone or middle L tone may not be realized due to undershoot.
 - b. Four syllables or more:

The second syllable of the *wh*-word will have an H tone.The following L tone will be realized on the penultimate of the phrase.The peak of the middle H tone is generally lower than that of the final H tone.

The diagram in (22) is an example of analyzed data of the Praat program (Boersma and Weenink, 2018) featuring a spectrogram, waveform, F0 contour, and labeled data. The presented data, "*nwu-ka mil-ess-ni*?" (who-TOP push-PST-Q?), illustrates the formation of one AP. Several observations can be made: i) the second syllable of the *wh*-word exhibits a H tone (point A), ii) the peak of this H tone is slightly higher than the final H (point C), demonstrating the downstep effect, and iii) the penultimate of the phrase carries an L tone (point B).



(22) A sample of analyzed data by the guiding principle

3.3 Results

Out of a total of 512 sentences [64 sentences (32 multiple *wh*-questions and 32 declaratives) across eight participants], this study analyzed 443 sentences. We excluded 64 sentences, which involved verbs starting with fricatives, as well as five sentences that were misread.⁹

The figure in (23) shows the AP boundary patterns in declaratives. The numbers enclosed in square brackets indicate the number of words used to form a single AP. [1][1][1][1][1] indicates that each word in a multiple *wh*-question forms individual APs resulting in four APs, while [1][1][2] indicates that the two words from the beginning of the sentence form two independent APs, and the next two words are pronounced as one AP. Again, the case of [1][3] illustrates that the three words form one AP except for the beginning word of the sentence. Declarative sentences were predominantly pronounced in four APs ([1][1][1][1][1]), which accounted for 95.3% of the entire dataset. This indicates that in declaratives, each word had the highest tendency to form its own AP boundary.

⁹ Fricatives are a type of speech sound where there is close contact between speech organs like lips, teeth, or the tongue, creating a sound characterized by turbulent airflow. This turbulent airflow causes difficulties in analysing the data. The turbulence is transcribed as an evenly distributed intensity in a spectrogram, and this makes it difficult to analyse any consistent contours out of the utterance as it essentially "cuts" the contour. Due to this data disruption, we have ruled out fricatives in our test sentences.



(23) AP boundary patterns in declarative sentences

(24) The possible combinations in AP formation

FRONT/BACK	Variation	Clustering	wh-factor	IP%-factor
	[1][1][1][1]	X	Х	Х
	[1][1][2]	X	Х	Ο
	[1][2][1]	X	Ο	Х
FRONT	[2][1][1]	0	Ο	Х
wh-wh-x-x%	[2][2]	0	Ο	О
	[1][3]	Х	Ο	О
	[3][1]	0	Ο	Х
	[4]	0	Ο	О
	[1][1][1][1]	X	Х	Х
	[1][1][2]	Х	Ο	О
	[1][2][1]	0	Ο	Х
BACK	[2][1][1]	Х	Х	Х
x-wh-wh-x%	[2][2]	Х	Ο	$?^*$
	[1][3]	0	Ο	?
	[3][1]	0	Ο	Х
	[4]	0	Ο	О

*: This mechanism is marked with a "?" as it requires supporting data from the FRONT data set. BACK data alone cannot tell for certain whether IP% is a factor.

The table in (24) represents all the possible combinations in AP formation and their corresponding possible implications about the involvement of each factor in the formation of APs. For example, if the majority of the data supports the [2][1][1] pattern for the

FRONT factor (which would equate to $[wh \ wh]$ [x] [x%]), which heavily implies that *wh*-clustering is in effect, while the other mechanisms ($[wh \ x]$ or sensitivity to IP%) are not. In Table 2, O means that the variation is consistent with the indicated mechanism. X indicates that it is inconsistent with the given mechanism. For example, FRONT [2][2] is consistent with Clustering, which is indicated by O. Conversely, as for FRONT [1][2][1], the *wh*-element can be the factor of *wh*-phrasing since the data reveals that the second (*wh*) and the third (FW) word form one AP while IP boundary tone is not a contributing factor in this particular case. In the case of FRONT [1][1][2], the data indicates that the impact of the *wh*-factor cannot be predicted in this scenario, indicated by X in the table.

In the case of BACK factor, there can be cases where the role of the IP boundary tone or *wh*-factor as a contributing factor can be ambiguous. This ambiguity arises due to the final word aligning with an IP boundary. Therefore, to clarify the result, the result of FRONT factors is necessitated. For example, BACK [1][1][2] pattern on its own can mean that either the *wh*-factor or the IP boundary tone (or possibly both) influences the *wh*-phrasing. If the FRONT [1][2][1] data pattern in tandem with the BACK [1][1][2] data, it is highly likely that *wh*-factor is the only factor in the AP formation. If, on the other hand, the FRONT data supports [1][1][2] pattern, it would imply that the BACK data [1][1][2] should also be understood in the context of the IP boundary tone being the only factor in its AP formation. In addition, if FRONT dataset supports [1][3] (*wh* [*wh* x x%]) and [4] ([*wh wh* x x%]) as well as BACK dataset [1][1][2], it would mean that both *wh*-factor and the IP boundary tone are affecting the AP formation.

Of the *wh*-clustering effect, as seen in (25), only 26.1% (66/253) of the test sentences were spoken as one AP, or a *wh*-cluster. The numbers in this table compare the results of $[2][1][1]_{\text{FRONT}}$, $[2][2]_{\text{FRONT}}$, $[1][2][1]_{\text{BACK}}$, and $[1][3]_{\text{BACK}}$, which indicate the formation of phonological boundaries that lead to the *wh*-clustering effect, with the remaining data. The majority of participants did not pronounce the *wh*-words as a cluster. This indicates that the *wh*-adjacency effect that was observed in Lee and Chung's (2020) word-order task experiment is not realized phonologically.

(25) Wh-clustering effect



Next, we examined what factors affected the AP formation in *wh*-questions. (26) shows three possibilities, of both the *wh*-factor and the IP boundary tone being the factor, of IP boundary tone being the only factor and lastly the *wh*-factor being the only influence.



(26) Factors in AP formation

It should be noted that, due to the aforementioned ambiguous nature of the BACK dataset in interpreting the factors, the BACK dataset was excluded from calculating the percentage.¹⁰ The result showed a clear preference in the factors, where both *wh*-element

and the IP boundary were seen contributing to the AP formation as 52.8% of the data had this formation.¹¹

3.4 Interim discussion

Experiment 1 holds significance in clarifying the factors in *wh*-phrasing effect and *wh*-clustering. In regards to *wh*-clustering, this experiment shows that the *wh*-clustering does not happen phonologically. *Wh*-phrasing effect, on the other hand, is seen as an actual phenomenon in Korean prosody, though it differs from Jun and Oh's (1996) prediction. Contra Jun and Oh (1996), it is observed that not only does *wh*-element influence the AP formation, but also that the IP boundary plays an important role in determining the prosodic boundaries. The schema in (27) shows the condition for *wh*-phrasing inferable from this result.

(27) Tentative *wh*-phrasing condition (Revised from Jun and Oh (1996)) [\cdots [*wh* \cdots]_{AP}]_{IP%}

This discovery opens up the possibility of how *wh*-phrasing may not be a strictly phonological phenomenon, especially if it is sensitive to the type of C head that hosts the IP, which is clarified in the upcoming Experiment 2. While the current research primarily focuses on clarifying the phonological aspect of the phenomena, the refined *wh*-phrasing condition opens up intriguing possibilities for future investigations into the syntax-phonology interface. It raises questions about whether the *wh*-phrasing effect is influenced by the sentence-final IP boundary tone or sensitive to the C head. Examining *wh*-questions with embedded clauses could provide evidence of an interface between syntax and phonology.

¹⁰ In the BACK dataset presented in (24), the only possibility that demonstrates the IP boundary being a factor in wh-phrasing is [1][1][2]. However, even in this case, it remains uncertain whether the wh-phrasing is a result of the wh-element, the IP boundary, or both. Consequently, the BACK data was not taken into account in this analysis.

¹¹ The figure 52.8% is considered as a significant rate for the factor of 'forming an AP boundary' by the following reason. Since the average value of the three possibilities is about 33.3%, then about 33% of total responses indicate that they are evenly distributed in the three positions. However, 52.8% is sufficient evidence to demonstrate that both the *wh*-element and the IP% are essential factors in forming an AP. In addition, the rest of the data, 36%.

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4. Experiment 2

The procedure, methods, and data analysis in Experiment 2 are identical to those used in Experiment 1. Ten native speakers of Korean participated in this experiment, where they were tasked with reading sentences.¹² Their voices were recorded in the same environment as Experiment 1 (see Section 3.2).

4.1 Factorial design and materials

In order to examine the potential influence of IP boundaries on the *wh*-phrasing effect, the target *wh*-questions were specifically designed to include embedded clauses. The factorial design, outlined in (28), captures the experimental setup with the numbers in parentheses indicating the number of factors.

(28) a. CLAUSE TYPES (2): *if*-clause (Q-feature) vs. *that*-clause (C head)
b. LOCATION of [+Q] (2): Embedded vs. Matrix
c. DISTANCE (2): LONG (wh + x + IP_{Embedded}%) vs. SHORT (wh + IP_{Embedded}%)

The first factor (28a) investigates whether *wh*-phrasing is a phonological (C head) or syntactic (e.g., Q-feature) phenomenon. To determine the impact of the Q-feature's location on phonological phrasing (28b), the [+Q] feature is located in either embedded clauses or matrix clauses. Finally, the third factor (28c) examines whether the distance between the IP boundary and the *wh*-element influences the phonological phrasing effec t.¹³ The factorial-designed set of *wh*-questions is exemplified in ((29), see also Appendix B).¹⁴

¹² Experiment 1 also had 10 participants, but we had to rule out two of them due to faulty recording. All participants were university students in their twenties (five males and five females). The participants joined in Experiment 2 were separated individuals from Experiment 1. This is considered because repeated exposure to test sentences could affect the participants' utterances.

¹³ The third factor is examined in Experiment 1. However, in Experiment 2, we re-examine the interaction between the IP boundary and the *wh*-element, specifically within clauses that include embedded clauses.

¹⁴ Jung (2012) also investigated similar wh-questions in Busan Korean, focusing on the tonal contour observed in the embedded wh-questions. However, there are three key differences between Jung's research and ours. First, while Jung examined Busan Korean as presented in (i), our research investigates Seoul Korean as in (ii). Second, Jung compared a content question embedded within a polarity question (i-a) and a wh-question with matrix C agreeing with the embedded wh-element (i-b). In contrast, our research eschewed this because

(29) The factorial-designed set of wh-questions in Seoul Korean

a. <i>if</i> -clause/[+Q] _{Embedded} /SHORT							
Mina-nun	nae-ka	mwue-l	ye-nunci	molu-n-ta.			
Yengi-TOP	I-NOM	what-ACC	open- <i>if</i>	doesn't know-PRS-DEC			
'Mina does	'Mina doesn't know what I opens.'						
b. if-clause/[+	Q] _{Embedded} /LON	IG					
Mina-nun	nwu-ka	mwun-ul	ye-nunci	molu-n-ta.			
Mina-TOP	who-NOM	door-ACC	open- <i>if</i>	doesn't know-PRS-DEC			
'Mina doesn't know who opens the door.'							
c. that-clause	/[+Q] _{Matrix} /SHC	RT					
Yumi-nun	cyay-ka	nwukwu-l	an-tako	mit-nun-ke-ni?			
Yumi-TOP	he-NOM	who-ACC	know-that	believe-PRS-NML-Q			
'Whom does Yumi believe he knows?							
d. <i>that</i> -clause/[+Q] _{Matrix} /LONG							
Yumi-nun	nwu-ka	kyay-lul	an-tako	mit-nun-ke-ni?			
Yumi-TOP	who-NOM	he-ACC	know-that	believe-PRS-NML-Q			
'Who does Yumi believe knows him?'							

4.2 Results

Out of a total of 180 sentences (18 sentences (12 *wh*-questions and six non-*wh* questions) across 10 participants), this study analyzed 176 sentences and excluded 8 misread sentences. The findings of Experiment 2 further support the impact of syntactic

- (i) The design of the target sentences in Jung (2010, 2012, 2014): Q + Q vs. C + Q
 - a. Subj_{Matrix} [NP_{Subj} NP_{Obj} PP V CP_[+Q]] NP_{DAT} V-na_[POL]
 - b. Subj_{Matrix} [NP_{Subj} NP_{Obj} PP V CP_[-Q]] NP_{DAT} V-no_[+Q]
- (ii) The schema of target sentence in this paper: Q + C vs. C + Q
 - a. Subj_{Matrix} [NP_{Subj} wh V CP_[+Q]] V- $ta_{[-Q]}$
 - b. Subj_{Matrix} [NP_{Subj} wh V CP_[-Q]] V-ni_[+Q]
 - c. Subj_{Matrix} [wh NP_{Obj} V CP_[+Q]] V-ta_[-Q]
 - d. Subj_{Matrix} [wh NP_{Obj} V CP_[-Q]] V-ni_[+Q]

the morphology of the *wh*-question marker and the polarity question marker is uniform (-*ni*) in Seoul Korean (ii-a and ii-c), causing a potential ambiguity in meaning. Busan Korean, contrastively, has distinct morphologies for each agreement pattern (-*na*: polarity question marker, -*no*: content question marker). Finally, our research minimized the distance of the matrix verb from the embedded question by allowing no intervening elements between the matrix predicate and the embedded clause.

features on the prosodic grouping of *wh*-phrasing. Experiment 2 investigates two major cases: *if*-clauses with the Q-feature in the embedded C and *that*-clauses with the Q-feature in the matrix C. The result for the *if*-clause is shown in (30). The 'Short' category is the case where the *wh*-element and the *nunci* (if) are adjacent to each other, while the 'Long' category is the case where the two are more distant due to an intervening element. The Figure (30) presents the results, indicating that the *wh*-phrasing is consistently maintained regardless of the distance. Both cases demonstrate a high occurrence of *wh*-phrasing, with each case showing more than 80% frequency.¹⁵





The Praat diagrams in (31) and (32) provide examples of the intonational contour of the *wh*-phrasing effect discussed in (30). (31) displays the tonal contour of a sentence where the [+Q] feature is located in the embedded clause, and the *wh*-element and

¹⁵ The results in this paper do not rely on statistical figures to establish significance; instead, they are presented as percentages, showing the intonation patterns of Seoul Korean interrogative sentences that were most frequently spoken. The percentages themselves are distinctly contrastive. Since the purpose of this experiment is not to verify a hypothesis, but to observe and report on a certain Seoul Korean phonetic phenomena, providing statistical metrics may not be essential. As such, emphasizing observational results rather than statistical metrics was considered more appropriate. Additionally, given their clarity in the distribution, additional statistical figures to prove the relevance of these findings were considered, but not reproduced on the paper for the succinctness of the argument.

Q-feature are adjacent to each other. In this configuration, the *wh*-element and *nunci* (if) form an AP, demonstrating the occurrence of the *wh*-phrasing effect. The diagram in (32), on the other hand, shows the tonal contour of a sentence under the same conditions as (31), but with a slightly greater distance between the *wh*-element and the Q-feature. In this case, an intervening element *mwun-il* (door-ACC) appears between the *wh*-element and the Q-feature. Interestingly, this intervening element does not produce the expected independent pitch contour and instead has a flat pitch represented below the horizontal line drawn on the tonal contour. This means that even when an intervening element exists between the *wh*-element and the Q-feature, the *wh*-phrasing effect remains intact, and this phenomenon is reflected in a flat intonational contour.



(31) Praat diagram for *if*-clause/[+Q]_{Embedded}/SHORT, (29a)



(32) Praat diagram for *if*-clause/[+Q]_{Embedded}/LONG, (29b)

This observation confirms the result of Experiment 1 replicated instead with an embedded CP structure. First, through (31), the data confirms the *wh*-phrasing between the *wh*-element and the IP boundary which aligns with the right edge of *munci*. Second, (32) and its high occurrence also reinforce the findings from Experiment 1 that the *wh*-phrasing effect is maintained between the *wh*-element and the IP boundary regardless of the intervening elements, suggesting that the phrasing is not merely phonological. Of course, while considering the embedded CP data alone allows confirmation of the *wh*-phrasing, this is insufficient to clarify what factors, phonological or syntactic, impact this phrasing. The following results from the sentences with the Q-feature on matrix C offers a definite answer.

For the case with the Q-feature on matrix C, similar consistency was observed in how *wh*-phrasing occurred. The data in (33) shows a consistent tendency to prosodically group the *wh*-element with the licensing C head, regardless of the distance between the *wh*-element from the C head. The *wh*-phrasing tendency sustained a similar percentage of around 80%. This leads to a significantly reduced pitch on the intervening embedded C *tako* (that). Praat diagram (34) and (35) embody this pitch reduction pattern well.



(33) Wh-phrasing effect in [wh ... that]-clause type sentences

The Praat diagram in (34) reveals that the expected H tone for DEC-COMP (*ta-ko*) is absent, leading to a flat tone for all intermediate elements between the *wh*-element and matrix C (nwu_Lkwul^H an_Lta_Lko_L mit_Lnun_Lke_Lni^H?). If the C head is crucial for forming *wh*-phrasing, a H tone would be expected on the embedded C head, indicating a phonological boundary with an LHLH contour corresponding to mu_Lgut^H $an_Lda_Lgo^H$ (who-ACC know-*that*). However, (34) demonstrates complete pitch deletion between the *wh*-element and the matrix Q, resembling a *basin*-like shape. In essence, in *wh*-phrasing, the *wh*-element interacts with the more distant matrix C rather than the closer C head. This suggests that the presence or absence of the Q-feature may be major influence on the formation of a coherent *wh*-phrasing structure, disregarding the proximity of the closer C head (*that*, [-Q]) in favor of the more distant matrix C (*-ni*, [+Q]).



(34) Praat diagram for *that*-clause/[+Q]_{Matrix}/SHORT, (29c)

Next, in (35), we present the data for cases where the *wh*-element is further away from both the embedded clause's C head and the matrix clause's C head. Similar to the *basin*-like intonational contour observed in (34), this contour pattern was also evident in these cases (77.8% of the entire case). What is intriguing is that despite the presence of multiple intervening elements between the *wh*-element and the matrix C, including an embedded C head, all the elements located between them demonstrated complete pitch deletion/reduction and appeared flat. Consequently, we can confidently infer that the *wh*-element establishes a cohesive *wh*-phrasing structure with the more distant C head, here the matrix C that carries the Q-feature, instead of with the closer C head. Therefore, based on the observation of pitch deletion/reduction in the elements located between the *wh*-element and the Q-feature, we can ascertain the factor that determines *wh*-phrasing as a C head with a Q-feature.



(35) Praat diagram for *that*-clause/[+Q]_{Matrix}/LONG, (29d)

The diagram (36), where the *wh*-element is replaced with a DP, shows the right-edge H tone in the embedded C head is pronounced saliently. This data serves as a piece of evidence for the following claims. First, a H tone on the embedded C head is realized in sentences without a *wh*-element that requires a licensing C head. This accentuates the difference of pitch deletion/reduction in (34) and (35), and proves *wh*-element is an integral part of the phrasing effect.



(36) Praat diagram for that-clause/[-Q]_{Matrix}

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In addition, we revealed a potential relationship inside an embedded clause, especially between the Topic DP and the embedded C head in (36). The pitch contours between the Topic DP and the embedded C are seen to be deleted/reduced (Yumi-TOP ... know-*that*), similar to what we observed in *wh*-questions. While the similarity in phonological phrasing behavior between Topic DP and embedded C is interesting, we do not pursue this phenomenon in this paper and leave it to future research.

4.3 Interim discussion

Experiment 2 investigates the potential impact of IP boundaries on the *wh*-phrasing effect. The first question in conducting Experiment 2 was whether the type of C head (*-nunci* (if), *-tako* (that), *-ta* (DEC), *-ni* (Q)) influences how the prosodic phrasing is handled. If the C head was the only factor in deciding the prosody, the phrasing would have been consistent only with the proximity of the C head regardless of the type of C ([-Q] vs. [+Q]), as curly-bracketed in (37a) and (37b).

(37) Possibilities of grouping (reiterated from (17)) If the only factor is the proximity of the C head: a. [CP X {[CP $wh \cdots C_{[-Q]}]$ } C_[+Q]] b. [CP X {[CP $wh \cdots C_{[+Q]}]$ } C_[-Q]]

However, the empirical data actually goes against this prediction and rather opts for a prosodic grouping that seems sensitive to Q-feature as well, illustrated in (38a) and (38b). The evidence for the grouping in (38) is furnished as follows. To this end, we have compared the tonal contours of sentences where the location of the [+Q] feature varied between the matrix and the embedded clause. In *wh*-questions with *if*-clause, the *wh*-element and *nunci* form an AP, providing evidence of the presence of the *wh*-phrasing effect. This phenomenon is also observed in cases where there is a certain distance between the *wh*-element and the Q-feature. In *wh*-questions with *that*-clause, the *wh*-phrasing persists, and the anticipated H tone on the embedded C head is deleted, causing all intermediate tones to be flat. This implies that the presence or absence of the Q-feature has a significant influence on the *wh*-phrasing, disregarding the proximity of the closer C head.

(38) Case of grouping if Q-feature is the factor (reiterated)
a. [CP X {[CP wh ··· C[-Q]] C[+Q]]}
b. [CP X {[CP wh ··· C[+Q]]} C[-Q]

The following section will introduce our proposal based on the two experiments in this paper.

5. Proposal

Through the two experiments, we propose the conditions for *wh*-phrasing in Seoul Korean based on Richards' (2016) Generalized Contiguity theory. Accordingly, a novel formation in phonological *wh*-licensing is also proposed for Korean in this section with a discussion of Kawahara et al.'s (2022) take on pitch reductions in Japanese.

5.1 The condition for wh-phrasing in Seoul Korean

Initially, Jun and Oh (1996) analyze that the *wh*-element and the following word form one AP, with the peak of the High tone appearing on the last syllable of the *wh*-element and the following L tone realized on the penultimate syllable of the following word. However, our consequent experiment with varying distances between *wh*-elements and IP boundaries has shown a consistent prosodic grouping between the two. This indicates that *wh*-phrasing is not purely phonological and that syntactic conditions are in action.

Richards' (2016) Contiguity Theory proposes that both phonological cues and their structures play a role in determining *wh*-movement or *wh*-in-situ in a certain language. When the prosodically active edges of phonological phrases are on the opposite side of the *wh*-phrase from the C head, this arrangement allows the *wh*-phrase to stay in its original position and create a structure with C through Grouping. This satisfies the notion of Generalized Contiguity, where the element that agrees with or selects another element must be included in a single prosodic domain. Our experiments have shown that Korean can prosodically group its *wh*-element with the licensor, and shows a high occurrence of Grouping. Furthermore, in every observed instance, the *wh*-element consistently found its place at the left edge of the prosodic boundary. By adhering to this specific positioning, any element present to the left of the *wh*-element was deliberately excluded from the

phonological grouping. This robust pattern of behavior serves to affirm and substantiate the concept of Contiguity-adjunction in Generalized Contiguity, as proposed in Richards' (2016) theory. Based on the results and discussion (see Section 3.4), we propose the following conditions for *wh*-phrasing in Seoul Korean.

- (39) The condition for *wh*-phrasing in Seoul KoreanA *wh*-phrasing effect is activated when the following two conditions are satisfied:
 - a. Grouping for wh-phrasing

Take a prosodic node of a *wh*-element and another of a C head and group them into one AP that dominates them both.

b. Contiguity-adjunction for wh-phrasing

For the C head_[+Q] that Agrees with a *wh*-element, both must be dominated by a single prosodic node, within which the *wh*-element is located at the left edge of a prosodic boundary.

5.2 The prosodic structure observed in Seoul Korean: Basin Formation

Kawahara et al. (2022) aims to further verify Richards' (2010) claim regarding prosodic licensing of *wh*-element in Japanese. Their criteria for prosodic grouping involved the eradication/reduction of the lexical pitch accents of words that come between, in addition to sharing a pitch contour of a prosodic group. Through reanalysis and refinement of their prior research, they conclude that, while Japanese speakers do reflect prosodic grouping of *wh*-element and its licensor, the occurrence is not overwhelming. Thus, their conclusion is that the mechanism allowing *wh*-in-situ in Japanese is more abstract in nature, and they also claim that the ability for Grouping is sufficient to support the Contiguity Theory.

Through our examination of interrogatives in Seoul Korean, however, we confirm a high tendency to prosodically group *wh*-element and its licensor, while also showing similar behavior to Kawahara et al.'s (2022) findings about pitch deletion/reduction. Hence we propose a pitch suppression that occurs in Korean *wh*-phrasing that creates this *basin*-like depressed pitch between the two highs in (40).

(40) Basin Formation for Contiguity (Pitch reduction/deletion) Only the elements located at the phonological edges can be realized as a H tone, whereas the remaining elements of the Grouping undergo pitch reduction/deletion.

 $[wh^H x_L x_L x_L Q^H]$

In sum, we have proposed two novel observations for the prosodic grouping of *wh*-phrases in Seoul Korean based on the empirical data. First, *wh*-element is phonologically grouped with its licensor regardless of the structure of the sentence and the distance. Second, in order to achieve this grouping, the pitch contours of the intervening words are seen to be either deleted or harshly reduced, resembling a basin formation.

6. Conclusion

We have examined the wh-questions in Seoul Korean. The goal of this study is to clarify the phonological characteristics of wh-questions in Seoul Korean and gain a better understanding of their prosodic grouping conditions. Two phonological experiments were conducted in this paper for this purpose: Experiment 1 to verify Jun and Oh's (1996) phonological account of wh-phrasing and Experiment 2 to examine whether the grammatical phenomena and effects, previously attributed to syntax, can be adequately accounted for on phonological grounds. Through Experiment 1, we examined multiple-wh questions in Korean. We showed that the explanation of Jun and Oh (1996) lacks flexibility in accounting for the variable length between the *wh*-element and its following words. Instead, this paper suggests that both wh-element and IP boundary are crucial factors for wh-phrasing. Experiment 2 develops this idea by testing wh-questions with embedded clauses in order to examine the potential influence of IP boundary on wh-phrasing. We identified that the wh-element and its licensor are phonologically grouped regardless of the structure and distance. Additionally, to achieve this grouping, the pitch contours of the intervening elements are deleted or reduced, creating a basin formation.

The significance of this paper lies in the strong empirical data that supports the possibility of an interaction between phonology and syntax in that the licensing operation

is realized as a phonological representation of the utterance. Of course, as Kawahara et al. (2022) also note, this does not serve as a piece of concrete evidence that syntax can vary to fit phonology, but that prosody may be utilized as a part of a syntactic process to license *wh*-in-situ. In this sense, the current results presented in this paper support Richards' Generalized Contiguity Theory, which claims that syntactic representations can incorporate phonological information. This study of *wh*-phrasing in Seoul Korean provides valuable insights into the intricate interplay of prosody and syntax in language. The findings contribute to the broader understanding of language-specific phenomena and set the stage for further research into phonological organization in different languages.

References

- Branan, Kenyon Garrett. 2018. *Relationship preservation*. PhD Dissertation. Massachusetts Institute of Technology.
- Breiss, Canaan and Bruce Hayes. 2020. Phonological markedness effects in sentence formation. *Language* 96(2): 338-370.
- Chomsky, Noam. 1995. The minimalist program. Cambridge, MA: The MIT Press.
- Compton, Richard and Christine Pittman. 2010. Word-formation by phase in Inuit. *Lingua* 120(9): 2167-2192.
- Deguchi, Masanori and Yoshihisa Kitagawa. 2002. Prosody and *wh*-questions. Proceedings of North East Linguistics Society 32 (NELS 32), 73-92.
- Elfner, Emily. 2015. Recursion in prosodic phrasing: Evidence from Connemara Irish. *Natural Language and Linguistic Theory* 33(4): 1169-1208.
- Jun, Sun-Ah. 1993. The phonetics and phonology of Korean prosody. PhD Dissertation. Ohio State University.
- Jun, Sun-Ah. 1998. The accentual phrase in the Korean prosodic hierarchy. *Phonology* 15(2): 189-226.
- Jun, Sun-Ah. 2000. K-Tobi (Korean ToBI) labelling conventions. Speech Sciences 7(1): 162-188.
- Jun, Sun-Ah and Mira Oh. 1996. A prosodic analysis of three types of *wh*-phrases in Korean. *Language and Speech* 39(1): 37-61.
- Jung, Yeun-Jin. 2012. On the nature of *wh*-prosody and its syntactic dependency. *Korean Journal* of Linguistics 37(2): 417-444.
- Jung, Yeun-Jin. 2014. On the syntactic grounding of the prosodic interpretation of *Wh*-questions. *Studies in Generative Grammar* 24(1): 105-132.
- Kawahara, Shigeto, Jason A. Shaw, and Shinichiro Ishihara. 2022. Assessing the prosodic licensing

of *wh*-in-situ in Japanese: A computational-experimental approach. *Natural Language and Linguistic Theory* 40: 103-122.

- Kratzer, Angelika and Elisabeth Selkirk. 2007. Phase theory and prosodic spellout: The case of verbs. *The Linguistic Review* 24(1): 93-135.
- Lee, Chung-hoon and Heeryun Chung. 2020. *Wh-in-front-of-V* and *wh*-adjacency in Korean. In Tae Sik Kim and Sae-Youn Cho (eds.), *Proceedings of the 22nd Seoul International Conference on Generative Grammar*. Jinju: Gyeongsang National University. August 12-14.
- Newell, Heather and Glyne Piggott. 2014. Interactions at the syntax-phonology interface: Evidence from Ojibwe. *Lingua* 150: 332-362.
- Newell, Heather, Noonan Maire, Piggott Glyne, and deMena Travis Lisa (eds.). 2017. *The structure of words at the interfaces*. Oxford: Oxford University Press.
- Richards, Norvin. 2010. Uttering trees. Cambridge, MA: The MIT Press.
- Richards, Norvin. 2016. Contiguity theory. Cambridge, MA: The MIT Press.
- Richards, Norvin. 2018. Contiguity-prominence: A prosodic parameter with syntactic consequences. Presented at the Forty-Ninth Annual Meeting of the North-Eastern Linguistic Society. Ithaca, NY: Cornell University. October 5-7.
- Selkirk, Elisabeth. 2009. On clause and intonational phrase in Japanese: The syntactic of prosodic constituent structure. *Gengo Kenkyui* 136: 35-75.
- Selkirk, Elisabeth. 2011. The syntax-phonology interface. In Goldsmith John, Riggle Jason, and Yu Alan (eds.), *The handbook of phonological theory*, 435-484. West Sussex: Wiley-Blackwell.
- Smith, Jennifer. 2011. [+wh] complementizers drive phonological phrasing in Fukuoka Japanese. Natural Language and Linguistic Theory 29: 545-559.
- Weber, Natalie. 2020. Syntax, prosody, and metrical structure in Blackfoot. PhD Dissertation. University of British Columbia.

Appendix A

Target sentences for experiment 1

A. Sample target sentences with context and multiple *wh*-questions

1. [Context] 연우가 친구들과 놀았다는 얘기를 듣고 민지가 무슨 일인지 더 알고 싶 어서 물어봅니다.

Q: 연우가 <u>언제 왜</u> 놀았니? A: 밤에 공부가 끝나서 놀았어.

2. [Context] 도통 웃지 않는 영미가 웃었다는 말을 듣고 철수가 물어봅니다.

Q: <u>언제</u> 왜 영미가 웃었니? A: 아침에 동생 때문에 웃었어.

3. [Context] 반장인 진수는 아침에 누가 누구를 밀었는지 선생님께 알려야해서 친구 에게 물었습니다.

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Q: 아침에 <u>누가 누구를</u> 밀었니? A: 윤아가 민호를 밀었어.

4. [Context] 어제 누군가 된통 혼났다는 소문을 들은 영희가 무슨 일인지 궁금해서 물어봅니다.

- Q: <u>누가 누구를</u> 저녁에 혼냈니? A: 민우가 윤지를 혼냈어.
- 5. [Context] 다리를 다친 유미가 걷는 것을 봤다는 얘기를 듣고 민지가 물어봅니다.
 Q: 유미가 어디서 왜 걸었니?
 A: 운동장에서 운동삼아 걸었어.
- 6. [Context] 도통 웃지 않는 영미가 웃었다는 말을 듣고 철수가 물어봅니다.
- Q: <u>어디서 왜</u> 영미가 웃었니? A: 집에서 동생 때문에 웃었어.
- 7. [Context] 다리를 다친 유미가 걷는 것을 봤다는 얘기를 듣고 민지가 물어봅니다.
- Q: 유미가 <u>언제 어디서</u> 걸었니? A: 어제 운동장에서 걸었어.

8. [Context] 연우가 친구들과 놀았다는 얘기를 듣고 민지가 무슨 일인지 더 알고 싶 어서 물어봅니다.

Q: <u>언제 어디서</u> 연우가 놀았니? A: 밤에 노래방에서 놀았어.

B. Sample target sentences with context and declarative sentences

[Context] 새벽 보초를 서는 철수가 누가 누구를 깨웠는지 기록하기 위해 물어봅니다.
 Q: 무슨 일이니?
 A: 새벽에 윤호를 민수가 깨웠어.

2. [Context] 철수는 오전에 누가 누구를 만났는지 몰라서 친구에게 물었습니다.

Q: 무슨 일이니? A: 민우가 윤미를 오전에 만났어.

3. [Context] 반장인 진수는 아침에 누가 누구를 밀었는지 선생님께 알려야해서 친구 에게 물었습니다.

Q: 무슨 일이니? A: 아침에 윤아가 민호를 밀었어.

4. [Context] 유미가 어제 농사일를 돕다가 덥고 짜증나서 나가버렸습니다. 영희가 무슨 일인지 물어봅니다.

Q: 무슨 일이니? A: 유미가 논에서 욱해서 나갔어.

5. [Context] 영미가 감기로 아파서 오늘 낮에 자기 방에서 쉬었습니다. 그 사실을 모 르는 철수가 무슨일인지 물어봅니다.

Q: 무슨 일이니? A: 아파서 낮에 영미가 쉬었어.

6. [Context] 철수는 오전에 누가 누구를 만났는지 몰라서 친구에게 물었습니다.

Q: 무슨 일이니? A: 윤미를 민우가 오전에 만났어.

7. [Context] 유미가 어제 농사일를 돕다가 덥고 짜증나서 나가버렸습니다. 영희가 무슨 일인지 물어봅니다.

Q: 무슨 일이니? A: 유미가 어제 욱해서 나갔어.

8. [Context] 명희가 기차 타려고 서두르는 승객에 밀려서 넘어져 다쳤습니다. 명희가 약속장소에 오지 않자. 철수가 무슨일인지 궁금해서 다른 친구에게 물어봅니다.

Q: 무슨 일이니? A: 방금 밀려서 명희가 다쳤어.

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Appendix B

Target sentences for experiment 2

A. Sample target sentences with whether-clause

1. 민아는 내가 무언가를 여는 소리를 들었다. 그런데 그게 무엇인지는 보지 못했다. [Target] 민아는 내가 무얼 여는지 모른다. 2. 민아는 누군가 문 여는 소리를 들었다. 그런데 그게 누구인지는 모른다. [Target] 민아는 누가 문을 여는지 모른다. 3. 영이는 그가 뭔가를 맛있게 먹고 있는 소리를 들었다. 그런데 그게 뭔지는 모른다. [Target] 영이는 그가 무얼 먹는지 궁금하다. 4. 유미는 아이가 누군가를 방에 들어오지 못하게 막고 있는걸 목격했다. 그런데 그게 누구인지는 모른다. [Target] 유미는 얘가 누굴 막는지 모른다. 5. 영이는 가족 중에 누군가 약을 먹고 있다는 걸 안다. 그런데 그게 누군지는 모른다. [Target] 영이는 누가 약을 먹는지 궁금하다. 6. 교실에 잡상인이 들어오지 못하게 누군가가 막고 있는 듯 하다. 그런데 유미는 그게 누구인지 모른다. [Target] 유미는 누가 그를 막는지 모른다. 7. 민아는 내가 문 여는 소리를 들었다. 그런데 그게 나인지는 보지 못했다 [Target] 민아는 내가 문을 여는지 모른다. 8. 이 아이는 사람들이 지나다니는 길을 막고 있다. 그런데 유미는 그 사실을 모른다. [Target] 유미는 얘가 길을 막는지 모른다. 9. 영이는 그가 이틀 째 기침하는 소리를 자주 들었다. 그런데 그가 약을 먹는 모습을 본 적이 없다. [Target] 영이는 그가 약을 먹는지 궁금하다. B. Sample target sentences with *that*-clause 1. [Target] 유미는 얘가 누굴 안다고 믿는거니? A: 대통령. 2. [Target] 은아는 뭐가 그를 문다고 믿는거니? A: 철수가 키우는 강아지. 3. [Target] 유미는 <u>누가</u> 걔를 안다고 믿는거니? A: 3반 선생님. 4. [Target] 민아는 내가 <u>무얼</u> 연다고 믿는거니? A: 저 창문.

- 5. [Target] 영이는 개가 누굴 문다고 믿는거니?
- 6. [Target] 민아는 <u>누가</u> 문을 연다고 믿는거니?
- 7. [Target] 영이는 개가 그를 문다고 믿는거니?
- 8. [Target] 민아는 내가 문을 연다고 믿는거니? 9. [Target] 유미는 내가 얘를 안다고 믿는거니?
- A: 할아버지.
- A: 경비원 아저씨.
- A: 응. 실제로 봤대.
- A: 응. 너가 제일 일찍 오잖아.
- A: 응. 그럴걸?

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