Wh-operator and phonological phrasing in North Kyungsang Korean[*]

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Sohn, Hyang-Sook. 2004. Wh-operator and phonological phrasing in North Kyungsang Korean. *Studies in Phonetics, Phonology and Morphology* 10.2. 293-325. Based on the end-based approach, in conjunction with optimality theory, this paper provides an account of the prosodic phenomena of phonological phrasing and dephrasing triggered by the wh-operator in North Kyungsang Korean. Advancing the basic tenet in Kenstowicz and Sohn (1997) and Sohn (1999) that focus triggers the onset of a phonological phrase and dephrasing of the following phonological phrases, this paper claims that focus is attracted by the wh-operator as well. A phonological phrase is created flush against the wh-operator, which in turn dephrases the following phonological phrases. Supporting evidence is drawn from wh-movement in simple and complex question sentences. Also claimed in this paper is that the interrogative verb, located in the sentence-final position, also attracts focus, but that the one in the wh-question is systematically dephrased by the preceding wh-operator. Phonological phrasing of complex sentences, whereby the sentence-final main verb is dephrased by the wh-operator although the intervening lower clause is exempt from dephrasing, serves to establish the argument that dephrasing triggered by the wh-operator spans over the entire IP. The domain of dephrasing, i.e. the domain of IP is crucially determined by the overt interrogative verbal ending, which marks the presence or absence of correspondence between the wh-operator and the main verb. Also discussed in this paper is a correlation between the directionality of the stacked branching structure and the obligatory or optional propensity for eurythmy. **(Kyungpook National University)**

keywords: wh-operator, focus, phonological phrase, dephrasing, interrogative sentence, eurythmy, stacked right-branching structure, intonational phrase

1. Introduction

The phonological phrase is partially determined by syntactic structure since in some cases the two structures of prosody and syntax may coincide but they may also diverge (Kaisse 1985, Odden 1987, Inkelas and Zec 1990, 1995). Agreeing on the claim that prosodic structure deviates from syntactic structure in a systematic way, two major approaches to the syntax-phonology mapping have been advanced in the literature: the end-based approach (Selkirk 1986, 1995, Cho 1990, Truckenbrodt 1995, 1999), and the relation-based approach (Nespor and Vogel 1986, N. Kim 1997). The main difference between the two approaches resides in the nature of

the syntactic information to which the mapping conditions are sensitive: the former responds to edges of a selected syntactic category (i.e. the right or left edge of such category types as X^{lex} or XP), whereas the latter to heads and adjacent constituents (i.e. the presence or absence of a head-complement relation).

Adopting the end-based approach, this paper accounts for the prosodic phenomena of phonological phrasing and dephrasing triggered by the wh-operator in North Kyungsang (henceforth, NK) Korean. The basic support for the prosodic hierarchy in this study is the domain of tonal interaction bounded by a phonological phrase, which has been discussed in the literature as the domain of operation of sandhi processes. Based on the tonal evidence, this paper argues that prosodic behavior of the wh-operator is parallel to that of lexical or discourse-related focus. The wh-operator triggers the onset of a phonological phrase and dephrasing of the following phonological phrases. Supporting evidence is drawn from wh-movement in simple and complex sentences. Various patterns of phonological phrasing and dephrasing in the wake of the wh-movement are examined in relation to whether the wh-operator is base-generated in the upper or lower clause.

This paper claims, first, that phonological phrasing of the question sentence differs from its declarative counterpart by separating off the verb as an independent phonological phrase from the higher constituent VP. Islanding of the verb from the VP in phonological phrasing is attributed to the focus-triggering effect of the interrogative verb. Second, the domain of dephrasing primarily coincides with the scope of the Rightmost-IP constraint. The domain of dephrasing stretches to the sentence-final main verb to effect the rightmost prominence of IP, and this is overtly indicated by the interrogative ending [-no] corresponding to the wh-operator, regardless of whether it is base-generated in the upper or lower clause. Third, directionality of the headedness is related to the asymmetry in phonological phrasing. Eurythmy is optional in the right-branching structure, whereas it is obligatory in its left-branching counterpart, where it systematically eliminates the oversized phonological phrase.

This paper is organized as follows: the following section discusses the general property of the focus effect on phonological phrasing. In section 3, the phonological phrasing pattern of the interrogative sentence, in contrast with that of the declarative counterpart, is discussed to argue for a phonological phrase consisting of the interrogative verb alone. Section 4 deals with phonological phrasing and dephrasing in the wake of the wh-movement in syntax. When dephrasing triggered by the wh-operator results in an oversized phonological phrase and is challenged by paralinguistic factors such as speech rate and formality, eurythmy comes into play to split it up into smaller eurythmic phrases. When dephrasing is triggered by the wh-operator in the initial position of the stacked right-branching structure, breaking up the oversized phonological phrase motivated by eurythmy is not obligatory. This forms a contrast to the stacked left-branching structure,

in which operation of eurythmy is obligatory. Section 5 deals with the wh-operator in the complex sentence and its dephrasing pattern, which differs according to whether it is base-generated in the upper or lower clause, and argues that the domain of dephrasing is isomorphic to the domain in which the wh-operator corresponds to a verb.

2. Focus effect on phonological phrasing

In the previous studies of phonological phrasing based on various types of declarative sentences, Kenstowicz and Sohn (1997) and Sohn (1999) show that phonological phrases of NK Korean are primarily determined by the constraint interaction where Align-XP,L ranks higher than Wrap-XP[1] or Align-X^{lex}.

(1) a. Wrap-XP: Enclose a lexical head and its arguments in one phonological phrase.
    b. Align-XP: Align the L/R edge of XP with the L/R edge of a phonological phrase.
    c. Align-X^{lex}: Align the L/R edge of a lexical category with the L/R edge of a phonological phrase.

While Wrap-XP groups a lexical head and all of its arguments into a single phonological phrase, Align-XP aligns the left edge of each syntactic phrase with the left edge of the phonological phrase. Align-X^{lex} maps each lexical category into a phonological phrase. Within the framework of optimality theory (McCarthy and Prince 1993a, b, Prince and Smolensky 1993), the conflict among these constraints is resolved by the constraint ranking, as given below:

(2) [NP NP V]$_{VP}$
    Seoul Korean: (NP)(NP)(V) Align-X^{lex} Align-XP,L, Wrap-XP
    NK Korean: (NP)(NP V) Align-XP,L   Wrap-XP, Align-X^{lex}

In Seoul Korean each lexical item forms its own phonological phrase (Baek 1997); by contrast, in NK Korean the verb groups with the immediately preceding object. Grouping the object with the following verb is not affected by the presence or absence of the object case marker, although the pitch peak is located in a different position as a function of the tonal interaction within the phrase:

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[1] Wrap-XP is proposed by Truckenbrodt (1995, 1999) to accommodate as many governed elements as possible into a single phonological phrase. Refer to Sohn (2001a) to see how Wrap-XP derives the phrasing requirement that the leftmost phonological phrase contain more phonological words than any other phrases in the left-branching structure.

(3) a. (átul-i)   (namwúl-ul   mek-nun-ta)   'Son eats vegetables.'
        son-nom.   vegetable-acc. eat-prs.-ind.
    b. (átul-i)   (namwul   mek-nún-ta)   'Son eats vegetables.'
        son-nom.   vegetable   eat-prs.-ind.

The following tableau illustrates the way in which optimal phonological phrasing of (3b) is selected:

(4) /átul-i namwúl mek-nún-ta/   (átul-i) (namwul mek-nún-ta)

/átul-i namwúl mek-nún-ta/	Align-XP	Wrap-XP
a. (átul-i) (namwul mek-nún-ta)		
b. (átul-i)(namwúl)(mek-nun-ta)		*!
c. (átul-i namwul mek-nun-ta)	*!	

Both candidates (4a)[2] and (4b) satisfy Align-XP,L, but candidate (4b) fails to wrap the verb phrase. Candidate (4c) fatally violates Align-XP,L by grouping the subject NP and the verb phrase together. Provided Align-XP,L is undominated in the constraint ranking, the subject is systematically separated off from the verb phrase in phonological phrasing.

   Under focus, however, this type of canonical phonological phrasing is revamped (See Kanerva (1990) for comparable focus effect in Chichewa). Three sentences in (5) are identical, except that the focus is introduced in different positions in each sentence. The focused words are indicated by underlining.

(5) a. <u>átul-i</u>   namwúl   mek-nún-ta   '<u>Son</u> eats vegetables.'
         (<u>átul-i</u>   namwul   mek-nun-ta)
    b. átul-i   <u>namwúl</u>   mek-nún-ta   'Son eats <u>vegetables</u>.'
         (átul-i) (<u>namwul</u>   mek-nún-ta)
    c. átul-I   namwúl   <u>mek-nún-ta</u>   'Son <u>eats</u> vegetables.'
         (átul-i) (namwúl) (<u>mek-nún-ta</u>)

In (5a) the focus on the subject triggers dephrasing of the following phrase; by contrast, in (5c) the focus on the verb brings about a separate phonological phrase on the verb when compared with the non-focused counterpart (3b). In the case of (5b) in which the object is focused, there is no observable change in phonological phrasing.

   As claimed in Truckenbrodt (1995), Kenstowicz and Sohn (1997), and Sohn (1999), the data in (5) define two characteristic effects of focus on phonological phrasing, namely introduction of a new phonological phrase cued by the focus and dephrasing of the following phonological phrases. These two generalizations are captured in the following constraints:

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[2]   Refer to discussion in 3.2 for the locus of pitch peak.

(6) a. Align-Focus: Align the element carrying the syntactic feature [+focus] with the left edge of a phonological phrase.
   b. Rightmost-IP: Pitch peak of the focused element constitutes the rightmost prominence in intonational phrase (IP).

Prominence in the focused element is represented by Align-Focus. Rightmost-IP reflects a strong UG bias toward default rightmost prominence of IP through post-focus phrase deletion (Truckenbrodt 1995, Frota 2000). That is, the peak of IP prefers to project from the rightmost phonological phrase. As the focused element never fails to begin a new phrase, Align-Focus ranks higher than Align-XP,L; Rightmost-IP also ranks higher than Align-XP,L, since a phonological phrase conditioned by the latter becomes dephrased when it is preceded by a focused element. By transitivity, the following ranking results:

(7) Align-Focus, Rightmost-IP   Align-XP,L   Wrap-XP

   An optimality-theoretic account of the phonological phrasing in (5c) is illustrated in the tableau below:

(8) /átul-i namwúl <u>mek-nún-ta</u>/   (átul-i)(namwúl)(mek-nún-ta)

/átul-i namwúl <u>mek-nún-ta</u>/	Align-Foc	Rmost-IP	Align-XP,L	Wrap-XP
a. (átul-i)(namwúl)(mek-nún-ta)				*
b. (átul-i namwul)(mek-nún-ta)			*!	*
c. (átul-i)(namwul mek-nún-ta)	*!			
d. (átul-i namwul mek-nun-ta)	*!		*	

Rightmost-IP is satisfied by all the candidates since the focused element is located in the utterance-final position. However, candidates (8c) and (8d) fatally violate Align-Focus by failing to align the focused element with the phonological phrase. Candidate (8b) violates Align-XP,L by failing to align the left edge of the verb phrase with the left edge of a phonological phrase. Candidate (8a) is selected as optimal by satisfying both Align-XP,L and Align-Focus. Thus, the verb, when focused, no longer groups together with its immediately preceding argument.

3. Phonological phrasing of interrogative sentences

3.1 Yes-No questions

Similar to the focus effect on the verb discussed above is phonological phrasing of the question sentence. Unlike the non-focused declarative sentences in (3), yes-no question sentences cued by the verbal ending [-na] phrase the verb by itself, and hence the object and the following verb do not group together:

(9) a. (nwúna-ka)   (w-áss-ná)
       sister-nom.   come-pst.-int.
       'Did sister come?'
   b. (nwúna-ka)   (namwúl-ul)   (mék-ess-na)
       sister-nom.   vegetable-acc.   eat-pst.-int.
       'Did sister eat vegetables?'
   c. (nwúna-ka)   (mánul-ul) (péli-ess-na)
       sister-nom.   garlic-acc. throw away-pst.-int.
       'Did sister throw away garlic?'

The verb with yes-no question ending [-na] separates off and phrases by itself. This is a phenomenon parallel to the focus effect on the verb in the declarative counterpart (cf. (8)). Yes-no question ending [-na] brings about the same phrasing effect as the case in which the utterance-final verb is focused. Therefore, it can be inferred that the interrogative ending [-na] behaves like focus-triggering particles such as [-man] 'only', [-to] 'also', and [-cocha] 'even'[3].

In spite of the focus effect on the verb triggered by the interrogative ending [-na], the verb in turn is subject to the general property of the focus if focus is laid on the preceding lexical items such as the subject or object. In (10) we see various phrasing patterns as the default yes-no question (9b) is focused in different positions.

(10) a. <u>nwúna-ka</u>   namwúl-ul   mék-ess-na
         (nwúna-ka   namwul-ul   mek-ess-na)
         'Did <u>sister</u> eat vegetables?'
     b. nwúna-ka   <u>namwúl-ul</u>   mék-ess-na
         (nwúna-ka) (namwúl-ul   mek-ess-na)
         'Did sister eat <u>vegetables</u>?'
     c. nwúna-ka   namwúl-ul   <u>mék-ess-na</u>
         (nwúna-ka) (namwúl-ul) (mék-ess-na)
         'Did sister <u>eat</u> vegetables?'

When the subject is focused as in (10a), the phonological phrase of the subject dephrases the following two phonological phrases, that of the object and that of the verb. Likewise, the focused object in (10b) dephrases the following phonological phrase of the verb. When the verb is focused as in (10c), however, the effect is not obvious since the phonological phrase comprising the verb is allowed anyway and there is no other phrase after to

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[3]   With respect to focus-related phonological phrasing, refer to Choe, et. al. (1999) and Sohn (1999) among others.   It is also noteworthy that the negation prefix in the verb also triggers focus:

    /nwúna-ka   namwúl-ul   an-mek-nún-ta/
    sister-nom.   vegetable-acc.   neg.-eat-prs.-ind.
    'Sister does not eat vegetables.'
    (nwúna-ka) (namwúl-ul) (an-mek-nún-ta)

be dephrased by it. As a consequence, phonological phrasing in (10c) is, to a certain extent, ambiguous with its default counterpart[4]. However, the fact that the pitch peak of the phonological phrase comprising the verb shoots up substantially higher than its default counterpart indicates that there is focus effect observed in this phrasing.

In sum, the phonological phrasing of the yes-no question differs from its declarative counterpart by separating off the verb as an independent phonological phrase from the higher constituent VP. Islanding of the verb from the VP in phonological phrasing is attributed to the focus-triggering effect of the interrogative verb marked by the ending [-na]. However, (10a) and (10b) show that focus elsewhere in the sentence overrides the focus effect of [-na] on the verb. Dephrasing of the subsequent focused phrase is also observed in the wh-question sentences, which we now turn to.

3.2 Wh-Questions

First examined is the tonal pattern of wh-operators. Listed in the following are wh-operators in Korean[5]:

(11) wh-operators

	Aorist	nominative	accusative
'who'	nwúkwú	nwúká	nwúkwú-lul
'what'	mwués mwé	mwues-í mwe-ká	mwues-úl mwe-lúl
'when'	éncéy		
'where'	etí etiéy etisé etieysé		

The wh-operators in (11) divide into two tonal classes of the doubled and the final[6]: [nwúkwú] 'who' and [éncéy] 'when' belong to the former, while [mwués] 'what' and [etí] 'where' to the latter. [mwués] as a final class, however, behaves differently from other lexical items drawn from that class in that the pitch peak of the nominative and accusative inflection also appears on the final syllable. Note that the lexical item [namwúl] 'vegetable', for example, shows its pitch peak on the penultimate syllable of the phonological word in its inflection, e.g. [namwúl-i] 'nom.', [namwúl-ul] 'acc.', and [namwúl-e] 'loc.'. In contrast, [mwués] has its inflectional paradigm as in [mwues-í] and [mwues-úl], not *[mwués-i] and *[mwués-

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[4]   This type of ambiguity is reported in the intonational phonology of English as well. "Five francs", as a response to "how much is it?", lays stress on <u>francs</u>, but it would emphasize <u>five</u> if the question were "Was it six francs?". Likewise, if it were the response to the question "Was it five marcs?", stress will be laid on <u>francs</u>. Thus, with respect to the intonation, the default (wide scope) case is identical to the case in which the utterance-final word is focused (narrow scope). For further details, refer to Ladd (1996).

[5]   The argument [enú] 'which' and the adjunct [wáy] 'why' are excluded from the discussion because the former patterns tonally with the argument [mwués] 'what' and the latter with [éncéy] 'when' with respect to phonological phrasing.

[6]   Refer to G. Kim (1988), Y. Chung (1991), and N. Kim (1997) for tone classes.

ul]. Apart from the tonal irregularity involved in the wh-word [mwués], the wh-operators follow the general pattern of tonal interaction in the phrasal phonology.

Another remark to be made about the wh-operators is, as observed in Choe (1995), the correspondence in Kyungsang Korean between the yes-no question clause and its interrogative ending [-na] on the one hand, and between the wh-question clause and its interrogative ending [-no] on the other. Just as the yes-no question ending [-na] triggers the focus effect on phonological phrasing, we might also expect the focus-triggering effect from the wh-question ending [-no]. However, the islanding effect, in which the verb is separated off from the VP in phonological phrasing, is not observed in wh-questions, as shown below:

(12) a. **nwúká** mék-no   (**nwúká** mek-no) 'Who eats?'
         who-nom. eat-int.
     b. **mwues-í** mék-no   (**mwues-i** mek-no) 'What eats?'
         what-nom. eat-int.
     c. **éncéy** mék-no   (**éncéy** mek-no)   'When do (you) eat?'
         when   eat-int.
     d. **etisé** mék-no   (**etise** mék-no)   'Where do (you) eat?'
         where eat-int.

In all cases in (12) the verb groups together with its preceding wh-operator regardless of whether it is an argument or an adjunct, and does not show the islanding effect observed in the yes-no questions, whereby the verb phrases by itself[7].

Given that the interrogative ending [-na] triggers focus, we might draw an analogy that the wh-question ending [-no] also triggers focus on the verb. Under this interpretation the verb is expected to phrase by itself, but it does not. This study claims that the failure to phrase the verb by itself in wh-questions is due to the focus effect of the wh-operator, which is in conflict with the focus effect of [-no]. Sohn (1999) argued that negative polarity items such as [amwutó] 'nobody', [amwukestó] 'nothing', and [pákkey] 'none except' attract focus with respect to phonological phrasing in the same way as some inherently focus-attracting particles such as [-to] 'also', [-man] 'only', and [-cocha] 'even'. As a parallel to these inherently focus-attracting particles and negative polarity items in Korean, the wh-operators are also claimed to attract focus in phrasal phonology. This

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[7] It is noteworthy at this point that wh-operators in (11) are isomorphic to the indefinite pronoun/adverb, hence [nwúká] meaning 'someone', [mwúes] 'something', [éncéy] 'sometime', [étise] 'somewhere', although there is tonal difference involved between some related lexemes. However, these indefinite pronouns show different tonal behavior with respect to phonological phrasing: they do not attract focus, and consequently, as illustrated in (9), the interrogative verb ending with [-na] is separately phrased by itself due to its own focus effect:
  /**nwúká** mék-na/   (**nwúká**) (mék-na) 'Does anyone eat?'
  /**éncéy** mék-na/   (**éncéy**) (mék-na) 'Will (pro) eat sometime?'

results in two foci in each sentence in (12), namely that of the wh-operator and that of [-no]. Note that this is parallel to the cases in (10a) and (10b), where there are two foci arising from the syntactic and discourse-related factors.

No matter what the nature of the focus is, it is characterized by a uniform effect in phonological phrasing, namely dephrasing of the following phonological phrases as well as aligning an edge of the focused word with an edge of a phonological phrase. Given two foci within a sentence created by the wh-operator and its corresponding verb respectively, there inevitably arises conflict between them. The wh-operator, under focus, would dephrase the following phrase wrapping the verb; on the other hand, the verb, also under focus, would be separated off from the preceding wh-operator and phrase by itself. In NK Korean this conflict is resolved by having the dephrasing of the wh-operator dominate the islanding effect of the verb. As a consequence, the focus effect of the verb triggered by the wh-question ending [-no], is blocked by the dephrasing effect of the wh-operator, and the onset of a phonological phrase at the left edge of the verb does not take place in wh-questions. This is the same dephrasing effect as observed in (10a) and (10b), where the focus effect of [-na] is overridden by the preceding discourse-related focus.

When the focus effect (dephrasing in this case) of the wh-operator on the verb is cast in a constraint-based framework, however, we run into difficulties, as illustrated below:

(13) /nwúká mék-no/   (nwúká mek-no)

/nwúká mék-no/	Align-Foc	Rmost-IP	Align-XP
a. (nwúká) (mék-no)		*	
b. (nwúká mek-no)	*		*!

Candidate (13a) satisfies Align-Focus since the left edge of the verb as well as that of the wh-operator is aligned with the left edge of a phonological phrase. As the left edge of the verb is aligned with a phonological phrase, however, the phonological phrase wrapping the wh-operator violates Rightmost-IP in (13a). *Mutatis mutandis*, in the case of candidate (13b), Align-Focus is violated since the verb is wrapped together with the wh-operator to satisfy Rightmost-IP. Candidate (13a), however, is favored on the basis of the lower ranked constraint Align-XP, L. After all, the above tableau wrongly selects candidate (13a) as the optimal form.

Failure to make a correct prediction is due to the fact that the constraint Align-Focus refers to two separate sources of focus--one triggered by the wh-operator and the other by the verb in interrogative sentences. This suggests that the focus constraint family be split into sub-constraints, hence making it possible for them to be separately ranked with respect to other

constraints. In this case, Align-Focus is split into two types of constraints[8], one aligning the wh-operator and the other aligning the interrogative verb to the edge of a phonological phrase:

(14) a. Align-Wh,L
       Align the left edge of the wh-operator with the left edge of a
        phonological phrase.
     b. Align-Qv,L
       Align the left edge of the verb in the interrogative sentence with
       the left edge of a phonological phrase.

Dividing the Focus constraint family into these two constraints, we suggest the following constraint ranking, as modified from the ranking in (7):

(15) Align-Wh,L, Rightmost-IP   Align-XP,L   Align-Qv,L, Wrap-XP

   Given the constraint ranking (15), the tableau (13) needs to be rewritten as follows:

(16) /nwúká mék-no/   (nwúká mek-no)

/nwúká mék -no/	Align-Wh	Rmost-IP	Align-XP	Align-Qv
a.(nwúká) (mék -no)		*!		
b.(nwúká mek-no)			*	*

(16a) violates Rightmost-IP since the wh-operator is one phonological phrase away from the right edge of IP. The candidate (16b) wins out although it fails to align the left edge of the verb with the left edge of a phonological phrase. Selection of the optimal form is made possible by splitting the focus factors into two separate constraints, hence ranking them separately.

   Before we turn to a more complex focus effect triggered by the wh-operator, we briefly detour to examine the locus of the pitch peak in a phonological phrase since the pitch peak of the phonological phrase serves as a diagnostic of phonological phrasing. In (12a) and (12c) the wh-operators attract the accentual peak, whereas in (12b) and (12d) the accentual peak is realized on the verb. No matter where the accentual peak is realized, the pitch peak is a function of tonal interaction delimited by the phonological phrase boundary. Based on the asymmetrical behavior of two types of tonal melodies LHL and HL in phrasal phonology, Kenstowicz and Sohn (1997) account for the tonal interaction within a phonological phrase by way of downstep and upstep. The following is an illustration of the

[8] A third constraint as a sub-constraint in the Align-Focus family, alias Align-F, is also required to subsume the alignment of focus attracted by lexical or discourse-related factors, as shown in (10). As the alignment constraints are undominated when they are attracted by NPI and other inherently focus-attracting particles, Align-F is also undominated.

downstep and upstep phenomena shown in (12a) and (12b) respectively:

(17) a. Downstep

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     nwúká  #  mék-no      nwúká  mek no      nwúká  mek no
      \ |       | |          \ |    | |         /\ |   /|   |
      L H L     H   L        Ⓛ H Ⓛ H  L        Ⓛ H Ⓛ!H   L
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   b. Upstep

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     mwues-í  #  mék-no      mwues-i mek-no     mwues-i  mék-no
       |         | |            |  |   |          | | | /  |   |
       H L       H   L          H  H   L          Ⓛ Ⓛ H  H   L
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The tone-doubling class words like [nwúká] enter the phrasal phonology with a LHL pitch accent[9], whereas words drawn from the final accent class enter the phrasal phonology with just a final H tone, deleting the unassociated L, if there is any. In (17a) the L tone is not deleted upon entering the phrasal phonology even though it is unassociated. This L triggers downstepping of the following H in the next word of the phonological phrase. By contrast, in (17b) the unassociated L tone is deleted and this makes the H tone spread to the following H, which is then upstepped. Due to these tonal interactions delimited by the phonological phrase, the pitch peak does not necessarily fall on the wh-operator.

   Returning to phonological phrasing, let us now consider the SOV structure. (18a) shows that the declarative sentence divides up into two phonological phrases. (18b) and (18c) are the wh-question counterparts of (18a), whose subject and object are replaced by the wh-operator respectively.

(18) a.   énni-ka   namwúl-ul   mék-ess-ta   'Sister ate vegetable.'
          sister-nom.   vegetable-acc. eat-pst.-decl.
          (énni-ka)   (namwúl-ul   mek-ess-ta)
     b.   **nwúká**   namwúl-ul   mék-ess- no   'Who ate vegetable?'
          who-nom.   vegetable-acc. eat-pst.-int.
          (**nwúká**   namwul-ul   mek-ess-no)
     c.   énni-ka   **mwue-lúl**   mék-ess-no   'What did sister eat?'
          sister-nom.   what-nom.   eat-pst.-int.
          (énni-ka)   (**mwue-lul**   mék-ess-no)

When the wh-operator appears in the subject position as in (18b), the two phonological phrases in the declarative counterpart are reduced to one. Dephrasing here is parallel to the focus effect in (5a) and (10a). Phonological grouping in (18c), where the object is replaced by the wh-operator, is parallel to (5b) and (10b). It is noteworthy that as in (5b), the pitch peak of the second phonological phrase in (18c) falls on the verb

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9   None of the wh-operators belongs to the nonfinal class. This class behaves in the same way as the doubling class by having the unassociated L trigger downstep of the following H.

although the focus is attracted by the wh-operator.   This shows again that the locus of the pitch peak is not directly mapped onto the focus, but is represented as a function of the tonal interaction within the phonological phrase.

The following tableau shows the way in which two phonological phrases of the object and the interrogative verb are dephrased in (18b):

(19) /nwúká namwúl-ul mék-ess-no/   (nwúká namwul-ul mek-ess-no)

/nwúká namwúl-ul mék-ess-no/	Align-Wh	Rmost-IP	Align-XP	Align-Qv
a. (1 2 3)			*	*
b. (1) (2)(3)		*!*		
c. (1) (2 3)		*!		*
d. (1 2)(3)		*!	*	

Satisfying Align-XP,L and Align-Qv,L, candidate (19b) allows two phonological phrases of the object and the verb, but in doing so, it fatally violates the higher ranking constraint Rightmost-IP. The optimal candidate (19a) satisfies Rightmost-IP at the cost of violating Align-XP,L as well as Align-Qv,L, to effect dephrasing of the subsequent phonological phrases. Dephrasing of the following phonological phrases when it is triggered by the wh-operator is made possible by sorting out the Align-Focus family and hence ranking its sub-constraints separately with respect to other constraints.

Dephrasing of the following phonological phrases, however, is not always observed. When there appear more than two wh-operators within an IP, each wh-operator attracts its own phonological phrase. Note again that the wh-operator does not necessarily attract the pitch peak of the phonological phrase, as shown in (20a, b, d).

(20) a. **nwúká   mwue-lúl**   mék-ess-no
           who-nom. what-acc.   eat-pst.-int.
           'Who ate what?'
           (**nwúká**) (**mwue-lul**   mék-ess-no)
      b. **nwúkwú-lul etisé**   manna-ss-no
           who-acc.   where   meet-pst.-int.
           'Whom did (you) meet where?'
           (**nwúkwú -lul**)   (**etise** mánna-ss-no)
      c. **nwúká   éncéy** namwúl-ul   mék-ess-no
           who-nom. when   vegetable.-acc. eat-pst.-int.
           'Who ate vegetable when?'
           (**nwúká**) (**éncéy**   namwul-ul   mek-ess-no)
      d. **nwúká   etisé   mwue-lúl**   mék-ess-no
           who-nom. where   what-acc.   eat-pst.-int.
           'Who ate what where?'
           (**nwúká**) (**etisé**) (**mwue-lul**   mék-ess-no)

In all the cases above, the left edge of the wh-operator is aligned with the left edge of a phonological phrase, but the wh-operator fails to dephrase the following wh-operator. That is, two wh-operators yield at least two phonological phrases. The cases in (18) and (20) lead to the claim that the focus effect of the wh-operator overrides the focus effect of [-no] on the verb. This is the prediction made by the constraint ranking, whereby Align-Wh,L is ranked above Align-Qv,L.

Based on the constraint ranking discussed so far, phonological phrasing in (20d) can be represented as follows, but only to fail in its selection of the correct form:

(21) /nwúká etisé mwue-lúl mék-ess-no/   (nwúká) (etisé) (mwue-lul mék-ess-no)

/nwúká etisé mwue-lúl mék-ess-no/	Align-Wh	Rmost-IP	Align-XP	Align-Qv
a. (1 2 3 4)	**		**	*
b. (1)(2)(3)(4)		***!***		
c. (1)(2)(3 4)		***!		*
d. (1)(2 3)(4)	*	**!**	*	
e. (1 2)(3 4)	*	**!	*	*

In evaluation of Rightmost-IP, violation marks are added up by the distance from each wh-phrase to the right edge of the IP. Given the constraint ranking as postulated in (15), the candidate (21a) is wrongly selected as the optimal form. The correct phrasing (21c), however, can be selected if the constraints Align-Wh,L and Rightmost-IP are not unranked with respect to each other, but are strictly ranked in that order. Thus, the constraint ranking in (15) is revised as in (22):

(22) Align-Wh,L   Rightmost-IP   Align-XP,L   Align-Qv,L, Wrap-XP

Given the revised constraint ranking, the tableau in (21) correctly selects (21c) as the optimal candidate. The fact that the focus effect of the wh-operator is not overridden by another preceding wh-operator is reflected in the constraint ranking in (22), whereby Align-Wh,L dominates Rightmost-IP.

To summarize, the wh-operator is argued to attract focus. As a consequence, it triggers the onset of a phonological phrase and effects dephrasing of the following phonological phrases. Between these two effects triggered by the wh-operator, the former takes priority over the latter, as tested out in the case of multiple foci. What follows from the constraint ranking in which Align-Wh,L is ranked above Align-Qv,L is that the focus effect of the wh-operator overrides that of [-no] on the verb. As the wh-operator in the interrogative sentence must correspond to the verbal ending [-no], and vice versa, the wh-operator cannot be deleted insofar as the question sentence ends with the verbal ending [-no]. Therefore, the

verbal ending [-no] never fails to be dephrased by the preceding wh-operator. It is also noted in the discussion that inherent focus on the wh-operator does not necessarily attract the pitch peak of the phonological phrase, since the pitch peak is realized as a function of the tonal interaction within a phonological phrase, rather than as a manifestation of raw tonal emphasis on the focused word.

4. Wh-movement and phonological phrasing

4.1 Wh-movement and the eurythmy effect

Based on phonological phrasing of the wh-operator in a simple sentence in the canonical order, we now turn to phonological phrasing of the wh-operator in the wake of syntactic wh-movement. Word order is relatively free in Korean insofar as the case markers are overtly specified, and scrambling takes place in the wh-questions as well. The following data show that arguments as well as adjuncts can be moved out of the canonical position and that the pattern of phonological phrasing varies according to their syntactic movement.

(23) 'What did sister eat?'
   a. énni-ka   **mwue-lúl**   mék-ess-no
      sister-nom. what-acc.   eat-pst.-int.
      (énni-ka) (**mwue-lul**   mék-ess-no)
   b. **mwue-lúl**   énni-ka   mék-ess-no
      what-acc.   sister-nom. eat-pst.-int.
      (**mwue-lul** énni-ka   mek-ess-no)

(24) 'Who met sister?'
   a. **nwú-ká**   énni-lul   mánna-ss-no
      who-nom.   sister-acc. meet-pst.-int.
      (**nwú- ká** enni-lul   manna-ss-no)
   b. énni-lul   **nwú- ká**   mánna-ss-no
      sister-acc. who-nom.   meet-pst.-int.
      (énni -lul) (**nwú- ká**   manna-ss-no)

In (23a) and (24b), where the wh-operator is located in the object, phrasing of (S)(OV) is simultaneously conspired by Align-XP,L and Align-Wh,L. As the wh-operator, like other focus, seeks for the rightmost prominence of IP, the interrogative verb is prevented from forming a phonological phrase by itself. When the wh-operator is moved to the sentence-initial position as in (23b), the entire sentence groups together due to the dephrasing effect of the wh-operator. The same is true of phrasing in (24a). Thus, the claim that the wh-operator marks the onset of a phonological phrase and dephrases its following phonological phrases is also borne out in phonological phrasing

after the wh-movement.

In the following we see scrambling of the wh-operator [etisé] 'where', yielding three different locations in the sentence, i.e. post-object, post-subject, and sentence-initial positions.

(25) 'Where did Youngmi meet sister?'
 a. yéngmi-ka énni -lul **etisé** mánna-ss-no
  Youngmi-nom. sister-acc. where meet-past.-int.
  (yéngmi-ka) (énni -lul) (**etise** mánna-ss-no)
 b. yéngmi-ka **etisé** énni-lul mánna-ss-no
  Youngmi-nom. where sister-acc. meet-past.-int.
  (yéngmi-ka) (**etise** énni-lul manna-ss-no)
 c. **etisé** yéngmi-ka énni-lul mánna-ss-no
  where Youngmi-nom. sister-acc. meet-past.-int.
  i) (**etise** yéngmi-ka enni-lul manna-ss-no)
  ii) (**etise** yéngmi-ka) (énni-lul manna-ss-no)

Align-XP,L yields three phrasal breaks at the left edge of XP in (25a). When the wh-operator shifts to the left of the object as in (25b), it dephrases the following object and verb, hence yielding two phonological phrases. Note that the H tone associated with the final syllable of the wh-operator [etisé] upsteps the following H of the next word, which signals a tonal process bounded by a phonological phrase. When it moves to the sentence-initial position as in (25c), its dephrasing effect causes the entire sentence to be wrapped into a single phonological phrase. Given below is the way in which constraints interact to yield a single phonological phrase in (25ci):

(26) /etisé yéngmi-ka énni-lul mánna-ss-no/
  (etise yéngmi-ka enni-lul manna-ss-no)

/etisé yéngmi-ka énni-lul mánna-ss-no/	Align-Wh	Rmost-IP	Align-XP	Align-Qv
a. (1 2 3 4)			**	*
b. (1 2)(3 4)		*!	*	*
c. (1)(2 3 4)		*!	*	*
d. (1 2 3)(4)		*!	**	
e. (1)(2)(3 4)		*!*		*

The candidate (26a) alone satisfies Rightmost-IP, and the above tableau selects (26a) as the optimal candidate.

Depending on speech styles, however, the candidate (26b) (=25cii) is accepted as an alternative to the optimal candidate (26a). It is reported in N. Kim (1997) and Sohn (2001a) that in allegro speech NK Korean maximally allows three phonological words within a phrase. The eurythmy effect in the stacked left-branching structure is accounted for by way of the

constraint interaction in which Minimum Binarity ranks above Maximum Binarity.

(27) a. Minimum Binarity: Avoid a phonological phrase consisting of less than two phonological words.
    b. Maximum Binarity: Avoid a phonological phrase consisting of more than two phonological words.

Note that these two constraints relating to eurythmy cannot be conflated into one since preference of ternary to unary phrasing in NK Korean (Sohn 2001a) or the other way around in Italian (Truckenbrodt 1999) is accounted for by the interaction between these two constraints, although unary and ternary phonological phrases are both penalized in both languages.

In light of the eurythmy, the candidate in (26a) violates Maximum Binarity. For the speaker who selects (26b) as the optimal candidate, eurythmy is more imperative than the rightmost prominence of the focus, i.e. dephrasing of the following phonological phrases. Therefore, the eurythmy constraints in (27) rank above Rightmost-IP, hence offsetting the dephrasing effect, as shown below:

(28) /etisé yéngmi-ka énni-lul mánna-ss-no/
      (etise yéngmi-ka)(énni-lul manna-ss-no)

/etisé yéngmi-ka énni-lul manna-ss-no/	Align-Wh	MinBin	MaxBin	Rmost-IP	Align-XP
a. (1 2 3 4)			*!		**
b. (1 2) (3 4)				*	*
c. (1)(2 3 4)		*!	*	*	*
d. (1 2 3)(4)		*!	*	*	**
e. (1)(2)(3 4)		*!*		**	

A single phonological phrase in (26a) (=28a) is split up into binary grouping as in (28b) crucially due to the eurythmy constraints dominating Rightmost-IP. If the ranking were reversed and Rightmost-IP were ranked above eurythmy constraints, then the eurythmy effect would be always suppressed and the entire sentence would be wrapped under a single phonological phrase as in (28a)[10].

The constraint ranking in the tableau (28) shows that when the dephrasing effect is challenged by paralinguistic factors, the way in which a large-sized phonological phrase is broken down into smaller phrases is not directly guided by Align-XP,L (cf. (28e)); rather, it is split up into

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[10] This leaves room for discussion on the constraint ranking discussed in Sohn (2001a), where, unlike the claim in this study, Align-XP,L ranks above Eurythmy. As the constraint ranking Align-XP,L   Eurythmy is subject to question to the extent that none of the tableaux in Sohn (2001a) is affected by the reversed ranking in selection of the optimal form, the ranking is revised in this study to Eurythmy   Rightmost-IP   Align-XP,L.

binary grouping following the eurythmy.

4.2 Wh-operator and dephrasing of the stacked right-branching structure

The claim that the wh-operator dephrases the following phonological phrases is borne out when there are one or two arguments following the wh-operator, as shown in (23) through (25). Multiple arguments are set up in the data in (29), so that the range of dephrasing triggered by the wh-operator can be tested out. In the following the wh-operator is located in the pre-verbal, post-dative, post-nominative, and sentence-initial position respectively:

(29) 'Where did Youngmi send vegetable to the sister?'
    a. yéngmi-ka   énni-eykey   namwúl-ul   **etisé**   ponáy-ss-no
      youngmi-nom. sister-dat.   vegetable-acc. where send-pst.-int.
      (yéngmi-ka) (énni-eykey) (namwúl-ul) (**etise** ponáy-ss-no)
    b. yéngmi-ka   énni-eykey **etisé** namwúl-ul   ponáy-ss-no
      youngmi-nom. sister-dat.   where vegetable-acc. send-pst.-int.
      (yéngmi-ka) (énni-eykey) (**etise** namwúl-ul   ponay-ss-no)
    c. yéngmi-ka   **etisé** énni-eykey namwúl-ul   ponáy-ss-no
      youngmi-nom. where sister-dat. vegetable-acc. send-pst.-int.
      i) (yéngmi-ka) (**etise** énni-eykey namwul-ul ponay-ss-no)
      ii) (yéngmi-ka) (**etise** énni-eykey) (namwúl-ul ponay-ss-no)
    d. **etisé** yéngmi-ka   énni-eykey namwúl-ul   ponáy-ss-no
      where youngmi-nom. sister-dat.   vegetable-acc. send-past.-int.
      i) (**etise** yéngmi-ka enni-eykey namwul-ul ponay-ss-no)
      ii) (**etise** yéngmi-ka) (énni-eykey namwul-ul ponay-ss-no)
      iii) (**etise** yéngmi-ka enni-eykey) (namwúl-ul ponay-ss-no)

As the wh-operator is pushed further back to the sentence-initial position from the pre-verbal position, the number of phonological phrases decreases. When the wh-operator is followed by one or two phonological words as in (29a, b), it groups with whatever elements it is followed by. When it is followed by three phonological words as in (29c), it also dephrases the following phonological phrases as a parallel to the case in (25ci). The phonological phrase in (29c) wrapping four phonological words is optionally broken down into binary grouping, as in (25cii).

   When the wh-operator moves to the sentence-initial position as in (29d), it entirely dephrases the following phonological phrases, hence yielding a single phonological phrase comprising five phonological words as in (29di). In a more stylized speech sensitive to the size of a phonological phrase, however, the phonological phrase is regulated by eurythmy, namely, Minimum Binarity and Maximum Binarity dominating Rightmost-IP as in tableau (28). In (29d), however, the odd number of phonological words cannot be evenly divided into two phrases and the lower-ranking constraint Wrap-XP comes into play to break the tie incurred by the higher-ranking

constraints, as illustrated below:

(30) etisé   yéngmi-ka   [énni-eykey   [namwúl-ul   ponáy-ss-no]$_{VP2}$]$_{VP1}$
      (etise   yéngmi-ka) (énni-eykey   namwul-ul   ponay-ss-no)

/etisé yéngmi-ka énni-eykey namwúl-ul ponáy-ss-no/	Align-Wh	Min	Max	Rmost-IP	Align-XP	Align-Qv	Wrap-XP
a. (1 2 3 4 5)			**!*		***	*	
b. (1 2)(3 4 5)			*	*	**	*	
c. (1 2 3) (4 5)			*	*	**	*	VP1!
d. (1 2) (3) (4 5)		*!		**	*	*	VP1
e. (1 2) (3 4) (5)		*!		**	**		VP1, VP2

Note that Maximum Binarity is gradiently evaluated in the above tableau to measure the degree of deviation from the canonical pattern of eurythmy. Given the eurythmy constraints, candidates (30b) and (30c) are tied, whereas those in (30a)[11], (30d) and (30e) fatally lose out. (30b) and (30c) continue to tie until they are evaluated by Wrap-XP. As the structure under consideration for Wrap-XP is a stacked right-branching VP, Wrap-XP is satisfied when all the elements governed by VP are contained within a single phonological phrase as in (30b). (30c) loses out by crucial violation of one category. Thus, the heavy phonological phrase in (29di) is optionally split up into smaller phrases as in (29dii).

What remains rather problematic in the present analysis, however, is that candidate (30c) (=29diii), which is less optimal than (30b) according to tableau (30), is equally acceptable to some speakers: (etise yéngmi-ka enni-eykey) (namwúl-ul ponay-ss-no). This poses a challenge to the status of Wrap-XP in the present analysis, since but for Wrap-XP, the two candidates (30b) and (30c) would tie. This suggests that the gradiently evaluated Wrap-XP is dormant (or "switched off" as in serial derivation) at a certain point down the constraint ranking, and EVAL does not have access to this constraint. However, this would seriously undermine the primary tenet of parallelism in optimality theory.

Adopting a less radical stance, this study proposes that Rightmost-IP be gradiently evaluated by counting the number of phonological words as well as that of phonological phrases. As for the violation of Rightmost-IP in terms of the number of phonological phrases, (30b) and (30c) tie. As for the violation of Rightmost-IP in terms of the number of phonological words, however, candidate (30b) is penalized for three violations since the rightmost phonological phrase contains three phonological words, whereas (30c) is penalized for two violations due to the two-word phonological phrase. Thus, (30c) wins out. Under this approach, Rightmost-IP conspires

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[11]   Note that the candidate (30a) is the optimal candidate for the speech style in which eurythmy is not taken into consideration. In this case, Minimum and Maximum Binarity are ranked lower than Rightmost-IP.

to extend the range of dephrasing triggered by the wh-operator as in (ABC)(DE) (=30c), where phonological words B and C are dephrased by the wh-operator. By comparison, in phrasing (AB)(CDE) (=30b), what is dephrased by the wh-operator is B only. Under this interpretation, those speakers who opt for (30c) select the phrasing with a wider range of dephrasing, while those for (30b) select the phrasing that satisfies Wrap-XP. After all, selection of an optimal form boils down to a matter of trade-off between the two constraints Rightmost-IP and Wrap-XP.

What is tested out by all the possible wh-movements in (29) is the repeated claim, namely that the wh-operator signals the onset of a phonological phrase and that the post-focus dephrasing follows suit. The range of dephrasing by the sentence-initial wh-operator proves to be unbounded to the extent that phonetic implementation of the caliber of a phonological phrase is possible (cf (29di)). Note that the unbounded dephrasing observed in the present discussion is based on the stacked right-branching structure, as schematically illustrated in (31a). Compare the right-branching structure with the stacked left-branching structure represented in (31b). What is intriguing here is the asymmetry between the stacked right- and left-branching structures with respect to optionality of breaking down an oversized phonological phrase into smaller ones.

(31) a. right-branching structure   b. left-branching structure
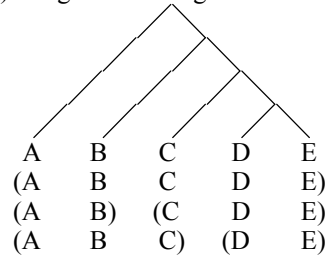
A	B	C	D	E		A	B	C	D	E
(A	B	C	D	E)		*(A	B	C	D	E)
(A	B)	(C	D	E)		*(A	B)	(C	D	E)
(A	B	C)	(D	E)		(A	B	C)	(D	E)
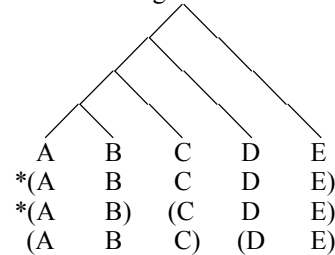
At issue in the schematic representation in (31a) are the cases in which the wh-operator is moved to the sentence-initial position [12], so that the phonological phrases (A)(B)(C)(DE) yielded by Align-XP,L are dephrased by A into a single phonological phrase (ABCDE). In (31b) Align-XP,L would render a single phonological phrase (ABCDE) because the left edge of every XP is aligned to the left of A. Thus, whatever triggers grouping of

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[12]   An equivalent to (31a) in the canonical declarative sentence is a sentence consisting of five phonological words where the sentence-initial subject is focused:

    yéngmi-ka   écey   énni-eykey   namwúl-ul   ponáy-ss-ta

    youngmi-nom. yesterday sister-dat.   vegetable-acc. send-past.-int.

    i) (yéngmi-ka ecey enni-eykey namwul-ul ponay-ss-ta)

    ii) (yéngmi-ka ecey) (énni-eykey namwul-ul ponay-ss-ta)

    iii) (yéngmi-ka ecey enni-eykey) (namwúl-ul ponay-ss-ta)

Note that the three types of phrasing available here are equivalent to those in (29c).

the entire sentence into a single phonological phrase, both of the two structures in (31) merge in their phonological phrasing until Align-XP,L is the only constraint under consideration.

Phonological phrasing of these two structures in (31), however, diverge: in the case of (31a) the phonological phrase (ABCDE) is possible, whereas in (31b) it is not. The right-branching structure in (31a), when headed by the wh-operator, is legitimately wrapped into a single phonological phrase as in (29di), which may split up into two phonological phrases only optionally by the speech style. Unlike the right-branching structure, the stacked left-branching structure in (31b) is forced by eurythmy to obligatorily group into two phonological phrases (ABC)(DE)[13]. An oversized phonological phrase is required to split up in the stacked left-branching structure, whereas it is permitted in the right-branching structure when it arises as a result of dephrasing triggered by the wh-operator. This suggests that directionality of the headedness is related to the asymmetry in phonological phrasing. First, eurythmy is optional in the right-branching structure, whereas it is obligatory in its left counterpart, hence systematic-cally eliminating the oversized phonological phrase. Second, the gradiently evaluated lower-ranking constraint Wrap-XP actively responds to selection of the optimal candidate in the left-branching structure, whereas it needs to be either optional or demoted to even lower rank in evaluation of the right-branching structure. As optionality of a constraint is expressed by way of constraint ranking in optimality theory, however, the idea that Wrap-XP is an optional constraint poses a serious challenge to the theory. For now, this study points out the asymmetry whose true nature remains a puzzling mystery, and leaves it for future research.

5. Wh-operator in the complex sentence and the domain of dephrasing

We now turn to the prosodic behavior of the wh-operator in the complex sentence. The wh-operator shows different patterns of dephrasing depend-ing on whether it is base-generated in the upper or lower clause, and on where it is located at the point of syntax-phonology interface.

5.1 Wh-operator in the upper clause

We first examine the cases in which the wh-operator is base-generated in the upper clause. Both of the sentences in (32) have their upper clause subject dropped and they are identical except for the wh-movement. Their lower clauses have overt subject [tongsáyng-i] and verb [ó-n-tá-ko]. In (32a) the wh-operator immediately precedes the main verb, but it is moved to the sentence-initial position preceding the lower clause in (32b).

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[13]   Refer to Sohn (2001a) for the way in which Wrap-XP prefers (ABC)(DE) to *(AB)(CDE) in the stacked left-branching structure.

(32) 'When did (pro) say that the brother comes?'
    possible answer: ((pro) said yesterday.)
    a. tongsáyng-i   ó-n-tá-ko   **éncéy**   málhá-yess-no
      brother-nom. come-prs.-ind.-comp. when   say-pst.-int.
      [[[[N   V]$_S$]$_{S'}$ [WH   V]$_{VP}$]$_{VP'}$]$_S$
      (tongsáyng-i o-n-ta-ko)   **(éncéy** malha-yess-no)
    b. **éncéy**   tongsáyng-i ó-n-tá-ko   málhá -yess-no
      when   brother-nom. come-prs.-ind.-comp. say-pst.-int.
      [[WH   [[[N   V]$_S$]$_{S'}$ V]$_{VP}$]$_{VP'}$]$_S$
      (éncéy) (tongsáyng-i o-n-ta-ko   malha-yess-no)

In (32a) the wh-operator dephrases the following verb, while marking the onset of a phonological phrase. In (32b), however, the sentence-initial wh-operator fails to dephrase the following phonological phrase comprising the lower clause and the main verb. This indicates that post-focus dephrasing triggered by the wh-operator is restricted to the same S node. As the wh-operator does not dephrase across the clause boundary, alignment of the lower clause with a phonological phrase is proposed:

(33) Align-S',L
    Align the left edge of S' with the left edge of phonological phrase.

As Align-S',L is purported to block dephrasing across the clause boundary, it ranks higher than Rightmost-IP. Align-S',L, on the other hand, is dominated by Align-Wh,L since the wh-operator does not fail to trigger a phonological phrase. Given the constraint ranking, phonological phrasing of (32b) is illustrated below:

(34) /éncéy   tongsáyng-i ó-n-tá-ko   málhá -yess-no/
    (éncéy) (tongsáyng-i   o-n-ta-ko   malha-yess-no)

/éncéy tongsáyng-i ó-n-tá-ko málhá-yess-no/	Align-Wh,L	Align-S',L	Rmost-IP	Align-XP,L	Align-Qv,L
a. (1 2 3 4)		*!		*	*
b. (1)(2 3 4)			*		*
c. (1)(2 3)(4)			**!		

The candidate (34a) fatally loses out by dephrasing the lower clause, although it satisfies Rightmost-IP. The candidate (34b) is selected as optimal by blocking dephrasing of the lower clause. Note here that the main verb is dephrased by the wh-operator, although the non-dephrased lower clause intervenes. This contrasts with the candidate (34c), which fails to dephrase the main verb, hence adding a violation mark for Rightmost-IP.

We now turn to the cases in which, like those in (32), the wh-operator is base-generated in the upper clause, but unlike them, the lower clause subject is dropped. Here the lower clause which consists of the verb alone intervenes the subject and the verb in the upper clause. The three sentences in (35) are identical except for different positions of the wh-operator due to wh-movement: the wh-operator is located immediately before the main verb as in (35a), or before the lower clause verb as in (35b), or else it is moved to the sentence-initial position as in (35c).

(35) 'When did the brother say that (pro) comes?'
       possible answer: (The brother said yesterday.)
   a. tongsáyng-i   ó-n-tá-ko   **éncéy**   málhá-yess-no
      brother-nom.   come-prs.-ind.-comp. when   say-pst.-int.
      [[N]$_{NP}$ [[[(e)   V]$_S$]$_{S'}$ [WH   V]$_{VP}$]$_{VP'}$]$_S$
      (tongsáyng-i)   (ó-n-tá-ko)   (**éncéy** malha-yess-no)
   b. tongsáyng-i **éncéy**   ó-n-tá-ko   málhá -yess-no
      brother-nom. when   come-prs.-ind.-comp. say-pst.-int.
      [[N]$_{NP}$ [WH   [[[(e)   V]$_S$]$_{S'}$ V]$_{VP}$]$_{VP'}$]$_S$
      (tongsáyng-i) (**éncéy**) (ó-n-tá-ko   malha-yess-no)
   c. **éncéy** tongsáyng-i   ó-n-tá-ko   málhá -yess-no
      when   brother-nom. come-prs.-ind.-comp. say-pst.-int.
      [WH   [[N]$_{NP}$ [[[(e)   V]$_S$]$_{S'}$ V]$_{VP}$]$_S$]$_{S'}$
      (**éncéy** tongsayng-i) (ó-n-tá-ko   malha-yess-no)

The alignment constraints Align-Wh,L, Align-XP,L, Align-Qv,L, and Align-S',L all contribute to triggering a phonological phrase. This results in three phonological phrases in (35a), with the wh-operator dephrasing the following main verb. By way of the alignment constraints, four phonological phrases might also be expected in (35b), but the sentence-final main verb is dephrased by the non-adjacent wh-operator. In (35c), as in (32b), the wh-operator fails to dephrase the following lower clause, but again it dephrases the non-adjacent main verb. As (35c) has the stacked right-branching structure with its wh-operator in the sentence-initial position, as schematized in (31a), dephrasing is expected to take place in one fell swoop in (35c), yielding a single oversized phonological phrase. However, dephrasing is blocked due to the internal clause boundary, as illustrated below:

(36) /éncéy   tongsáyng-i   ó-n-tá-ko   málhá -yess-no/
      (éncéy   tongsayng-i) (ó-n-tá-ko   malha-yess-no)

/éncéy tongsáyng-i ó-n-tá-ko málhá-yess-no/	Align-Wh,L	Align-S',L	Rmost-IP	Align-XP,L	Align-Qv,L
a. (1 2)(3 4)			*	*	*
b. (1 2)(3)(4)			**!	*	
c. (1 2 3 4)		*!		**	*

When the main verb is separately phrased to satisfy Align-Qv,L as in the candidate (36b), it inevitably conflicts with Rightmost-IP, whose function is to dephrase as many following phonological phrases as it can. Thus, candidate (36a) wins out by crucially incurring fewer violations of Rightmost-IP. The fact that /t/ in /tongsáyng-i/ in (35c) is phonetically realized as voiced [d] lends supporting evidence to the claim that the upper clause subject groups with the preceding wh-operator, since voicing is a sandhi process restricted to the phrase-medial, intervocalic environment.

It has been shown that when the wh-operator is base-generated in the upper clause, dephrasing does not take place across the S' boundary, but that the main verb is dephrased by the upper-clause wh-operator even when it is non-abutting.

5.2 Wh-operator in the lower clause

We now turn to cases in which the wh-operator is base-generated in the lower clause. In (37) the wh-operator is either preceded or followed by the subject. In the former case (37a), the subject is ambiguously interpreted as either upper- or lower-clause subject due to the identical phonological phrasing in both cases. However, for the present purpose, we will regard the subject as the upper-clause subject. In the latter case (37b), however, the subject is unequivocally identified as the lower-clause subject, given the lower-clause wh-operator.

(37) a. tongsáyng-i   **éncéy**   ó-n-tá-ko   málhá -yess-no
          brother-nom.   when   come-prs.-ind.-comp.   say-pst.-int.
          [[N]NP   [[[[WH (e)   V]VP]S]S'   V]VP]S
          (tongsáyng-i) (**éncéy**   o-n-ta-ko   malha-yess-no)
          'When did the brother say that (pro) comes?'
          possible answer: ((pro) comes on Saturday.)
      b. **éncéy**   tongsáyng-i   ó-n-tá-ko   málhá -yess-no
          when   brother-nom.   come-prs.-ind.-comp.   say-pst.-int.
          [[[WH   [[N]   [V]]S]S'   V]VP]S
          (**éncéy**   tongsayng-i   o-n-ta-ko   malha-yess-no)
          'When did (pro) say that the brother comes?'
          possible answer: (The brother comes on Saturday.)

The wh-operator dephrases the following phonological phrases, including the one comprising the upper clause verb. Note that the upper clause verb duly forms its own phonological phrase via Align-Qv,L. When the wh-operator is located sentence-initially as in (37b), there arises a phonological phrase containing four phonological words; yet, the oversized phrase is not broken down into two binary phrases[14].

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[14] Eurythmic grouping would result in a phrasing identical to the one in (35c), where both the wh-operator and the subject are generated in the upper clause.

The upshot here is that unlike the stacked left-branching structure, the right-branching structure in the lower clause is not readily subject to eurythmy, according to which the oversized phonological phrase is expected to split up. As a consequence, regrouping of the phrases into smaller (pseudo-)rhythmic ones is a matter of paralinguistic speech style (Refer to the cases in (25c) and (29c, d)). It follows then that the heavier a phonological phrase is, the more likely it splits up. This can be tested out by adding up arguments in the lower clause. The lower clause in (38) is parallel to (37b), with the stacked right-branching structure initiated by the wh-operator.

(38) **éncéy** yéngmi-ka   tongsáyng-ul mánna-ss-ta-ko   málhá -yess-no
    when   youngmi-nom. brother-acc.   meet-pst.-ind.-comp. say-pst.-int.
    [[[WH [[N]$_{NP}$ [[N]   [V]]$_{VP}$]$_S$]$_{S'}$ V]$_{VP}$]$_S$
    i) (**éncéy** yengmi-ka   tongsayng-ul   manna-ss-ta-ko   malha-yess-no)
    ii) (**éncéy** yengmi-ka) (tongsáyng-ul manna-ss-ta-ko   malha-yess-no)
       'When did (pro) say that Youngmi met the brother?'
       possible answer: (She met him on Saturday.)

The phonological phrase in (38i) is heavier than the one in (37b) due to the increased argument structure in the lower clause. Compared with (37b), (38) is more prone to regrouping, at the cost of semantic ambiguity, whereby both the wh-operator and the subject can be interpreted as base-generated in the upper clause as well (cf. (35c)).

In an effort to reduce the weight of the oversized phonological phrase in (38i), NK Korean transforms the sentence-final main verb into a kind of verbal ending on the verb of the dependent clause, so that the main verb no longer counts as a phonological word and consequently, phrasing in (37b) and (38) reduces to three and four phonological words respectively, as represented below:

(39) a. (**éncéy**   tongsayng-i o-n-ta-k^{h}ayss-no)
    b. (**éncéy**   yengmi-ka   tongsayng-ul   manna-ss-ta-k^{h}ayss-no)

The upper clause verb [mal-ha-ta] 'to say' drops its root [mal] 'word' in casual speech and often surfaces as [ha-ta] 'to do'. Now, the complementizer [-ko] in the lower clause and its immediately following reduced verb [ha-yess-no] fuses into [k^{h}ayss-no] through vowel truncation ([o] Ø), contraction (aye ay (=[æ])), and obstruent aspiration (kh [k^h]). From the prosodic point of view, reduction to and cliticization of [k^{h}ayss-no] to the verb of the dependent clause is motivated to cut down the weight of the oversized phonological phrase.

To summarize, dephrasing is initiated by the wh-operator and its domain stretches to the sentence-final main verb to effect the rightmost prominence of IP. This is overtly indicated by the interrogative ending [-no] corresponding

to the wh-operator, regardless of whether it is base-generated in the upper or lower clause. The domain of dephrasing coincides with the scope of the Rightmost-IP constraint since Rightmost-IP coupled with Align-Wh,L conspires to locate the focused word in the rightmost phrase of IP. It is also noteworthy that the intervening lower clause is exempt from the domain of dephrasing, as reflected in Align-S',L, but that the main verb never fails to be dephrased by the wh-operator.

5.3 Domain of dephrasing

The wh-operator, regardless of whether it is base-generated in the upper or lower clause, has been claimed to correspond to the interrogative ending [-no]. However, not all the wh-operator in the lower clause corresponds to the main verb. When the wh-operator in the lower clause does not correspond to the main verb, it is represented in the main verb by its yes-no question ending [-na], rather than [-no]. Depending upon whether there is correspondence between the wh-operator and the main verb, phonological phrasing of the main verb differs: unlike the previous cases in which the main verb is dephrased by the wh-operator, the main verb in (40) is separated off from the preceding phrase and forms its own phonological phrase.

(40) a. **nwúká**   tongsáyng-ul mánna-ss-nun-ci   málhá-yess-na
      who-nom.   brother-acc.   meet-pst.-ind.-comp. say-pst.-int.
      [[[[[[WH]$_{NP}$ [[N]   [V]]$_{VP}$]$_S$]$_{S'}$]$_{NP}$ V]$_{VP}$]$_S$
      (**nwúká**   tongsayng-ul manna-ss-nun-ci)   (málhá -yess-na)
      'Did (pro) say who met the brother?'
   b. **éncéy** yéngmi-ka   tongsáyng-ul mánna-ss-nun-ci málhá-yess-na
      when   youngmi-nom. brother-acc.   meet-pst.-ind.-comp. say-pst.-int.
      [[[[WH [[N]$_{NP}$ [[N]   [V]]$_{VP}$]$_S$]$_{S'}$]$_{NP}$ V]$_{VP}$]$_S$
      i) (**éncéy** yengmi-ka   tongsayng-ul manna-ss-nun-ci)   (málhá-yess-na)
      ii) (**éncéy** yengmi-ka)   (tongsáyng-ul manna-ss-nun-ci)   (málhá-yess-na)
      'Did (pro) say when Youngmi met the brother?'

In (40) the complementizer [-ci] indicates that the lower clause is dominated by NP, not S' and functions as an argument to the main verb. By contrast, when the wh-operator corresponds to the main verb with its overt ending [-no], the lower clause is dominated by S', not NP. It follows then that the intervening NP blocks the correspondence between the wh-operator in the lower clause and the main verb. Thus, the claim is to be revised to the effect that the domain of dephrasing triggered by the wh-operator is delimited to the lower clause, if the wh-operator does not correspond to the main verb. In other words, the domain of Rightmost-IP is restricted to the lower clause, if the wh-operator is base-generated in the lower clause and does not correspond to the main verb. Constraint

interaction in (40b) is illustrated in the following tableau:

(41) /éncéy yéngmi-ka tongsáyng-ul mánna-ss-nun-ci málhá-yess-na/
    (éncéy yengmi-ka tongsayng-ul manna-ss-nun-ci) (málhá-yess-na)

/Éncéy yéngmi-ka tongsáyng-ul mánna-ss-nun-ci málhá-yess-na/	Align-Wh,L	Align-S',L	Rmost-IP (Domain: embedded S)	Align-XP,L	Align-Qv,L
a. (1 2 3 4)(5)				**	
b. (1 2 3 4 5)				**	*!
c. (1 2)(3 4)(5)			*!	*	
d. (1 2)(3 4 5)			*!	*	*

Given the delimiting of the domain of Rightmost-IP to the lower clause due to the complementizer [ci], candidate (41a) as well as (41b) satisfies the constraint, but the other two candidates violate it. (41b) loses out by crucially violating the lower ranked constraint Align-Qv,L. Thus, the blocking effect of the NP node dominating the lower clause is accounted for by delimiting the span of IP to the lower clause. Otherwise, Rightmost-IP would operate on the entire sentence by default.

Comparing the phrasing in (38) with the one in (40b), the crucial difference stems from the complementizer. In (38) the lower clause is dominated by S', whose complementizer surfaces as [ko]; by contrast, in (40b) the lower clause is dominated by NP, which is cued by the complementizer [ci]. The fact that the wh-operator in the lower clause dominated by NP seeks rightmost prominence of IP in the domain of the lower clause, to the exclusion of the main verb, is best represented by mapping the embedded S onto IP, rather than to a phonological phrase, as illustrated below:

(42) a. prosodic structure of (38)
        [[[Wh   NP-nom.   NP-acc.   V-ko]$_{S'}$ V]$_{VP}$]$_S$
        i) {(   )$_{PP1}$}$_{IP1}$
        ii) {(   )$_{PP1}$ (   )$_{PP2}$}$_{IP1}$
   b. prosodic structure of (40b)
        [[[Wh   NP-nom.   NP-acc.   V-ci]$_{NP}$ V]$_{VP}$]$_S$
        i) {(   )$_{PP1}$}$_{IP1}$ {(   )$_{PP1}$}$_{IP2}$
        ii) {(   )$_{PP1}$ (   )$_{PP2}$}$_{IP1}$ {(   )$_{PP1}$}$_{IP2}$

(42a) yields a single IP, whereas (42b) two IPs. As the span of the first IP is coextensive with the embedded S in (42b), the main verb is naturally not dephrased by the wh-operator in the lower clause. Given the syntax-prosody mapping in (42), the domain of dephrasing triggered by the wh-operator remains constant as IP.

6. Conclusion

While the characteristic intonation pattern of non-tonal languages is crucially determined by the edge tone (Pierrehumbert and Beckman 1988, Ladd 1996, Jun 1998, Grice et al. 2000), the boundary tone does not play an active role in characterizing the overall intonation pattern in NK Korean. Rather, it is the tonal interaction of the lexically specified tones within a phonological phrase and the pattern of phonological phrasing, that determines the pitch contour in NK Korean. This is why the phonological phrase as a level of prosodic structure is crucially required.

The primary tenet of this study is that at the level of phonological phrase in NK Korean the wh-operator is characterized as attracting focus. As a consequence, a phonological phrase is triggered flush against the wh-operator, and dephrasing of the subsequent phonological phrases follows suit. Also argued in this study is that the interrogative verb attracts focus, hence having direct bearing on phonological phrasing. The interrogative verb is separated off as an independent phonological phrase from the higher constituent VP. In the case of the wh-question, the wh-operator marks the onset of a phonological phrase and dephrases the following phonological phrases including that of the interrogative verb. This claim is borne out in the phonological phrasing of scrambled sentences in the wake of wh-movement.

The wh-operator in the complex sentence lends supporting evidence to the primary claim that both the wh-operator and the interrogative verb attract focus, with the former dephrasing the latter. In the complex sentence, correspondence between the wh-operator, be it base-generated in the upper or lower clause, and the main verb, is overtly marked by the interrogative verbal ending [-no], and this scope of correspondence is isomorphic to the domain of dephrasing, which coincides with the domain of IP. Evidence crucial to this claim is drawn from the case in which the lower clause is not dephrased, and yet the subsequent main verb is dephrased by the wh-operator when it is base-generated in the upper clause. The claim that dephrasing triggered by the wh-operator spans over the entire IP is made as a function of the constraint interaction, as comprehensively represented below:

(43) Align-Wh,L   Align-S',L   (Minimum Binarity)
      Maximum Binarity   ) Rightmost-IP   Align-XP,L
      Align-Qv,L,   Wrap-XP

The proposed ranking accounts for the way in which a variety of prosodic structure is yielded through syntax-prosody mapping at their interface.

As for the locus of the pitch peak in a phonological phrase, this study supports the claim originally made in Kenstowicz and Sohn (1997) and subsequently in Sohn (1999, 2001a, b) that inherent focus on the wh-operator does not necessarily attract the pitch peak of the phonological phrase, since the pitch peak is realized as a function of the tonal interaction

within a phonological phrase, rather than as a manifestation of raw tonal emphasis on the focused word.

   With regard to the size of phonological phrase as an output of dephrasing, this study suggests that directionality of the stacked branching structure is related to the obligatory or optional operation of eurythmy on phonological phrasing. An oversized phonological phrase is required to split up in the stacked left-branching structure; by contrast, it is not disallowed in the right-branching structure. Only optionally due to paralinguistic factors does eurythmy come into play to undo dephrasing of the stacked right-branching structure. This asymmetry remains a puzzling mystery, and the present study leaves it for future research.

APPENDIX

The following pitch tracks of F0 values are made using CSL4300B developed by Kay Elemetrics Corp.

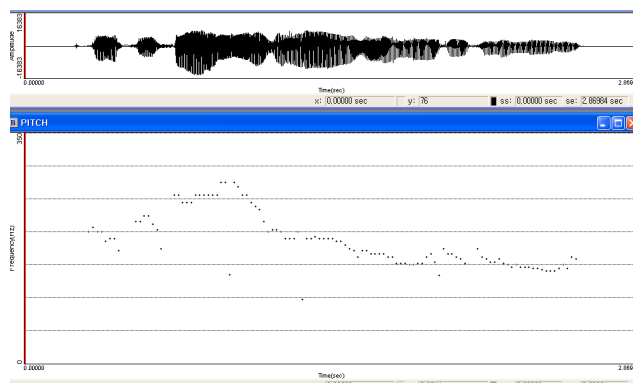(9b) (nwúna-ka)   (namwúl-ul)   (mék-ess-na)
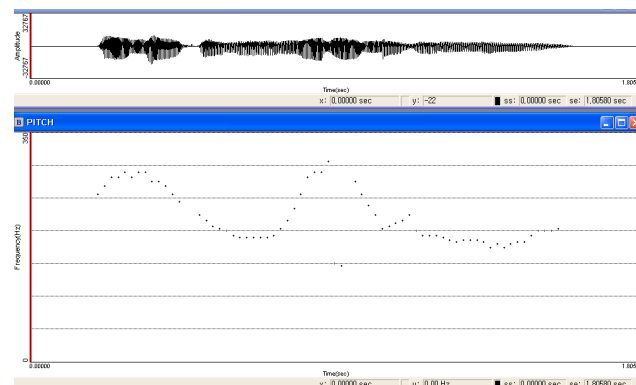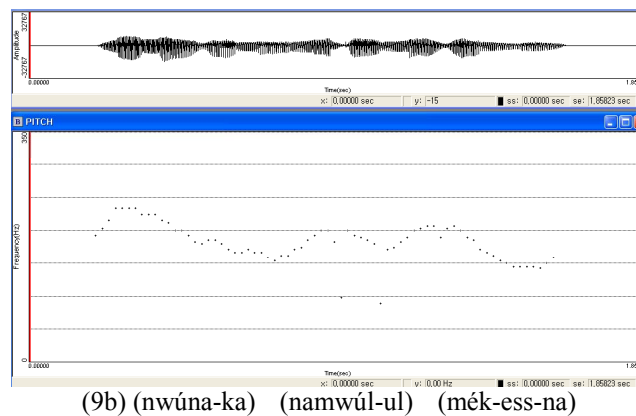
(10b) (nwúna-ka) (namwúl-ul   mek-ess-na)
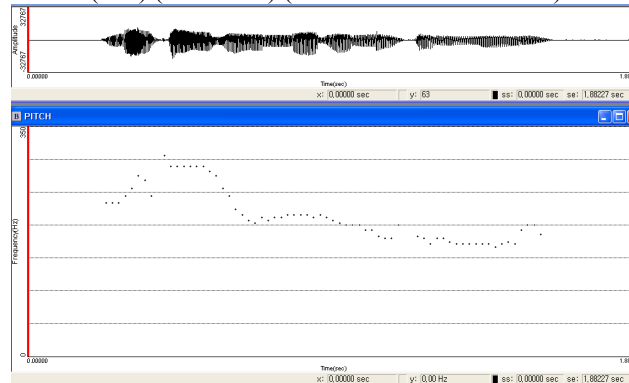
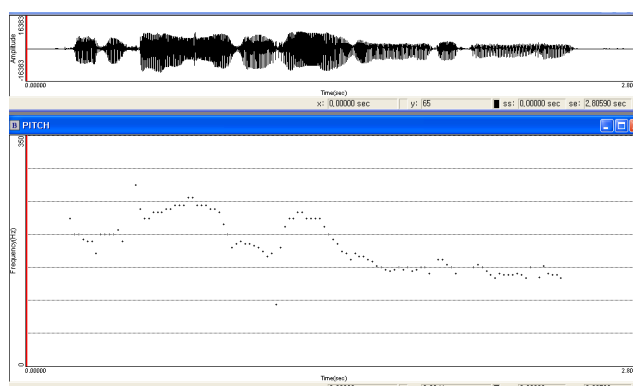
(18b) (**nwúká**   namwul-ul   mek-ess-no)
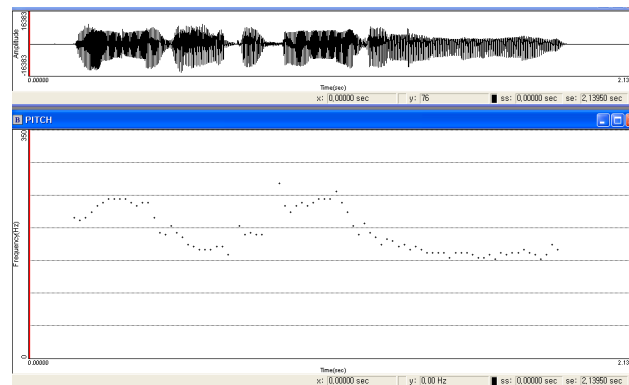
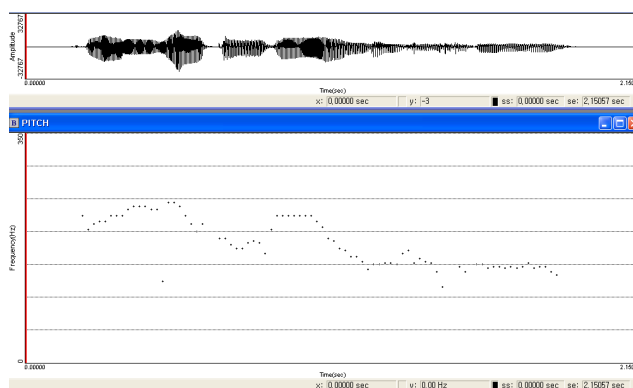(25b) (yéngmi-ka) (**etise** énni-lul manna-ss-no)
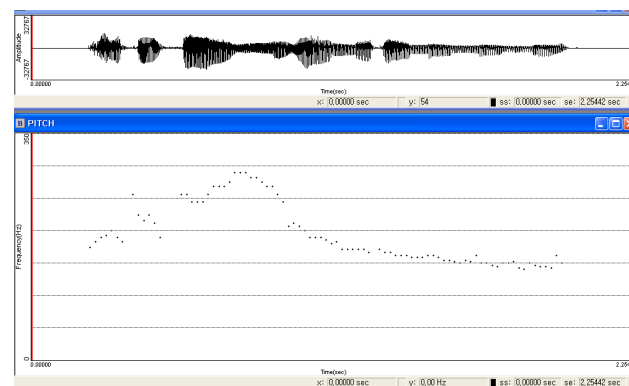
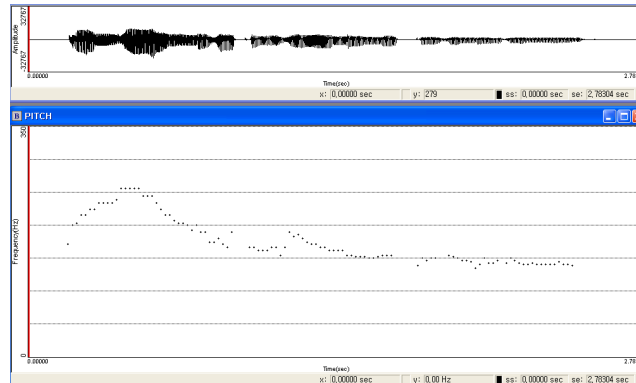(25ci) (**etise** yéngmi-ka enni-lul manna-ss-no)

(29di) (**etise** yéngmi-ka enni-eykey namwul-ul ponay-ss-no)
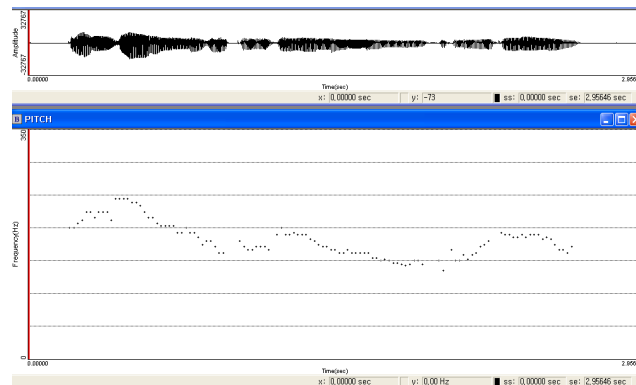

(29dii) (**etise** yéngmi-ka) (énni-eykey namwul-ul ponay-ss-no)

(32b) (**éncéy**) (tongsáyng-i   o-n-ta-ko   malha-yess-no)

(38i) (**éncéy** yengmi-ka tongsayng-ul   manna-ss-ta-ko   malha-yess-no)

(40bi) (**éncéy** yengmi-ka tongsayng-ul   manna-ss-nun-ci) (málhá-yess-na)

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