The Deterministic Prosody of Indeterminates

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1. Introduction

Korean has so-called indeterminate words (cf. Kuroda 1965) that can be used as either interrogatives or indefinites depending on the context. For instance, the indeterminate word *nwukwu* is ambiguous between an interrogative reading 'who' and an indefinite reading 'someone'. Thus the sentence in (1) has three different interpretations: i) an assertion with an indefinite, ii) a yes-no question with an indefinite, and iii) a *wh*-question with an interrogative.

(1) *Yuna-ka* ***nwukwu****-lul* *mann-a*[1]
Yuna-NOM **who**[2]-ACC meet-INT
i) 'Yuna is seeing someone.'
ii) 'Is Yuna seeing someone?'
iii) 'Who is Yuna seeing?'

It has long been noticed that prosody is an important cue to distinguish different uses of indeterminates and different sentence types. Among the different sentence types, yes-no questions are known to be clearly distinguished from others by the sharp rising contour at the end of the sentence (Jun & Oh 1996, I.-S. Lee & Ramsey 2000, Kwon 2002, H.-J. Hwang 2007). However, there has not been a clear-cut answer about how the prosody of an assertion is different from that of a *wh*-question. While the wide-spread impressionistic observation is that some kind of *phonological prominence* such as high pitch of the indeterminate word signals an interrogative reading (Choe 1985, Kang 1988, Kim 2000), the production experiment in Jun & Oh (1996) shows that *phonological dephrasing* after the indeterminate word is the most reliable prosodic cue of *wh*-questions. The current work supports the latter conclusion by showing that high pitch itself on the indeterminate phrase is not a decisive factor in perceiving *wh*-questions, while dephrasing is. The main role of phonological prominence of the indeterminate word in sentence processing is rather to disambiguate the scope configuration, giving a bias toward a wide scope interpretation.

2. The Intonation System of Seoul Korean

The language of discussion in this paper is limited to Seoul Korean, which is generally regarded as standard Korean[3]. For the description of prosodic features of Seoul Korean, the model developed by Jun (1993) is adopted. In this model, the basic prosodic unit above phonological Word is Accentual Phrase (AP). An AP contains one or more Words but generally consists of less than five syllables, and is

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[1] The Yale Romanization system has been adopted for the transcription of the Korean data in this paper.

[2] The indeterminate words are glossed with their corresponding *wh*-words in English for notational ease.

[3] Different dialects of Korean exhibit different prosody patterns. For instance, Kyeongsang Korean is well known for its distinctive prosody system as a tone language, and interested readers are referred to H.-S. Lee (2008) for North Kyeongsang Korean, and H.-K. Hwang (2011) for South Kyeongsang Korean. I leave it for future work to investigate if the findings in this paper can apply to other dialects of Korean.

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crucially marked by a phrase-final rising tone (LH) in Seoul Korean. Figure 1 illustrates a schematic representation of the tone patterns of APs. The basic pattern of an AP is characterized as LHLH tone[4], which is fully realized when the AP has four or more syllables as in Figure 1-b and 1-c: the first two tones (Low-High) are realized on the first two syllables in the AP, and the last two tones (Low-High) are on the last two syllables. If the AP consists of less than four syllables, only the first and last tones are fully realized due to undershoot as illustrated in Figure 1-a.

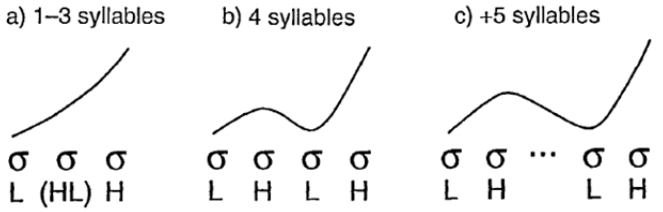


Figure 1: A schematic representation of the basic tone pattern of an Accentual Phrase in Seoul Korean (from Jun & Oh 1996:40).

At the end of the sentence, the sentence final tone (Low or High) overrides the Accentual Phrase boundary tone. In the typical tone pattern of simple declarative sentences, which is illustrated in Figure 2, the final rising tone of the last AP is not realized because of the sentence-final falling tone for assertion.

Figure 2: The typical prosody pattern of a declarative sentence. The vertical dash line indicates the boundary of Accentual Phrases.[5]

In the case of *wh*-questions, Jun & Oh (1996) observes that the boundary between the AP containing the indeterminate word and the following AP is deleted[6]. Their observation provides the basis of the model for the patterns of *wh*-questions, though the model adopted in this paper slightly deviates from their analysis. First, I posit that dephrasing occurs until the end of the interrogative clause, instead of the single word immediately following the indeterminate phrase. Notice that the two conditions were not distinguished from each other in Jun & Oh's experiment because the indeterminate phrase was followed by only one word in all of their test sentences. Second, indeterminate words introduce pitch rising in *wh*-questions, most prominently on the second syllable of the AP. This feature reflects the commonly shared intuition that *wh*-words bear a certain phonological prominence. Figure 3 schematizes a typical prosody pattern of *wh*-questions, where the boundary of an AP is extended to the end of the sentence when it contains an indeterminate word (marked by a box). The syllables between the second and penultimate syllables in the extended AP receive F0 values by means of interpolation.

[4] If the first syllable in the AP starts with a tense/aspirated obstruent, the first tone is realized as High instead of Low. Such a pattern will not be considered in the current work because the stimuli for the experiment in this paper are limited to APs starting with Low.

[5] The downward trend of F0 tracks over the course of utterances in Korean (cf. Lee 1996) is ignored in this simple schematization.

[6] They also noticed that there may be moderate sentence-final rising for *wh*-questions, which is not as sharp as yes-no question endings. As we will see later in the paper, however, the sentence final tone is not a decisive factor in perception of *wh*-questions.

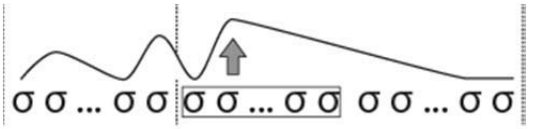


Figure 3: A typical prosody pattern of *wh*-questions. The syllables surrounded by the box indicate the indeterminate phrase.

In this model, the prosody pattern of *wh*-questions is characterized by two factors: an F0 boost on the indeterminate phrase and the elimination of AP boundaries afterwards. Between the two factors, F0 boost is generally regarded as the more easily perceptible cue to the listeners, as most of the impressionistic descriptions of *wh*-questions in the literature have emphasized the prominence of the indeterminate phrase but fail to mention a distinctive prosodic phrasing. My hypothesis is, however, that phrasing is in fact the crucial factor in the perception of *wh*-questions, while pitch prominence is not. The hypothesis is based on the observation that the high pitch on the indeterminate phrase does not necessarily lead to a *wh*-interrogative reading, but rather seems to correlate with the scope configuration. To confirm this hypothesis, a perception test was conducted as described in the next section.

3. Method

A perception experiment was conducted to see how native speakers of Seoul Korean correlate different prosody patterns with different readings of indeterminates.

3.1. Material

The test sentences were designed to have three different readings as follows. In each sentence, an indeterminate phrase was placed in a conditional clause as exemplified in (2), which makes different scope readings of indefinites available.[7] All the sentences ended with a neutral intimate ending *–e/a*, thus the sentence type was ambiguous between assertion and question. As a result, three different readings, i.e. i) wide scope indefinite, ii) narrow scope indefinite, and iii) *wh*-interrogative, are possible for the indeterminate.

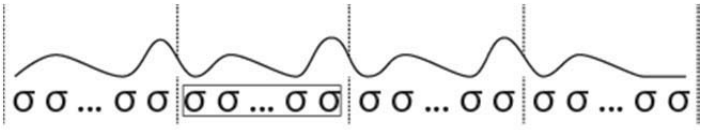
(2) *I* *pyeng-un* *mwe-lul* *mek-umyen* *na-a*
this illness-TOP what-ACC eat-if cured-INT
(Lit. 'This illness will be cured if you eat [what/something].')

i) narrow scope indefinite (if > ∃)
'This illness will be cured if you eat something.'
ii) wide scope indefinite (∃ > if)
'There is a certain something such that this illness will be cured if you eat it.'
iii) *wh*-interrogative
'What is the thing such that this illness will be cured if you eat it?'

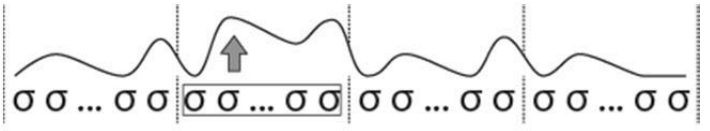
Five sentences with the above structure were chosen, varying the number of syllables in the indeterminate phrase (from two to five syllables). The list of the sentences is given in the Appendix. Each sentence was first recorded by the researcher herself, who is a native speaker of Seoul Korean, with a neutral tone with sentence-final falling contour, the tone expected to be employed for the sentence with a non-focused proper name in place of the indeterminate phrase as illustrated in Figure 4-a.

[7] Note that *if*-clauses are not *wh*-islands in Korean.

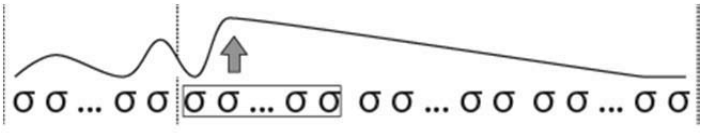
Two additional groups of stimuli were obtained by manipulating the pitch contour of the first set of sentences using the PSOLA algorithm implemented in Praat (Moulines and Charpentier 1990). Instead of recording all the test materials, synthesis from the base sentences was adopted so as to avoid potential influence of other irrelevant factors. In one group, the pitch of the indeterminate phrase was raised so that the highest pitch point in the sentence fell on the indeterminate phrase as in Figure 4-b. The other group replicated the contour of *wh*-questions with pitch boost on the indeterminate phrase as well as subsequent dephrasing, as in Figure 4-c. The highest F0 value of the indeterminate phrase was controlled to be the same for the corresponding sentences in the two synthesized groups. The F0 contour of the last two syllables in the sentence was not changed from the base during synthesis, so that the sentence final intonation was maintained to be the same for all the three groups. Thus the pitch range was also the same for the two synthesized groups.



a) neutral



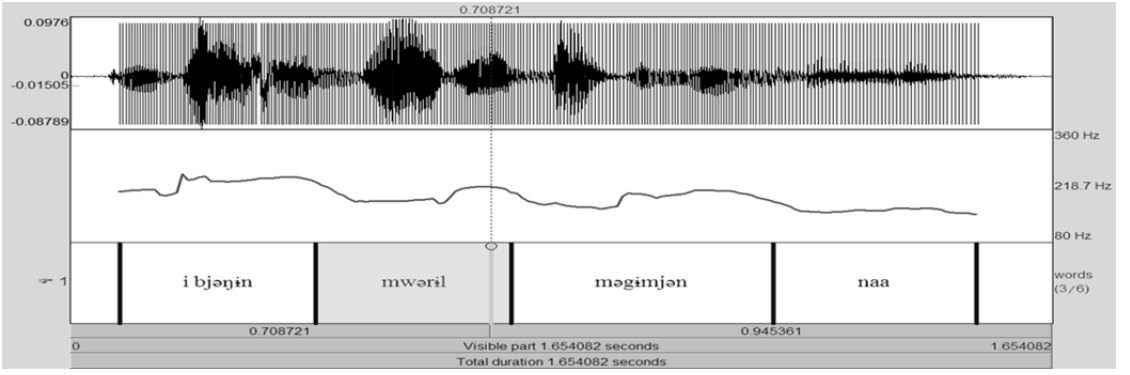
b) F0 boost only



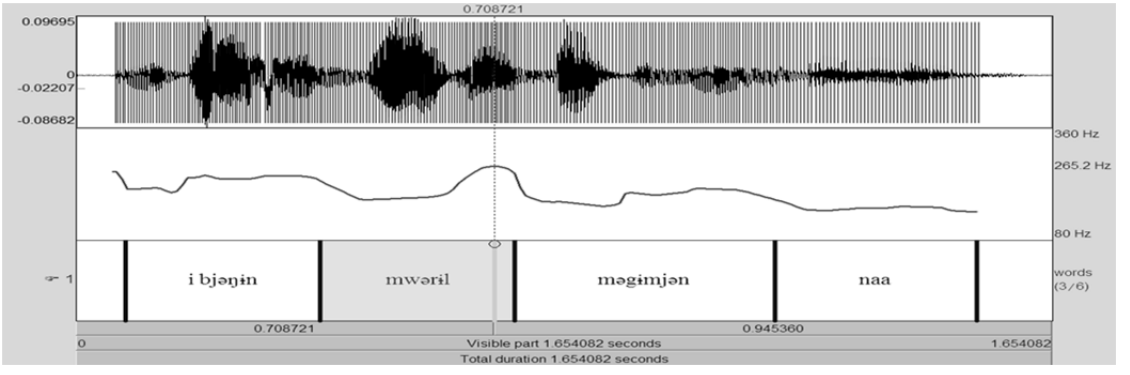
c) F0 boost + dephrasing

Figure 4: Schematic representations of F0 contours of test sentences.

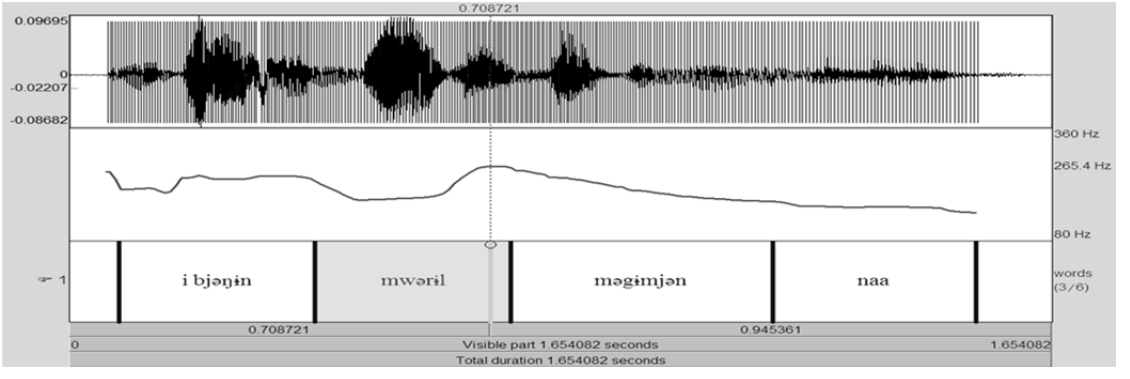
Figure 5 shows the actual F0 contours of the test sentence (2) with an indeterminate phrase composed of two syllables. Notice that the F0 tracks of the indeterminate phrase *mwe-lul* [mwərɨl] 'what-ACC' are the same in Figure 5-b and 5-c. The only difference between 5-b and 5-c lies in phonological phrasing after the indeterminate phrase. Such examples are expected to show the effect of dephrasing correctly, minimizing potential influence of other factors.



a) neutral



b) F0 boost only



c) F0 boost + dephrasing

Figure 5: Examples of actual F0 tracks from the test sentence in (2).

3.2. Participants

24 native Seoul Korean speakers (12 females and 12 males) took part in the perception test. All participants were in their late twenties or early thirties, and have lived for most of their lives in Seoul or its vicinity.[8]

3.3. Procedure

A web application was created for the perception test. The test sentences were displayed on the screen with a context that facilitates one of the three different readings illustrated in (2). An example of such context is given below:

(3) Example scenarios

Nay-ka	*nwukwu-hako*	*kyelhonha-myen*	*ton-ul*	*pat-a*
I-NOM	who-with	marry-if	money-ACC	get-INT

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

i) narrow scope indefinite context
Jinyoung is in huge debt and desperately needs money. One day a lawyer came to see her and said that a distant relative of hers wants to give her a lot of money as long as she gets married. After listening to this, Jinyoung told her friend: "[target sentence]. So please set up blind dates for me! Any guy would be okay!"
(intended reading: 'I will get money if I marry someone.')

ii) wide scope indefinite context
Jinyoung is in huge debt and desperately needs money. One day a lawyer came to see her and said that a distant relative of hers wants to give her a lot of money if she marries a certain person that the relative has in mind. After listening to this, Jinyoung told her friend: "[target sentence]. But I cannot get money if I marry someone else."
(intended reading: 'There is a certain someone such that I will get money if I marry that person.')

iii) *wh*-interrogative context
Jinyoung is in huge debt and desperately needs money. One day an old friend from her hometown came to see her and said that a distant relative of hers wants to give her a lot of money if she marries a certain person that the relative has in mind. After listening to this, Jinyoung asked the friend: "[target sentence]?" But the friend answered that he does not know who that person is.
(intended reading: 'Who is the person such that I will get money if I marry that person?')

The context and target sentence were provided in Korean. The participants were instructed to read the context including the target sentence, and then to listen to the target sentence by clicking a button, and finally to rate a score from 0 to 10 depending on how natural the sentence sounds in the given context. The listeners were allowed to hear the stimuli repeatedly. Once they gave a score, however, they were not allowed to go back to change their answer. Total 45 context-sentence pairs (5 strings of words × 3 prosody types × 3 context types) were given in a pseudo-random order so that the same strings of words did not appear in a sequence, mixed with 63 pairs of filler materials.[9]

[8] The average amount of time that the participants have lived in Seoul or Kyeonggi Province was 26.2 years and the standard deviation was 6.7 years.

[9] The fillers were chosen to have relatively uniform high or low acceptability, such as a yes-no question with a final rising tone (highly acceptable) or final falling tone (highly unacceptable). Those filler sentences constituted the majority of experiment materials in order to prevent informants from detecting repeated patterns in the real test materials and answering based on the detected patterns instead of their actual linguistic behavior (Cowart 1997).

4. Results

Figure 6 shows the average acceptance rates of different readings of indeterminates for each prosody type. Table 1 provides the exact values of the acceptance rates and the results of ANOVA and Tukey post-hoc tests (at .01 level). For the sentences with the neutral prosody, a narrow scope indefinite reading is most preferred for the indeterminate, as shown in Figure 6-a. When the pitch of the indeterminate word is boosted but dephrasing does not follow, a wide scope indefinite reading receives the highest score as in Figure 6-b. When dephrasing is added, on the other hand, a *wh*-interrogative reading is strongly preferred over indefinite readings as in Figure 6-c. Thus the high pitch of the indeterminate word alone does not make a decisive cue to the perception of a *wh*-question, unless dephrasing follows.

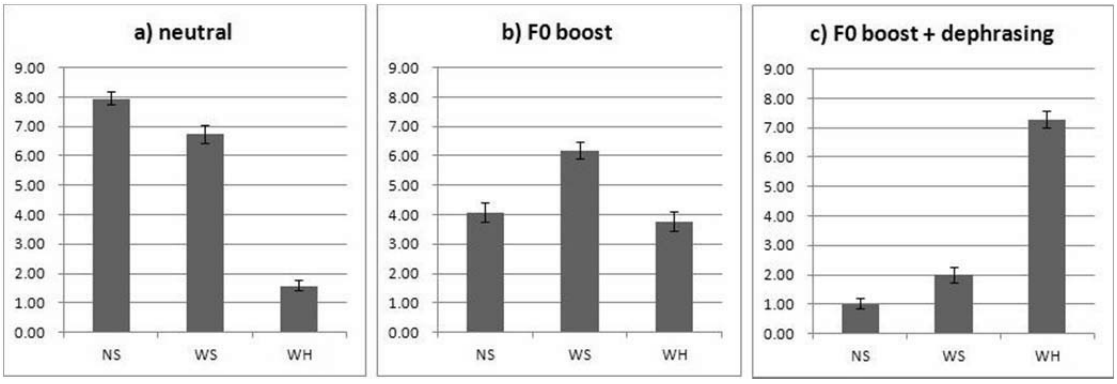


Figure 6: Acceptance rates of three different readings of indeterminates for each prosody type. (NS: narrow scope indefinite, WS: wide scope indefinite, WH: *wh*-interrogative)

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

Table 1: Mean acceptance rates and differences between the three readings of indeterminates (all effects at p<.01).

5. Discussion

5.1. The role of phonological phrasing

The importance of dephrasing in forming *wh*-questions in Korean can be explained by the general prosodic *wh*-scope marking strategy in many *wh*-in-situ languages that eliminates phonological phrase boundaries between the *wh*-word and the complementizer (Ishihara 2002, Kitagawa 2005, Richards 2010). In Japanese, for instance, the pitch accent on the words between the *wh*-word and the matching question particle are significantly reduced (i.e. deaccented) as illustrated in (4), where deaccenting is indicated by underline. If the sentence lacks appropriate deaccenting, it becomes unacceptable because bare *wh*-words in Japanese can only be used as interrogatives. On the other hand, the Korean case

suggests that if *wh*-words can have an indefinite reading, the lack of appropriate *wh*-scope marking would simply result in an indefinite interpretation.

(4) a. Assertion

Naoya-ga	***nanika**-o*	*nomiya-de*	*nonda.*
Naoya-NOM	something-ACC	bar-LOC	drank

'Naoya drank something at the bar.'

b. *wh*-question

Naoya-ga	***nani**-o*	*nomiya-de*	*nonda**-no**?*
Naoya-NOM	what-ACC	bar-LOC	drank-Q

'What did Naoya drink at the bar?'

(Examples from Ishihara 2002)

5.2. The role of phonological prominence

The results also show that phonological prominence forces a wide scope interpretation of indeterminates. It provides a new kind of empirical data to the typology of so-called *wh*-indefinites, i.e. indefinites that have the same form as *wh*-interrogatives. Contrary to the argument in previous works that *wh*-indefinites cannot take wide scope in general (Postma 1994, Ha 2004, Bruening 2007), the current study shows that *wh*-indefinites in Korean are actually ambiguous in their scope configuration, and that the pitch boost on the indeterminate word triggers a bias towards a wide scope interpretation. This is comparable with the long-standing observation that stress forces genuine indefinites such as *some* in English to take wide scope (Milsark 1974). Thus we can make a generalization that phonological prominence forces a wide scope interpretation for *wh*-indefinites as well as genuine indefinites.

6. Conclusion

The perception study in this paper suggests the following correlations between the prosody and meaning of indeterminates. First, an interrogative use of indeterminates is characterized not by the phonological prominence on the indeterminate word, but by the way of prosodic phrasing. Second, indeterminates used as indefinites share a property with genuine indefinites in that they can take wide scope, which can be forced by phonological prominence.

Some remaining questions are as follows. First, what would be the interpretation of a sentence with multiple indeterminate words? Kim (2000) argues that only ATB readings (i.e. all the indeterminate words are interpreted as either interrogatives or indefinites across the board) are possible for such sentences in Korean. However, given that appropriate prosody often can rescue otherwise ungrammatical sentences (cf. Kitagawa & Fodor 2006), it would be interesting to investigate whether prosody affects the interpretation of multiple indeterminate words in a sentence. The other issue concerns the generalization of the prosody-scope correlation: if it is universally true that phonological prominence such as pitch prominence or stress gives a bias to a wide scope interpretation of indefinites, then in the many languages in which *wh*-indefinites are known to be restricted to a narrow scope interpretation, the *wh*-indefinites should never be phonologically prominent. Indeed, many *wh*-indefinites in the world's languages have been reported to be phonologically unmarked or reduced (Haspelmath 1997). For instance, it has been argued that *wh*-indefinites in Mandarin Chinese cannot be phonologically prominent and cannot take wide scope (Dong 2009). Further investigation on more languages with *wh*-indefinites should be done in future research to confirm this generalization.

Appendix: Test Sentences

1. | | | | |
|---|---|---|---|
| *Yuna-nun* | *nwu-ka* | *o-lako ha-myen* | *o-l ke kath-a* |
| Yuna-TOP | who-NOM | come-tell-if | come-might-INT |

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

2. *Intheneys-eyse* *nwukwu-lul* *yokha-myen* *caphyeka*
   Internet-on who-ACC badmouth-if arrested.INT
   (Lit. 'You will be arrested if you speak ill of [who/someone] on the Internet')

3. *Nay-ka* *nwukwu-hako* *kyelhonha-myen* *ton-ul* *pat-a*
   I-NOM who-with marry-if money-ACC get-INT
   (Lit. 'I will receive money if I marry [who/someone]')

4. *I* *mwuncey-nun* *nwukwu-hantheyse* *towum-ul* *pat-umyen* *phwu-l swu iss-keyss-e*
   this problem-TOP who-from help-ACC receive-if solve-can-might-INT
   (Lit. 'You will be able to solve this problem if you get help from [who/someone]')

5. *I* *pyeng-un* *mwe-lul* *mek-umyen* *na-a*
   this illness-TOP what-ACC eat-if cured-INT
   (Lit. 'This illness will be cured if you eat [what/something]')

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