Criteria for Forming an AP Boundary in Korean

Heeryun Chung, Jungu Kang
Sogang University

1   Introduction

This paper investigates the conditions for the *wh*-phrasing effect in Korean, where a *wh*-element forms one prosodic unit with the following word in an interrogative construction, as suggested by Jun and Oh (1996). To test this claim, experiments with multiple-*wh* questions were constructed and were tested against eight native speakers of Seoul dialect of Korean.

Through the experiment, this paper clarifies the phonological condition for *wh*-phrasing:

(1)   a.   The sentence must be an interrogative *wh*-question.
       b.   A *wh*-element (WH) with a following word (x) can form one Accentual Phrase (AP).
       c.   Only one WH closest to the IP boundary becomes involved in the *wh*-phrasing.
       d.   The involved elements must be situated adjacent to the IP boundary.

As such, the formula that fits the clarification in 1 is as follows:

(2) $[\dots [\text{WH} + \text{X}]_{\text{AP}}]_{\textbf{IP}}\%$

The main evidence in support of the structure of 2 is the tonal contour of the different variations of the multiple-*wh* questions. Specifically, a Korean phonological phrasal unit that is assigned a prosodic is Accentual Phrase (Jun 1993), and it is commonly analyzed as having four tones of LHLH or HHLH. We observed that the tonal contour of [WH + x] formed this pattern of LHLH, while any other combination resulted in separate units of AP. Also, we observed that this tendency of wh-phrasing is the most prevalent only when the compound is located very adjacent to the sentence boundary tone, or an IP in this case. In addition, despite speakers' preference of having multiple WHs next to each other (Lee and Chung 2020), *wh*-clustering effect was not found phonologically.

Section 2 discusses the relevant information in regard to the topic of Korean *wh*-phrasing, including phonological domains, chracteristics of Korean interrogatives, and previous studies such as an Jun and Oh (1996) and Lee and Chung (2022) that served as the precursor to the research. Section 3 will detail how the experiment was designed and executed with what kind of research questions in mind. It will also detail the K-ToBI (Korean Tone and Break Indices) standards provided by Jun (2000) that was utilized in defining the phonological boundaries and domains of Korean. Section 4 will provide the experiment result with the significance of the said analysis. Finally, section 5 will conclude by discussing the possible significance of the experiment in the field of syntax-phonology interface in the possible implication the refinements for the *wh*-phrasing conditions can have for the theory.

2   Background

2.1   *Korean phonological domains and their definitions*   Human speech, or utterances, are considered to consist of various prosodic domains organized into a hiearchy, with each level in the hierarchy in charge of certain phonotactical 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 1998). Match Theory proposes that a prosodic structure is derived by a family of syntax-prosody MATCH constraints. Syntactic constituents (word, phrase, clause) and prosodic domains (ω, ϕ, ι) correspond to each other following the correspondence constraints given in Table 1.

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, 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.

Syntactic level	Match Theory	Intonational (Jun 1998)
CP	intonational phrase, ι	intonational phrase, IP
XP	phonological phrase, ϕ	accentual phrase, AP
X	phonological word, ω	phonological word, PW

Table 1: Examples of Prosodic Domains.

Whether one AP boundary is formed or not is defined in Jun (2000). According to the paper, the default Korean AP is defined as consisting of two contrastive tones of high(H) and low(L) alternating as in THLH, with T being the variable tone reliant on the laryngeal features of the onset consonant—if the onset consonant is either aspirated or fortis, the T tone will be realized as an H, and in other cases as an L.
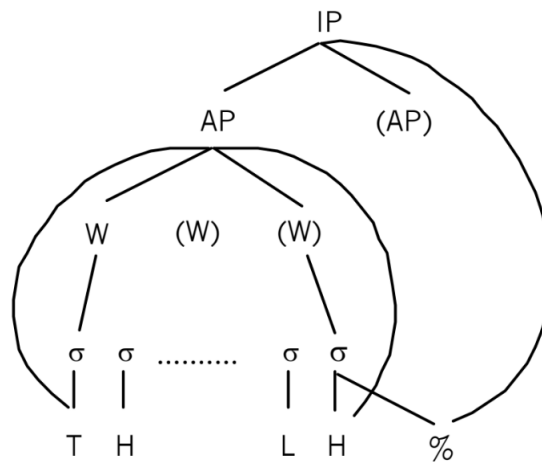

Figure 1: Intonational structure of Seoul Korean (Jun 2000).

An AP in Seoul Korean can have one or more phonological word in its phrase (Jun 2000). If the phrase has one to three syllables, the middle High tone or middle Low tone is not realized due to undershoot as in Figure 2a. Figure 2b is the standard example of a Korean AP with four syllables. If the phrase has more than four syllables, in contrast, the middle High tone is realized on the second syllable of the phrase to form one AP (Figure 2b). Figure 2 captures this well. We refer the reader to Jun's K-ToBI (2000) for further details on how the AP for Seoul Korean is defined.
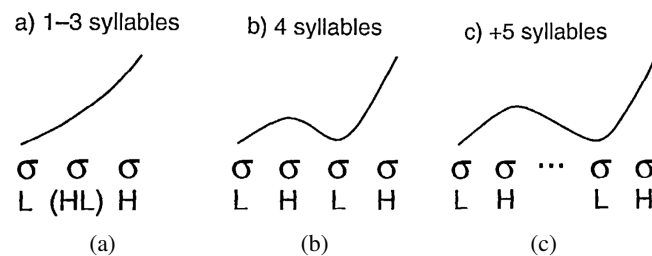

Figure 2: Korean prosodic contours by number of syllables.

2.2   *Characteristics of Korean wh-elements*   Korean is a language where *wh*-elements can appear in its base-generated position, namely a *wh*-in-situ language. In addition to this feature, Korean also allows for scrambling of its sentence elements, which leads to the relative freedom in the placement of the *wh* element in a sentence without resulting any ungrammaticality. Following example sentences from Jun and Oh (1996) that showcases this feature:

(3)   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 3a shows the adjunct *wh*-element *encey* appear in the center position of the sentence which would be its base-generated position if we surmise adjuncts as merging into the structure at *v*P, while 3b contrastively shows the case where *wh*-element in Korean can be placed freely as in front of the sentence without any difference in meaning.

Korean also allows for including multiple *wh* elements in an interrogative sentence, as the following examples show:

(4)   a.   Yengi-ka **encey etise** wul-ess-ni?
            yengi-NOM **when where** cry-Q
            'When and where did Yengi cry?'
       b.   **encey etise** Yengi-ka   wul-ess-ni?
            when where yengi-NOM cry-Q
            'When and where did Yengi cry?'

2.3   *Previous studies*   We review here two previous analyses; one about phonological patterns in three different types of Korean *wh*-questions (*wh*-question, yes/no-question, and incredulity question) another regarding distributive characteristics of *wh*-elements in Korean. We note some crucial differences in our findings and theirs and conclude that the facts presented here cannot be accommodated by these earlier analyses.

2.3.1   *Korean prosodic hierarchy and definitions*   Jun and Oh (1996) investigated the difference of phonological realization between three types of interrogatives in Korean, of polarity questions, content questions and incredulity questions.

One of the major difference they have noted between polarity questions and content questions was the number of accentual phrases in given sentences; for polarity questions, each accentual phrase boundaries matched to written word boundaries in Korean, while for content questions and incredulity questions the *wh*-element tended to form one accentual phrase with the following word.[1] Following figure (3) is the example given in Jun and Oh (1996):

Fig 3 shows an tonal exemplification of a Korean sentence meaning 'when do you feel dizzy, Madam¿' with the first half being the subject 'madam,' and the latter half being the WH 'when', being the predicate 'feel dizzy¿. Here we see the *wh*-phrasing effect in action; although morphologically the sentence is comprised of three words, it is only parsed into two sections. We see here that the distance between the High tone of the WH 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) analyzes that the WH and the following word form one AP when the peak of the High tone appears on the last syllable of the WH and the following Low tone is realized on the penultimate syllable of the following word.

---

[1] The pronounced difference between incredulity questions and content questions was the difference in how high the final pitch signaling the interrogative force was raised to.
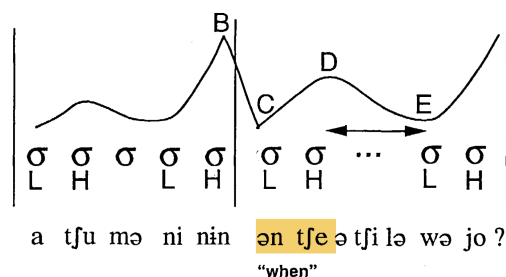
Figure 3: Example of a single AP including a ᴡʜ (Jun and Oh 1996).

Jun and Oh (1996) thus proposes that, in Korean, *wh*-word forms a prosodic unit with the following word. However, the proposition made in this article leaves some unanswered questions: what is the actual factor that causes this difference in the phonological behavior? Is it the *wh*-element itself, or is it the intonational tone placed at the right edge of the IP (referred to as IP boundary tone %)?

2.3.2   *Distributive characteristics of wh-elements in Korean*   As mentioned in 2.2, Korean is a type of language in which the *wh*-elements do not move overtly and thus it is predominantly considered as Korean *wh*-elements have no particular distributive characteristics. Lee and Chung (2020) examine whether there is any possibility that Korean *wh*-elements have patterns via word order task in their experiment. They compare the distribution of +*wh* with that of -*wh*, and give theoretical explanations for two interesting patterns observed in multiple *wh*-questions: i) preference of +*wh* in preverbal position (*wh*-in-front-of-V) and ii) preference of +*wh* to be adjacent to each other (*wh*-adjacency). The relevant example which satisfies the two patterns observed in Lee & Chung is presented below; the two *wh*-elements appear in front of the verb and they are adjoined to each other.

(5)   Chelswu-ka   Yengi-lul [encey etise]   manna-ass-ni?
       Chelswu-ɴᴏᴍ Yengi-ᴀᴄᴄ [when where] meet-ᴘsᴛ-Q
       'When and where did Chelswu meet Yengi?'

Based on the observations, Lee and Chung (2020) conclude that the economy of distance between *wh*-element and the Q-marker makes the *wh*-element adjacent to the verb to which the Q-marker is accompanied: farther the distance, lower the preference. They also give a phonological assumption that a single rhythm unit can be formed at PF when *wh*-elements are adjacent to each other. Specifically, the one-time operation between the rhythm unit and the Q-marker is sufficient for the agreement at PF to establish the *wh*-question intonation. If *wh*-elements are not adjacent to each other, however, two different rhythm units are formed for each *wh*-elements, and this leads to two operations which is less economical.

Lee and Chung (2020) gives additional evidence to support their proposals through the particle -*yo*, a hearer-honorification marker in Korean. A sentence-medial -*yo* is known to form a prosodic boundary (see Kim 1983, Kim & Lim 2014, Dobashi 2016). That is, a prosodic boundary is formed between the *wh*-element and the sentence final Q-marker when it is attached to the *wh*-element. As presented in 6a, the sentence is degraded since the sentence-medial -*yo* blocks the agreement between the *wh*-element and the Q-marker.

(6)   a.   nwu-ka-(??yo) keki-ey ka-ass-eyo?
             who-ɴᴏᴍ-yo   there-to go-ᴘsᴛ-Q
             'Who did go there?'
       b.   Chelswu-ka-(yo) keki-ey ka-ass-eyo?
             Chelswu-ɴᴏᴍ   there-to go-ᴘsᴛ-Q
             'Did Chelswu go there?'

Lee and Chung (2020, 2022) observed that *wh*-elements in Korean do have distributive patterns based on the empirical data and provide phonological assumptions (i.e., PF agreement between the *wh*-element and the Q-marker). However, the experiment was done by a word order experiment to see the preferred

position of *wh*-elements and the patterns, which means the phonological assumptions were yet to be verified and needs further investigation.[2]

3   Experiment

3.1   *Methodology*   As discussed, there have been various studies trying to identify the pattern of Korean interrogatives (Jun 1990, Jun & Oh 1996, Lee & Chung 2020, 2022). To our knowledge, however, no other works examine the tonal contour of multiple *wh*-questions in Korean. In this paper, we will show in the forthcoming discussion that there are critical conditions to form a phonological boundary in Korean multiple *wh*-questions via analyzing recorded data. The research questions explored in this experiment are as follows.

>   Research Question 1: In multiple *wh*-questions,
>   I) Does *wh*-cluster form one AP boundary?
>   II) Or, does it form separate two APs?

>   Research Question 2: What causes Jun & Oh's [wh + fw]~AP~?
>   I) Is the IP boundary tone a factor of forming an AP?
>   II) Or, is the wh a factor of forming an AP?

To examine whether Lee & Chung's observations regarding the preferred distribution of multiple *wh*-elements are also phonologically realized, we take multiple *wh*-questions as the target sentences in this experiment and compare their tonal pattern to those of declarative sentences which have -*wh*s (NPs). Specifically, as presented in Research Question 1, we will see whether the adjacent two *wh*-elements form one AP boundary or separate two APs. Therefore, the comparison of the tonal contour between the two *wh*-elements (multiple *wh*-questions) and two NPs (declaratives) are the first factor of this experiment as presented in 7a.

(7)   Experimental Design
    a.   WH (2): +*wh* vs. -*wh*
    b.   LOCATION (2): FRONT VS. BACK
    c.   ORDER (2) * PART OF SPEECH (4):
        [S O], [O S], [T P], [P T], [T R], [R T], [P R], [R P]

The second factor is LOCATION of two adjacent WHs: the initial position of the sentence (Front) versus the preverbal position (Back) as in 7b. These factors need to be considered to answer the Research Question 2-I, because, if the IP boundary tone is indeed the factor in forming an AP, the two WH would form one AP when adjacent to the IP boundary (BACK) and contrastively form two separate APs in the initial position of the sentence (FRONT). If the WH is the factor for forming an AP in multiple-*wh* questions (Research Question 2-II), it can be verified by comparing the tonal patterns between [*wh*+v]% and [NP+v]%.

(8)   LOCATION factor-applied to the multiple-*wh* questions[3]
    a.   FRONT: WH WH [X + V]%
    b.   BACK: X WH [WH + V]%

In this comparison, the components are all controlled and differ only in the location of the clustered *wh*-elements, as in whether the word preceding the verb is WH 8b or non-WH (X) 8a. In 8, both [X+V] and [*wh*+V] are adjacent to the IP boundary (%). If the IP boundary tone is the only factor in forming an AP (Jun and Oh 1996), then both cases will form one AP respectively. However, if *wh*-elements are also a factor in the formation of an AP, then, 8b would form one AP while the [X+V]% would be realized as two separate APs. As such, we can clarify which are the factors in the AP formation through comparing

---

[2] Word order task has been used in various studies such as Nam and Hong (2013), Yamashita and Chang (2001) as an experimental method of collecting data while presenting the components of the target sentence on the screen (computer monitor) and allowing participants to freely complete and utter the sentences.

[3] 'X' is a following word such as an NP or an AdvP in this schema.

the tonal contour of the two different structures provided in 8.

The third factor was designed on the basis of Gussenhoven (1983) and Jacobs (1993), where they proposed that there is a difference in the prosodic integration behavior between arguments and adjuncts. Based on these previous studies, we also considered ORDER and PART OF SPEECH as a factor in this experiment. Consequentially, the experiment would allow us to determine whether differences in syntactic word order (e.g., subject-object versus object-subject) or differences between *wh*-argument and *wh*-adjunct (T(ime), P(lace), R(eason)) affect phonological realization. The following are the excerpts from the target sentences to which the factors 7 were applied.

(9)   a.   [nwu-ka nwukwu-lul]$_{wh\text{-cluster}}$ ocen-ey   manna-ss-ni?
            who-NOM whom-ACC   morning-PRT meet-PST-Q
            'Who met whom this morning?'
       b.   ocen-ey   [nwu-ka nwukwu-lul]$_{wh\text{-cluster}}$ manna-ss-ni?
            morning-PRT who-NOM whom-ACC   meet-PST-Q
            'Who met whom this morning?'
       c.   [encey etise]$_{wh\text{-cluster}}$ Mina-ka   wul-ess-ni?
            when where   Mina-NOM cry-PST-Q
            'When and where did Mina cry?'
       d.   Mina-ka   [encey etise]$_{wh\text{-cluster}}$ wul-ess-ni?
            Mina-NOM when where   cry-PST-Q
            'When and where did Mina cry?'
       e.   [nwukwu-lul nwu-ka]$_{wh\text{-cluster}}$ ocen-ey   manna-ss-ni?
            whom-ACC   who-NOM   morning-PRT meet-PST-Q
            'Who met whom this morning?'
       f.   [etise encey]$_{wh\text{-cluster}}$ Mina-ka   wul-ess-ni?
            where when   Mina-NOM cry-PST-Q
            'Where and when did Mina cry?'

The examples in 9a and 9b are multiple-*wh* questions with *wh*-arguments and the only difference is the location; the *wh*-cluster appears in the initial position of the question in the former while it appears in front of the verb in the latter. In 9c and 9d, *wh*-adjuncts are clustered instead of *wh*-arguments and the two examples differ in terms of the location of the *wh*-elements, identical to the 9a and 9b. The examples 9e and 9f are designed to see the effect of the order of *wh*-elements in *wh*-phrasing by switching the orders of them relative to 9a and 9b.

3.2   *The guiding principle for analysis*   Before moving on to the discussion on the results of the experiment, we briefly note the guiding principle we adopted to analyze how many Accentual Phrases are realized in a multiple-*wh* question as we discussed above (Section 2.1 and 2.3.1).

(10)   The principles of forming one AP
       a.   Three syllables or less:
            -Middle High tone or middle Low tone may not be realized due to undershoot.
       b.   Four syllables or more:
            -The second syllable of the *wh*-word will have a High tone.
            -The following Low tone will be realized on the penultimate syllable of the phrase.
            -The peak of the middle High tone is in general lower than that of the final High tone.

A sample screen of Praat (Boersma & Weenink 2018) program showing a spectrogram, a waveform, an F0 contour, and labels is presented in Figure 4. It shows the data *nwu-ka mil-ess-ni*? (who-NOM push-PST-Q?) forming one AP: i) the second syllable of the *wh*-word has a High tone (point A), ii) its peak is minimally higher than that of the final High tone (point C) regarding the downstep effect, and iii) the following Low tone (point B) is realized on the penultimate syllable of the phrase.
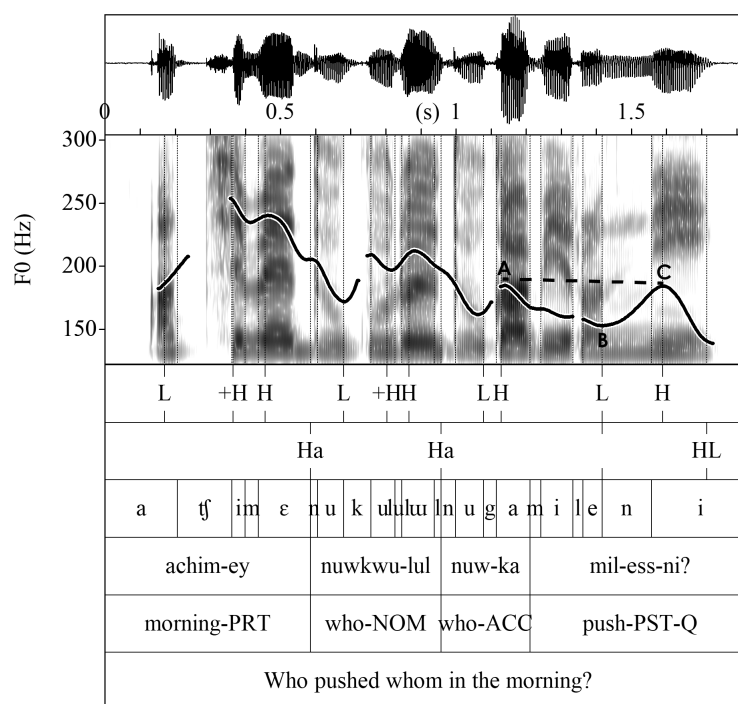
Figure 4: Sample screen of one AP formation between the *wh*-element and the following word.

4   Results and discussion

Out of total 512 sentences ((32 multiple-*wh* questions + 32 declaratives) * 8 participants), 443 were analyzed in this study. We excluded 64 sentences including the verbs starting with fricatives, and five misread sentences. Table 2 specifies the details of the analysis. For instance, $[1\text{-}1\text{-}1\text{-}1]_{IP\%}$ represents that each word in a multiple-*wh* question forms four different APs while $[1\text{-}1\text{-}2]_{IP\%}$ 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 $[1\text{-}3]_{IP\%}$ illustrates that the three words form one AP except for the beginning word.

		$[1—1—1—1]_{IP\%}$	262
		$[1—1—2]_{IP\%}$	91
Analyzed	Types	$[1—2—1]_{IP\%}$	28
		$[2—1—1]_{IP\%}$	27
		$[2—2]_{IP\%}$	26
		$[1—3]_{IP\%}$	9
Total			**443**
Dropped	Faulty	.	5
	Fricative	N/A	64
Total			512

Table 2: Overall distribution.

4.1   *Declarative vs. interrogative*   The difference between a declarative sentence and an interrogative was surprisingly pronounced; in Figure 5, we can see that declarative sentences (the left graph) were predominantly pronounced in four APs, signified by the blue part of the graph taking up about 92% of the entire sample. This means that, as the test sentences were comprised of four words, each word

formed its own AP; on the contrary, participants showed quite a different prosodic realization for the interrogatives—rather than pronouncing each word as individual AP, they instead had a much heightened chance of pronouncing some of the words together as one AP, signaled by the increase of three AP constructions to 52%, and four AP constructions decreasing to 35% of the total sample. From this we can observe that there is indeed a difference in how interrogatives form prosodic units. The next section will endeavor to further clarify the reason for this difference in interrogatives by answering the research questions posed in Section 3.1.
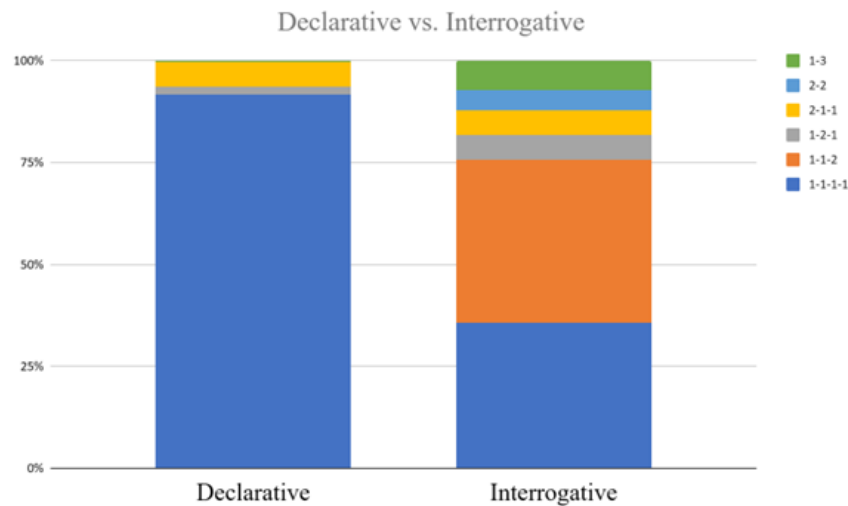

Figure 5: Declarative vs. Interrogative.

4.2   *Does multiple wh form one AP as a cluster?*   Of the interrogatives, as seen in Figure 6, only 21.9% of the test sentences were spoken as one AP, or a *wh*-cluster; most of the time, participants did not pronounce them in one phonological unit, leading to the conclusion that, unlike Lee & Chung's (2020) research where the *wh*-adjacency effect was observed word-order-wise, this effect is not observed phonologically.
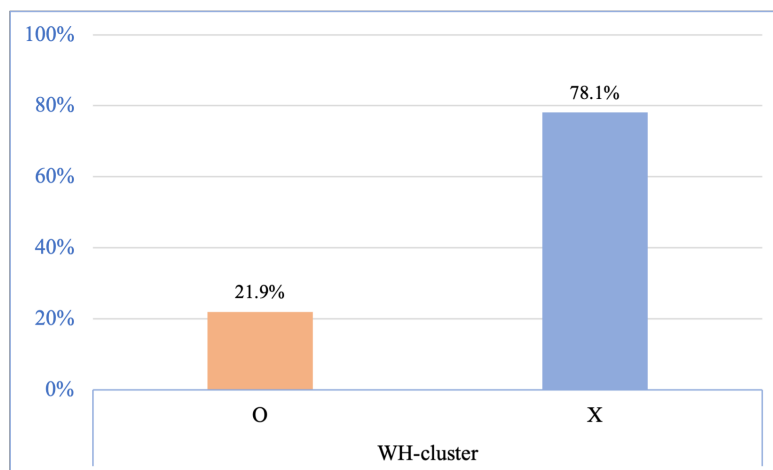

Figure 6: Wh-cluster percentages.

4.3 *What is the factor for AP boundary?*

4.3.1 *Is wh a factor?* To answer the question about whether a *wh*-element is indeed a factor in deciding the AP formation, we needed to compare the two scenarios of a *wh*-element being followed by any word (represented by [WH+X]) and a non-*wh* word followed by another non-*wh* word (represented by [X+X]).

The result shows an inversion in the percentage between the two; for [WH+X] constructions, a *wh*-element and a following word formed an AP 60% of the time; however, for the combination of two non-*wh* elements, they did not form a group around 60% of the time.
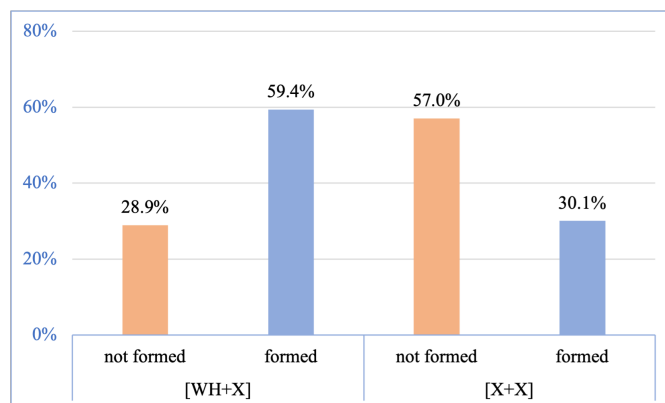

Figure 7: Effect of wh: WH-X vs. X-X.

From these results, we could argue that *wh*-elements do work as a factor in the *wh*-phrasing phenomenon. Also, the result supports Jun & Oh's (1996) observation about the *wh*-phrasing effect, in that *wh*-elements do interact differently with the following word phonologically.

4.3.2 *Is IP boundary tone a factor?* The result clarifying the effect of interrogative IP boundary tone on the AP formation is even starker; when [*wh*-X] is situated just one word away from the IP boundary tone, the wh-phrasing effect was observed only 2.3%, with 84.8% pronouncing the *wh*-element and the following word in separate accentual phrases as Figure 8 shows.[4]
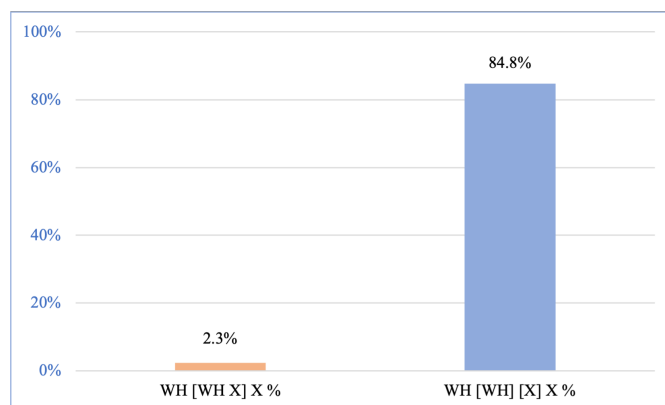

Figure 8: Effect of IP %.

Based on the result, it can be argued that the interrogative IP boundary tone plays an important role in deciding the *wh*-phrasing effect; however, this was not something that was included in the condition Jun and Oh 1996 mentioned; therefore, this requires further refinement of the condition that was given.

---

[4] Remaining 13% of the [*wh-wh*-X-X] were the cases where the wh-element closest to the IP boundary tone formed one AP with the following two words, as in [*wh*-X-X]

5   Conclusion

5.1   *Significance*   The significance of this paper is in its clarification of the effects of *wh*-elements phonologically, and in its refinement of the conditions for the *wh*-phrasing effect suggested by Jun and Oh (1996), the latter of which could prove fruitful in future endeavors regarding establishing the relationship between syntax and phonology.

1. *Wh*-adjacency effect is not observed phonologically.

2. *Wh*-phrasing suggested by Jun and Oh (1996) only forms consistently in the environment where a *wh*-element is followed by a word adjacent to an interrogative IP boundary tone.

5.2   *Wh-clustering*   This was an interesting difference that was not expected during the experiment design process; either *wh*-element is the factor deciding the *wh*-phrasing and thus forms a three-word AP in the form of [wh - wh -X] or simply [wh - wh]. Both cases were rarely seen, which would have suggested that *wh* is not a factor in the *wh*-phrasing effect.

However, further analysis of the experiment has shown that *wh*-element is indeed a deciding factor in the formation of an AP, but that only the *wh*-element that is located close to the interrogative IP boundary tone (which is the other factor in the *wh*-phrasing) is included in the AP formation.

From the discussion, we could clarify that both *wh*-element and the IP boundary tone are the deciding factors in creating the most consistent and stable environment for the *wh*-phrasing effect.

$$\left[\ldots \left[\text{WH} + \text{X} \right]_{\text{AP}} \right]_{\text{IP}\%}$$

5.3   *Wh-phrasing and further research*   While the current research has been focused more on clarifying the phonological aspect of the phenomena the refinement of the *wh*-phrasing condition allows for an interesting possible development in the syntax-phonology interface; namely, is the *wh*-phrasing effect caused by the sentence-final IP boundary *tone* or is it sensitive to the C head that encodes such sentential force? If it is the C head that the *wh*-phrasing is reacting to, which can be tested by creating a nested question, it can serve as evidence of an interface between syntax and phonology, where the syntactic information can be encoded into the phonology.

References

Jun, Sun-Ah. 1993. *The Phonetics and Phonology of Korean Prosody*. Columbus, OH: The Ohio State University Ph.D. Dissertation.

Jun, Sun-Ah and Mira Oh. 1996. A Prosodic Analysis of Three Types of Wh-Phrases in Korean. en. *Language and Speech* 39(1). Publisher: SAGE Publications Ltd, 37–61.

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. ko. 7(1). 162–188.

Yamashita, Hiroko and Franklin Chang. 2001. "long before short" preference in the production of a head-final language. *Cognition* 81(2). B45–B55.

Selkirk, Elisabeth. 2009. On clause and intonational phrase in Japanese: the syntactic grounding of prosodic constituent structure. *Gengo Kenkyu* 136. 35–75.

Selkirk, Elisabeth. 2011. The syntax-phonology interface. In John Goldsmith, Jason Riggle, and Alan Yu (eds.), *The Handbook of Phonological Theory*, 435–484. Columbus, Ohio: Wiley-Blackwell.

Nam, Yunju and Upyong Hong. 2013. Constituent length and word order preference in language production. *Korean Journal of Cognitive Science* 24(1). 25–47.

Elfner, Emily. 2015. Recursion in prosodic phrasing: evidence from Connemara Irish. *Natural Language & Linguistic Theory* 33(4). 1169–1208.

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.), 145–162. The Korean Generative Grammar Circle.

Lee, Chung-Hoon and Heeryun Chung. 2022. Constraints on the word order of Korean wh-elements: an experimental syntactic approach. *Journal of Korean Linguistics* (101). 3–58.