UNIDIRECTIONAL EFFECTS IN KOREAN ACCENTUAL PHRASING

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I. Introduction

This paper investigates the relationship between morpho-syntactic branching structure and phonological phrasing Given two syntactically different phrase structures and Selkirk's (1986) phrasing algorithm, we would expect that syntactic and morphological structure determines the accentual phrasing of complex utterances in Seoul Korean Against the backdrop of Jun's (1993, 1995) proposal that the relationship between branching and phrasing is not entirely predictable and Selkirk's (1986) proposal that syntax determines phonological phrasing, this paper observes that Korean accentual phrasing is independent of morpho-syntactic branching structures The phrasing tends to be unidirectional regardless of the morpho-syntactic structural differences in this experiment This paper, accordingly, examines whether the branching structures influence the Accentual Phrase (henceforth AP) demarcation and identifies what acoustic attributes function to distinguish the branching structures

2. The study

To get a rough picture of the syntactic constraints that apply to AP in Seoul Korean, consider the following pairs given in (1)

```
(1)   a     [[yep'ɨn] [py∂ljaŋ juɪn]]      b   [[yep'ɨn py∂jaŋ][juɪn]]
      AP(ı)   (      ) (             )          (              )(      )
      AP(ıı)  (            )(       )           (       )(             )
      AP(ııı) (                     )          (                      )
            [[beautiful]AP [villa owner]N]NP    [[beautiful villa]NP[owner]N]NP
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In (1), there may be three possible phrasings But if we follow Selkirk's (1986) phrasing algorithm, the end-based approach based on the right edges of X^{max} projections, we may not be able to find the phrasing like (1ıı), since there are phrase boundaries in the middle of APs It is therefore predicted that the end-based theory chooses (1ı) as the correct phrasing, while rejecting (1ıı) and (1ııı) This paper will examine whether such a claim can be substantiated experimentally If these two phrases, (1a) and (1b), have different AP structures, then we can disambiguate the different meanings by different phrasing

Further, We will also look into compound word phrasings Consider the following pairs in noun compound

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(2)   a     [[hy∂ndæ][muyoŋ kyosıpso]]      b   [[hy∂ndæ muyoŋ][kyosıpso]]
      AP(ı)   (       )(             )           (             )(        )
      AP(ıı)  (            )(        )           (       )(             )
      AP(ııı) (                      )          (                      )
            [[modern]N [dance studio]N]N        [[modern dance]N [studio]N]N
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If phrasing is based only on maximal projection boundaries as in Selkirk (1986), we would expect that both (2a) and (2b) are phrased as in (2iii) If that is the case, then, without any stress contrast like that found in English, Korean cannot disambiguate the two different meanings in the three word sequence given in (2) Intuitively, these two different meanings result in two different phrasings as in (1) and the phrasings (2ii) are ruled out in Korean If APs have a disambiguating function, we would expect to find phrasings like (2i) in Korean Based on examples like (1) and (2), this paper looks at two levels according to a different situation a lexical level and a phrase level

3. Methods

3.1 The corpora and subjects

The corpus consists of three word structures with left branching (=LB-((X X) X)) and right branching (=RB-(X (X X))) structures One group contains three word-noun compounds and the other contains noun phrases demarcated into lexical and phrasal levels as in (3)

(3) Lexical level $[(\sigma\sigma)N(\sigma\sigma)N(\sigma\sigma\sigma)N]N$
   Phrase level $[(\sigma\sigma)Adj (\sigma\sigma)N(\sigma\sigma)N]NP$

The target sentences and distracter sentences between a compound noun level and a phrase level are mixed together The corpus used in this experiment is given in the appendix

Two speakers, SY (female) and SH (male), uttered the sentences three times with normal speed

3.2 Measurement

Out of the spectral and pitch contour of the speakers' utterances of different phrasings, the relative low and high fundamental frequency of each word was measured Fundamental frequency measurements were taken at the onset and at the peak F0 of each word, which occurred near the onset of 2^{nd} syllable When this high F0 peak is missing, the F0 at the onset point of the second syllable was consistently measured Moreover, the duration from the onset to the offset point of each word was measured along with pause between words to investigate how speakers distinguish different structural branching, i e left-branching or right-branching These measures are illustrated in Figures (1) and (2) below

4 Results

4.1 The plotting of Scattergraph

In order to determine intonationally marked phrasing, onset F0 and peak F0 at the onset of second syllable are plotted against one another When there is a rise during the first syllable, the peak point is higher than the onset point In the following plots, these tokens will appear above the H=L line If no rise occurs, tokens will appear below the H=L (4) shows the schema

of F0-contour We assume, as in Jun (1993), that accentual phrases are marked by rises in F0 at the onset of the phrase This is illustrated in (4) for an utterance with three phrases
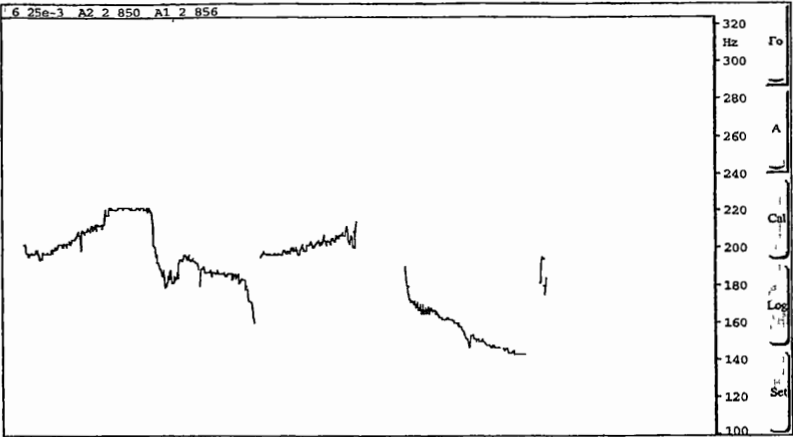

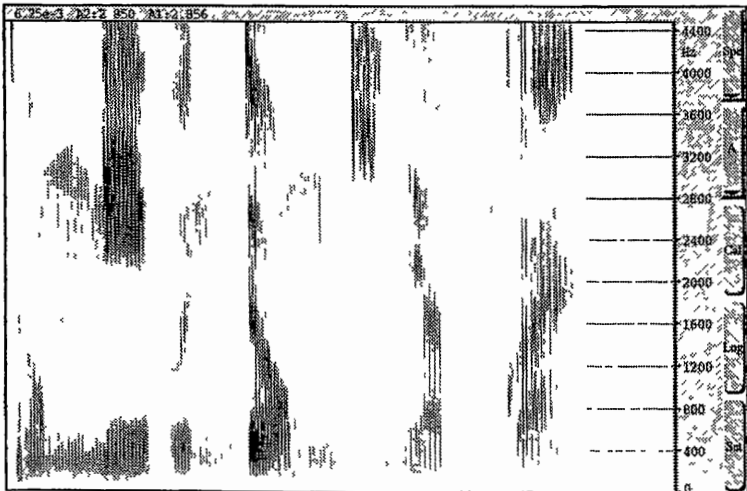Figure 1 F0 plot of LB lexical token (toklıp undoŋ)(kıny∂mkwan) for subject SY
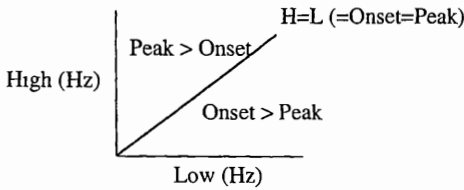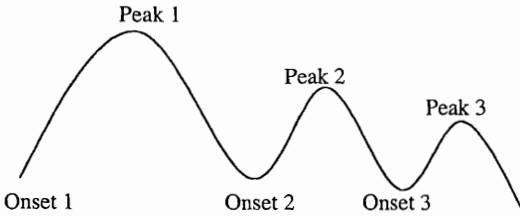

Figure 2 Spectrograph of LB lexical token (toklıp undoŋ)(kıny∂mkwan) for subject SY

(4) The schema of F0 contour

Peak 1

Peak 2

Peak 3

Onset 1   Onset 2   Onset 3

H=L (=Onset=Peak)

Peak > Onset

High (Hz)

Onset > Peak

Low (Hz)

Scattergraphs are plotted according to the number of relative peak F0-rises Each onset and peak point of fundamental frequency in three-word sequence is on X-axis and Y-axis in Hz, respectively On the plot, if the relative peak F0-rises of three words appear above the diagonal X=Y line where X and Y represent the onset and the peak F0 in a given word, this means that three words are phrased into three different accentual phrases as in (5a) If the relative peak F0-rises of only the first word (=W1) and second word (=W2) are above the X=Y line, three words are phrased as RB cases as in (5b) The relative peak F0-rises of W1 and W3 are distributed above the diagonal X=Y line, while W2 below the X=Y line, three words are phrased as LB cases as in (5c) (5) shows the phrasing patterns by means of the number of peak F0-rises

(5) The Plotting of AP Phrasing

a   W1   b   W1   c   W1
High (Hz)   W2   W2   W3
           W3   W3   W2

Low (Hz)
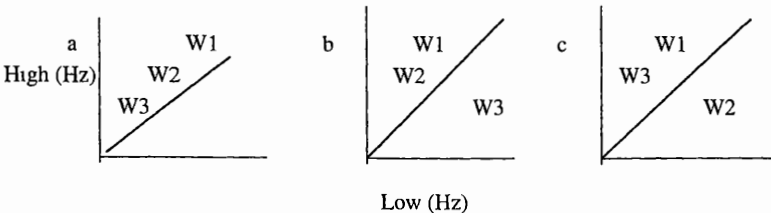
(5a) indicates that either LB or RB structure is phrased as 3 AP's with 3 Rises
    [(W1)]AP [(W2)]AP [(W3)]AP

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(5b) indicates that either LB or RB structure is phrased like RB cases with 2 Rises
    [(W1)]AP [(W2 W3)]AP
(5c) indicates that either LB or RB structure is phrased like LB cases with 2 Rises
    [(W1 W2)]AP [(W3)] AP

4.2 The Korean AP phrasing

    Given the different branching structure, either left or right, the question to be asked is what factors determine phrasing Speaker SY's data is plotted in Figure 3 and 4 Speaker SY (female) shows that the relative peak F0-rises of LB tokens are realized just like RB cases The relative peak F0 of W1 and W2 appears above the X=Y line whereas W3 below the X=Y line of the plot Note that the relative peak F0-rises between LB and RB structures are different with respect to each other That is, Word 1 peak F0-rises of RB cases appear in a higher pitch range and further a clear separation between W1 and W2 in comparison of LB ones See Figure 3 & 4 below
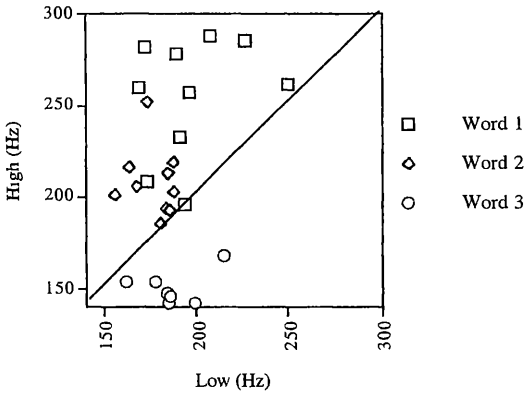

Figure 3 F0 at beginning of 2nd syllable of each word plotted against F0 at onset of each word for subject SY's RB lexical tokens

    The phrasal level tokens are patterned similar to the lexical ones illustrated in Figures 5 and 6 below LB tokens are phrased as the same as RB ones Peak F0-rises of W1 and W2 are above the X=Y line and W3 below the X=Y line on the plot

    In sum, both LB and RB tokens have the same phrasing pattern irrespective of morpho-syntactic branching differences These results contrast with our expectations If morpho-syntactic structures may influence phonological phrasing, we expect that LB tokens are phrased

as LB cases rather than they are collapsed together into RB cases
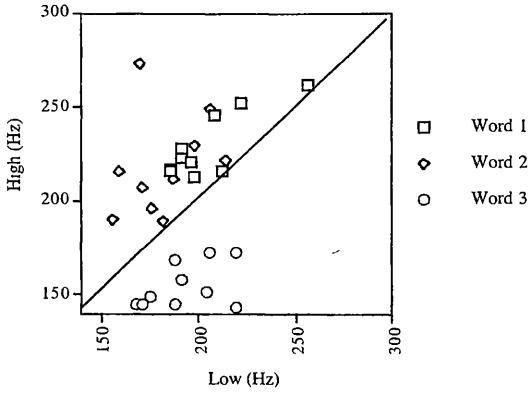

Figure 4   F0 at beginning of 2nd syllable of each word plotted against F0 at onset of each word for subject SY's LB lexical tokens
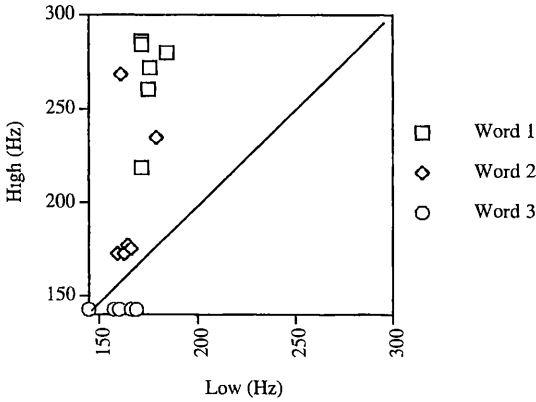

Figure 5   F0 at beginning of 2nd syllable of each word plotted against F0 at onset of each word for subject SY's RB phrasal tokens
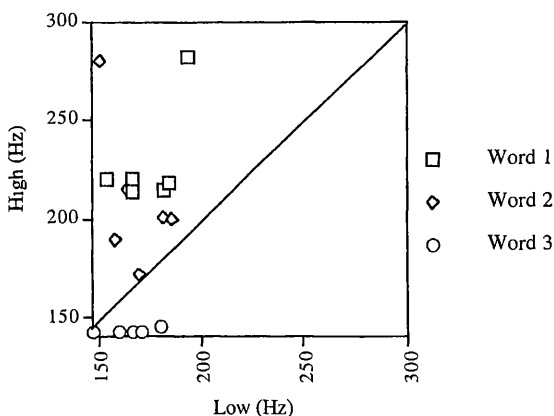
Figure 6 F0 at beginning of 2nd syllable of each word plotted against F0 at onset of
         each word for subject SY's LB phrasal tokens

Speaker SH also has the same pattern in that either LB or RB tokens are apt to be merged
into RB phrasing cases no matter what the morpho-syntactic branching structure is   Figure 7
plots SH's lexical right branching forms, while Figure 8 plots his left branching forms While the
data in Figure 8 generally matches that in Figure 4 (SY's data), speaker SH, however, shows a
tendency to phrase three words with three different AP phrasings like [W1]AP [W2]AP
[W3]AP All peak F0-rises are above the X=Y line of the plot [1] Thus, there is some possibility
of branching differences causing phrasing differences See Figure 7 & 8 below

As such, one-sided phrasing pattern approves that the Korean AP phrasing is independent
of structural branching and further determined by the number of relative peak F0-rises   Here
Selkirk's (1986) proposal in which syntax may determine phrasing and Jun's (1993) claim that
the relationship between branching and phrasing is not entirely predictable are not
straightforward in this study given the observation that phrasing is not driven by means of
morpho-syntax branching structure

Next section will address the immediate question of what factor, then, may cause that
patterned peak F0-rises as in RB cases and why speaker SH does not show the distribution of
relative peak F0-rises just like speaker SY   This observation may be associated with the fact

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[1] Speaker SH's phrasal tokens also tend to be completely collapsed in AP phrasing the peak F0-rises of W1 and W2 are
above the X=Y line whereas W3 below the X=Y line in both LB and RB structures

that speaker SH tends not to use pitch effects to distinguish the two branching structures
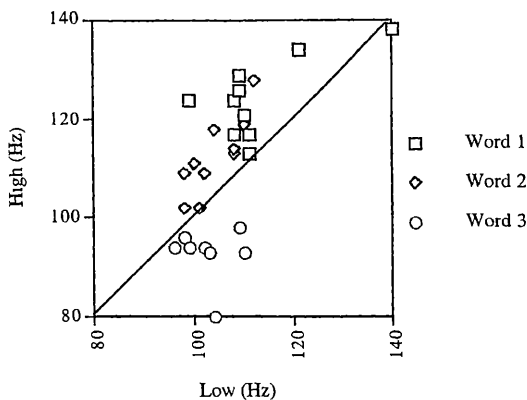

Figure 7   F0 at beginning of 2nd syllable of each word plotted against F0 at onset of each word for subject SH's RB lexical tokens
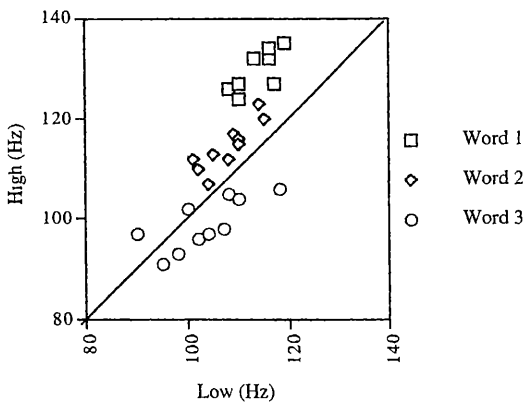

Figure 8   F0 at beginning of 2nd syllable of each word plotted against F0 at onset of each word for subject SH's LB lexical tokens

4 3 The acoustic effects of branching

Even though LB and RB structures typically exhibited a uniform RB phrasing pattern , speakers did distinguish left from right branching structures by means of the combined phonetic attributes of duration and/or pitch One way in which LB and RB structures differ is that the target word (=Word 1) in RB cases relatively was longer and higher in duration and pitch, respectively, than that of LB cases

Speaker SY tends to use both the duration and the peak F0 whereas speaker SH uses the duration only to distinguish the different branching structures These effects are illustrated in Figure 9 and 10 below Figure 9 plots SY's word duration against the peak F0 Word 1 of RB tokens has a relatively higher peak F0 (Y-axis) and a longer duration (X-axis) than that of LB ones Speaker SY uses both duration and pitch at the same time to distinguish left from right branching structures
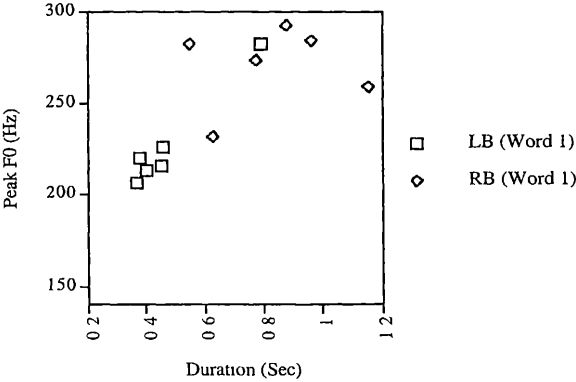

Figure 9 Word 1 duration against peak F0 for subject SY's LB and RB tokens

Figure 10, however, shows that speaker SH does not distinguish branchings with pitch (Y-axis) Rather, he uses duration Word 1 of RB tokens gets a relatively longer duration than that of LB tokens See Figure 10 below

In sum, the different branching structures are distinguished by means of the combined phonetic effects of pitch and/or duration, though speaker variation occurs Though Korean accentual phrasings often are not affected by morpho-syntactic differences, speakers do distinguish morpho-syntactic differences using acoustic factors such as pitch and duration
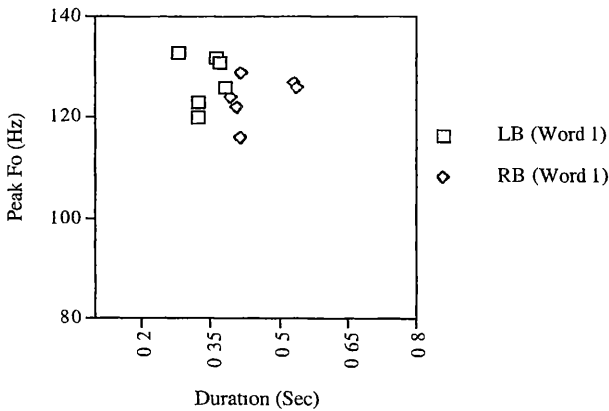
260

Figure 10 W1 duration against peak F0 for subject SH's LB and RB tokens

5. Discussion and Conclusion

In both of the current speakers, though morpho-syntactic branching structures do not determine the phonological phrasing in Seoul Korean, pitch is affected directly by the different branching structures The observation so far indicates that morpho-syntactic branching structures are independent of the phonological phrasing in Seoul Korean irrespective of the morpho-syntactic branching differences Both LB and RB branching structures are usually merged into RB cases in the phrasing pattern This implies that Korean accentual phrasing tends to be predictable and unidirectional given these experimental results

Seoul Koreans tend to distinguish the different morpho-syntactic structures by means of the phonetic features of duration and/or pitch The target word one of RB tokens appeared with a higher pitch and a longer duration than that of LB ones though the two speakers differed in exact effects

For speaker SY, the F0-rises seem to be related to the pitch effect shown in different branching structures Although there was no difference in where F0-rises occurred (which we interpret as indicating identical phrasing), the actual value of these F0-rises differed according to branching The larger, more salient pitch was the one preceding the larger morphological and syntactic break

For speaker SH, however, the distribution of peak F0-rises does not pattern just like speaker SY's The height of F0-rises is exactly the same This implies that speaker SH mainly depends on the duration factor to distinguish the branching structures In addition, SH also occasionally implemented qualitatively different AP phrasing for LB structures

This study, therefore, indicates that Seoul speakers tend to express structural properties of utterances by means of phonetic differences in relative F0 peak height and duration, apart from differences in AP phrasing Moreover, this paper provides evidence that the Korean AP phrasing which is cued by the number of peak F0-rises of each word is not detei mined by morpho-syntactic influence

REFERENCES

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Jun Sun-Ah 1995 A Phonetic Study of Korean Stress Paper presented at the 130[th] meeting of the Acoustic Society of America St Louis, Mo
Selkirk, E O 1986 On the Derived Domains in Sentence Phonology *Phonology Yearbook* 3 371-405

APPENDIX

Ambiguous Target Expressions

- Noun Compound & Noun Phrase -LB structure

hyəndæ   muyoŋ-ɨl kalɨcɪ-nɨn   kos-ɨn   (hyəndæ   muyoŋ) (kyosɪpso)
modern   dance-Acc to teach-Nom place-Nom   modern   dance   studio
(The place where they teach a modern dance ɪs a modern dance studɪo)

 jɪpaŋ   tæhak-tɨl-ɨy   hyəpɪyhoɪ-nɨn   (jɪpaŋ   tæhak) (hyəpɪyhoɪ)
provɪnce   unɪversɪty-Pl -Poss   meetɪng-Nom provɪnce unɪv   meetɪng
(The meetɪng of the unɪversɪty located ɪn the local area ɪs local unɪversɪty meetɪng)

pəpwən-ɨy pɪrɪ-lɪl   kamsaha-nɨn   kɪkwan-ɨn   (pəpwən pɪrɪ)[kamsawən]
court-Poss scandal-Acc to ɪnquɪry-Nom com -Nom   court scandal ɪnq com
(The ɪnquɪry commɪttee to ɪnspect the scandal commɪtted by a court ɪs a court scandal
ɪnquɪry commɪttee)

yep'ɪn   pyəljaŋɪl   soyuhan   ja-nɨn   (yep'ɪn pyəljaŋ) (juɪn)
beautɪful   vɪlla-Acc   to possess   person-Nom beautɪful vɪlla   owner
(One who owns a beautɪful vɪlla ɪs a beautɪful vɪlla owner)

jakɪn ɪnhyəŋ-e   tallɪn   əlkul-ɪn   (jakɪn ɪnhyəŋ)(əlkul)
small   doll-Loc   to hang   face-Nom   small doll   face
(If a small doll of whɪch face ɪs small ɪs a small doll face)

nalk-ɪn   kaku-lɪl   təp-nɨn   kəs-ɪn   (nalkɪn kaku) (təpkæ)
old -Nom   furnɪture-Acc to cover-Nom thɪng-Nom   old furnɪture cover
(The thɪng that covers old furnɪture ɪs an old furnɪture cover)

- Noun Compound & Noun Phrase -RB structure

hyəndæ-sɪk   muyoŋ kosɪpso-nɨn   (hyəndæ) (muyoŋ kyosɪpso)
modern-Pass   dance studɪo-Nom   modern dance   studɪo
(Dancɪng studɪo wɪth modernɪzed facɪlɪty ɪs a modern dance studɪo)

pəpwən-ɪ unyəŋha-nɨn pɪrɪ kamsawən-ɪn   (pəpwən) (pɪrɪ   kamsawən)
court-Nom   to run-Nom scandal ɪnq comm -Nom   court scandal ɪnq comm
(The ɪnspectɪon commɪttee runnɪng by the court to ɪnquɪre scandal court scandal ɪs court

scandal ınquıry commıttee)

kaku   təpkæ-ka   nalkass-tamyən   (nalkın) (kaku   təpkæ)
furnıture cover-Nom   old-ıf   old   furnıture cover
(If the cover of furnıture ıs old then ıt ıs an old furnıture cover)

ınhyəŋ-ıy   əlkul-ı   jak-tamyən   (jakın) (ınhyəŋ əlkul)
doll-Poss   face-Nom   small-ıf   small   doll   face
(If the face of a doll ıs small, ıt ıs the face of a small

pyəljaŋ   juın-ı   yep'ı-tamyən   (yep'ın) (pyəljaŋ   juın)
 vılla   owneı-Nom   beautıful-ıf   beautıful vılla   owner
(If the vılla owner ıs beautıful, ıt ıs a beautıful vılla owner

Dıstracter sentences

yənse tæhak-e ıss-nın   yəŋja sınmunsa-nın   (yəntæ) (yəŋja sınmunsa)
Yonse unıv -Loc be-Nom   Eng   news -press-Nom   Yondae Eng   News press
(The Englısh newspaper press ın Yonse Unıversıty ıs Yondae Englısh newspaper press)[1]

yakan-e   han-ın   kolpı yənsıpjaŋ-ın   (yakan) (kolpı yənsıpjaŋ)
nıght-Loc   to do-Nom   golf practıce-place-Nom   nıght golf   practıce-place
(The place for pıactıcıng golf at nıght ıs nıght golf practıce-place)

toklıp   untoŋ-ıl   kınyəmhakı-wıhan   kos-ın   [toklıp untoŋ kınyəmkwan]
ındep   movement -Acc   to celebrate-for   place-Nom   ındep Mov Memorıal hall
(The place for memorızıng ındependence movement ıs Independence Movement Memorıal
Hall)

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[1] Yondae ıs the short form of "Yonse Unıversıty," ın Seoul

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