

Korean Intonational Phrases Do Not Distinguish Dependent Clauses from Within-Clause Units

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This study examined how adult native speakers of Korean prosodically structure their speech during spontaneous story telling. It asked participants to produce a spontaneous story from a picture book in L1 Korean. Participants' phonological phrasing (via pause) was analyzed with reference to eight hierarchical syntactic structures defined in the study. The results suggested three-level hierarchy in phonological structure in spoken Korean: between sentences > between independent clauses > between a dependent clause and the matrix clause = any within-clause boundaries. Korean speakers paused the longest prior to starting a new sentence. They paused statistically significantly shorter between two independent clauses (e.g., coordinate clauses and adverbial clauses), and even shorter between a dependent clause (e.g., complement clauses and relative clauses) and the matrix clause. Interestingly, however, the last type of clausal boundaries, i.e., between interdependent but separate clauses, did not differ from any of the observed within-clause boundaries with respect to intonation structure marked by pauses. These results are consistent with the literature as to across-clause boundaries, but contra the traditional prediction that syntactic hierarchical structure may be mapped onto phonological structure: clausal boundaries are prosodically treated the same as within-clausal boundaries. Crosslinguistic and educational implications are discussed.

Key Words: syntactic structure, phonological structure, intonational phrase, dependent clause, language production

I . Introduction

Knowledge on syntactic structures of a language impacts perception (e.g., Friederici, 2002) and production processes (e.g., Bock, 1986) for the language. Native speakers demonstrate good use of such knowledge and successfully process the language. By contrast, given that L2 structures frequently differ from those of L1, nonnative learners often experience L1 interference in processing an L2. Inefficient use of L2 syntactic structures may prevent learners from using the L2 in a nonnative-like manner. In Marinis, Roberts, Felser, and Clahsen (2003), while native readers made use of intermediate syntactic gaps during on-line sentence processing of long-distance wh-

dependencies, L2 learners were limited in using nativelike strategies and underused the syntactic information. Juffs and Harrington (1995) reported Chinese speakers had difficulty in judging the grammaticality of English sentences with a subject-extracted relative clause as they failed to correctly parse the sentences at subject gaps. They interpreted the results as indicating lacking wh-traces in L1 be the cause of failure to reanalyze the English empty categories and of difficulty in L2 sentence processing. Vastly driven from such L1 influence, significant efforts of second language acquisition have been made to identify such crosslinguistic differences and interfaces (e.g., Gass, 2013).

One challenge is to understand the speech structures native speakers use. Based on a consensus that linguistic units are hierarchically structured (Garrett, 1975, Levelt, 1995), literature has identified linguistic constituents to define prominence relationships between them. Prosody has been considered the device to determine speech units (Shattuck-Hufnagel & Turk, 1996:194). Prosody refers to “acoustic patterns of F0, duration, amplitude, spectral tilt, and segmental reduction, and their articulatory correlates, and the higher-level structures that best account for these patterns” (Shattuck-Hufnagel & Turk, 1996:196).

In speech, speakers need to plan the upcoming units and thus need time to plan. Naturally, they pause while planning the to-be-spoken utterances. As they cannot plan the whole utterance at a time, they pause and plan a series of words at a time, then produce the set of words under a single intonation contour (i.e., intonational phrase), and then pause and plan the next set, and so on. Accordingly, pauses, one aspect of prosody, are used as a measure of examining planning units (Shattuck-Hufnagel & Turk, 1996). Pauses mark intonational boundaries/units in speech planning (Goldman-Eisler, 1958) and indicate structures of an utterance (Henderson, Goldman-Eisler, & Skarbek, 1966; Miller & Schwanenflugel, 2006). Intonation units are planning units and defined as a sequence of words spoken under a single intonation contour preceded by a pause (longer than 200 ms in English, Chafe, 1987). Examined of intonation, stress, and phrasing with respect to morphosyntactic hierarchies, prosodic structures were found to generally well map onto syntactic structures (Croft, 1995; Jun, 2005; Warren, 1996).

Despite the importance of successful parsing in both written and spoken language processing (Juff & Harrington, 1995; Kim, 1999; Packard, Ye, & Zhou, 2011), L2 learners of English do not parse incrementally as native speakers (Felser, Roberts, Marinis, & Gross, 2003). In order to ultimately help improve Korean learners’ comprehension and production of spoken English, it would be important to first understand how Koreans realize prosodic cues in Korean and then compare the properties with those in English L1 data and also with Koreans’ L2 English speech.

As an initial step, the current study attempts to examine how Korean native speakers

pause and parse during speaking Korean, expecting the pausing patterns to demonstrate what syntactic units they have in mind about Korean phrase structures and how the units are hierarchically structured if so. We expect to see whether native speakers of Korean really pause where traditional syntactic arguments predict they should pause. Literature (Cho, 1990; Jun, 2005) suggested syntactic boundaries do not always map onto phonological boundaries and that different languages have different syntactic and phonological structures.

II. Korean Sentence Structure

1. Syntactic Categories and Syntactic Roles

Korean is a language isolate, is agglutinative in morphology, and has nominative-accusative alignment with a basic SOV word order (the National Institute of the Korean Language, NIKL hereafter, 2005:23).

For current purposes, a word is defined as a formal unit that can stand alone. Using this independence criterion and following Nam and Ko (2011:43-47) and NIKL (2005:298-300), this paper adopts, for example, a five-word view for *cheol.su-ka tong.hwa-leul ilk-eoss-ta* ‘Cheolsu-NOM story-ACC read-PST-DCL’ ‘Cheolsu read a story.’ *Cheolsu*, *ka*, *tonghwa*, *leul*, and *ilkeossta* can stand alone; *ilk* or *eossta* cannot, thus not words.

Based on formal distributions and functions, six categories are defined: Nouns, Verbs, Postpositions, Adjectives, Adverbs, and Interjections. Nouns include nouns, pronouns, and quantifiers (e.g. *ha.na* ‘one’ as in *ha.na-ka ka-n-ta* ‘one-NOM go-PRS-DCL’ ‘One (person) goes’ as opposed to *han* ‘one.ADJ’ as in *han myeong* ‘one person’). Verbs are copula, verbs and predicate-adjectives (e.g., *a.ph* ‘be sick’ and *mu.seo* ‘be afraid’ that take honorific and tense suffixes as do verbs). Postpositions include case markers, conjoining postpositions (e.g. *-wa* ‘and’), location-referring words like *-e* ‘at’ and *-eu.lo* ‘to’, and other postpositions including topic markers like *-eun* ‘TOPIC’ and the ones like *-man* ‘only, emphasizing the singleness of a referent.’ They are attached to a noun or to a noun plus postposition(s). Traditional modifiers are split into adjectives and adverbs, considering that they are not grammatically interchangeable (e.g., *ye.ppeun* ‘pretty.ADJ’ in *ye.ppeun hak.saeng* ‘pretty student’ v.s. *ye.ppeu.ke* ‘prettily.ADV’ in *ye.ppeu.ke keot.neun.ta* ‘prettily walks’).

Five syntactic roles or grammatical relations are: subject (S), direct object (DO), indirect object (IO), oblique (OBL), and predicate (V). S, DO, and IO are core arguments of a predicate, whereas OBLs are not. Subjects include S of an intransitive verb and A of a transitive verb (Croft, 2001:134-5). DOs are P of a monotransitive verb and T of a

ditransitive verb, and IOs are G of a ditransitive verb (Croft, 2001:142-144). Obliques (or non-core arguments) or adjuncts “lack grammatical relation to some predicate” (Payne, 1997:129).

2. Main Clauses

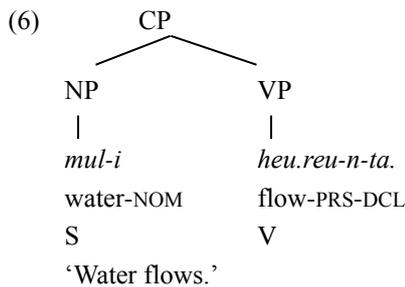
Three basic simple-sentence types are: intransitives (1), transitives (2~3), and ditransitives (4~5). Five major characteristics of main clauses can identify grammatical relations, relevant to boundary hierarchies. Showing nominative-accusative alignment, S of intransitive verb and A of transitive verb are treated the same as subjects while P of transitive verb (and T of ditransitive verb) behaves differently. While all arguments can be dropped leaving only the obligatory predicate (3), the subject argument can be recovered by the honorific agreement morphology on the verb if applicable. Otherwise, arguments are recovered based on the discourse context (e.g. ‘this’ in 3). Allowing free word order, the basic word order SOV should be followed when there is no case marker. Arguments need to be in AP or AGT order, normally followed by V. When the case markings are omitted, word order tells which argument is the subject and which is the object. Case marking can help identify the grammatical relations. While a topic marker often neutralizes the distinction between subjects and direct objects replacing a possible nominative (5) or a possible accusative case marker (5) and complete drops of the case markers are grammatically warranted, otherwise by default subjects are case-marked as nominative (1, 2, 4), direct objects are as accusative (2, 4) or nominative, and indirect objects are as dative (4, 5). These hold true for negative constructions (5) and interrogative constructions (3).

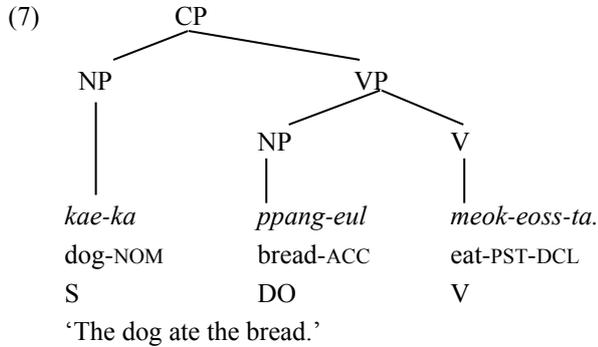
Subject	Predicate	
S	V	
(1) <i>seon.saeng-nim-kke.seo</i>	<i>ka-si-eoss-ta.</i>	
teacher-HON-NOM.HON	go-HON-PST-DCL	
‘The teacher went.’		
Subject	Direct Object	Predicate
A	P	V
(2) <i>a.peo.ji-kke.seo</i>	<i>jeo.nyeok-eul</i>	<i>man.teu-si-eoss-ta.</i>
father-NOM.HON	evening-ACC	make-HON-PST-DCL
‘He prepared a dinner.’		

- (3) \emptyset \emptyset *ha-si-l-lae-yo?*
 \emptyset \emptyset do-HON-FUT-Q-RSP
 (To a person at a higher rank than the speaker) ‘Do you want (to do) this?’

- | | Subject | Indirect Object | | Direct Object | Predicate |
|-----|---|------------------------|----------|----------------------|-----------------------|
| | A | G | | T | V |
| (4) | <i>nae-ka</i> | <i>keu a.i-e.ke</i> | | <i>tsaek-eul</i> | <i>ju-kess-ta.</i> |
| | 1SG-NOM | that child-DAT | | book-ACC | give-FUT-DCL |
| | ‘I will give that child a book.’ | | | | |
| (5) | <i>na-neun</i> | <i>keu a.i-e.ke</i> | | <i>tsaek-eun</i> | <i>an ju-eoss-ta.</i> |
| | 1SG-TOP | that child-DAT | book-TOP | NEG | give-PST-DCL |
| | ‘I did not give that child a book (but maybe someone else did or I gave him something else).’ | | | | |

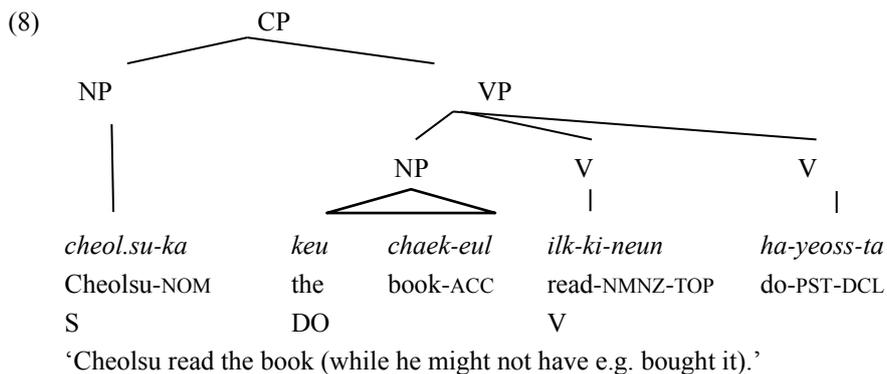
Intransitive constructions have a structure as in (6) (Cho, 1990:49). The subject ‘water’ is at the same level as the predicate ‘flows’, connected to the CP directly. Transitives are like the one in (7) (Cho, 1990:49; Lee, 2006:306). DO is subsumed under and connected to the VP, and is lower than the subject. Subjects are distinct categories outside of the VP in that we can substitute a subject with another NP without making the VP or the sentence ungrammatical while the object relation is more strictly restricted by the verb (Nam & Ko, 2011:37-38). In *cheolsu-ka tonghwa-leul ilk-eoss-ta* ‘Cheolsu-NOM story-ACC read-PST-DCL’ ‘Cheolsu read a story’, *cheolsu-ka* ‘Cheolsu’ can be replaced by *Youngsu-ka* ‘Youngsu’, but *pap-eul* ‘rice-ACC’ cannot freely replace the object requiring both O and V be replaced. An adverbial like ‘every day’ can come between the subject and the object, confirming the constituency.

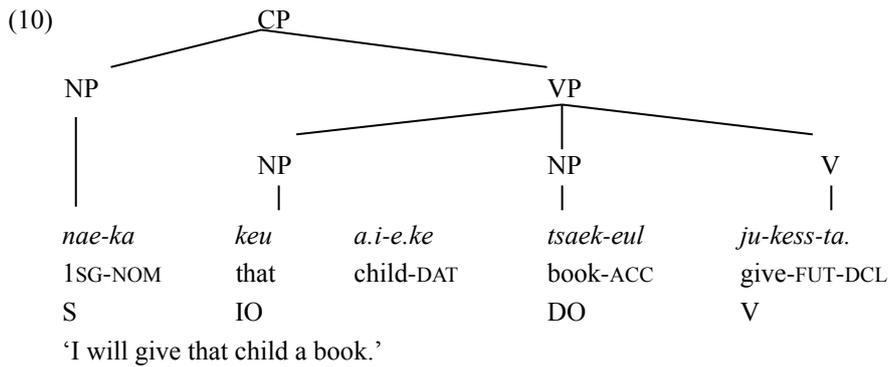
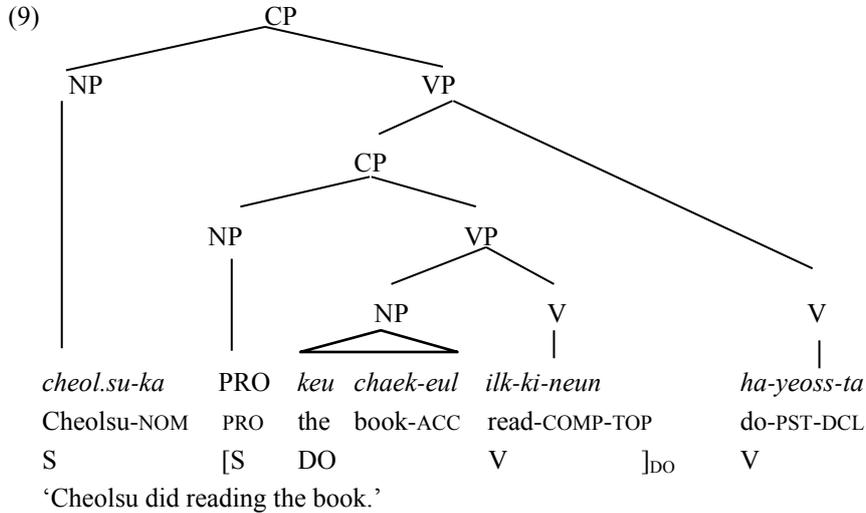




For some other transitives, however, dual analyses are possible, called VP-focus construction and bi-clausal analysis (Nam & Ko, 2011). The former, for example, sees two predicate forms ‘read’ and ‘do’ in (8) together take the object. It says the construction emphasizes the meaning of the verb ‘to read’ in this example and that *-ki* is not a complementizer. The latter, as in (9), argues the matrix verb ‘do’ takes all the inflectional elements and that ‘reading the book’ is a nonfinite complement clause. The current paper, following the VP-focus analysis, considers the example a single-clause sentence: it gives the topical interpretation on the verb; *ilk-ki-neun ha-yeoss-ta* as a whole behaves like a single serial verb referring to a single predicate meaning and requiring a single set of participants who ‘read.’

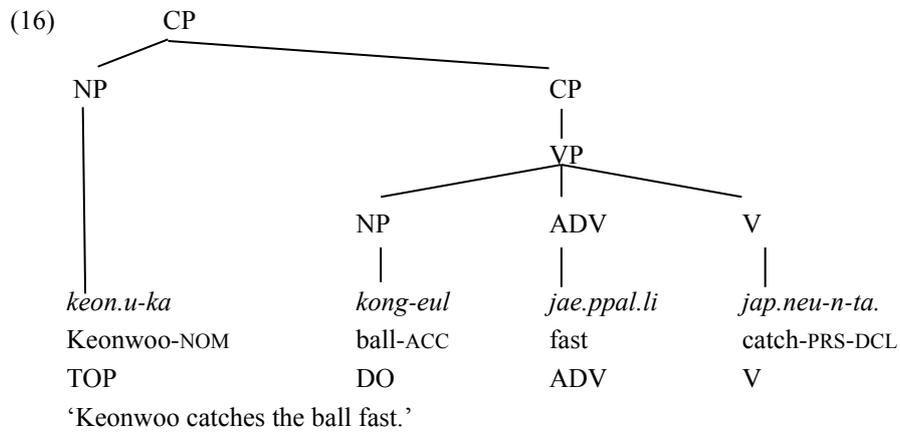
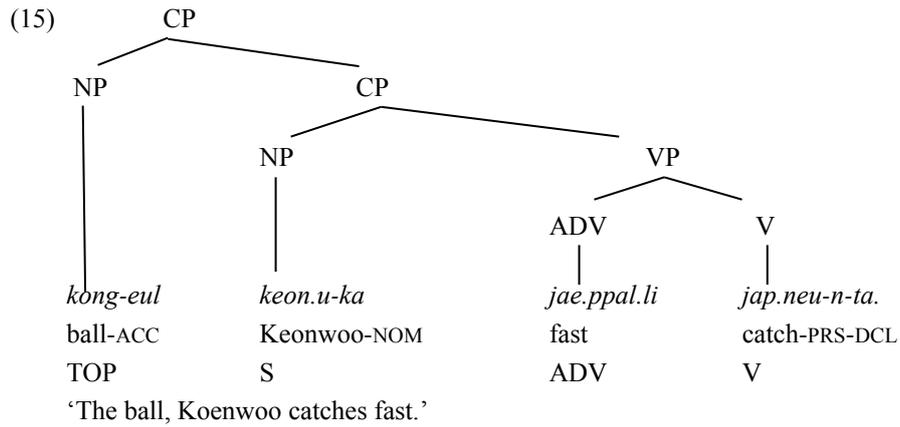
Ditransitive constructions are drawn from the transitive. IOs are treated the same as DOs (10), but are more loosely related to V and thus grouped as IO / DO V (e.g., obstruent voicing is blocked between IO and DO but not between DO and V, Cho, 1990:49).





When an additional phrase comes, it is connected to the modified maximal node. Five such types are a topic, an adjective phrase, two different adverbial phrases, and a negative construction. The same analyses hold true for transitives and ditransitives, in that an additional phrase is attached to the maximal node of CP, subject NP, or VP, which are higher than the (direct or indirect) object NP. First, often called double-subject construction in Korean, the topic is attached to the whole CP as in (11) (Cho, 1990:50). *Na-neun* is a discourse subject and *meo.li* is a grammatical subject (Lee, 2006:62). Second, an adjective phrase is subsumed under the NP (e.g., *tsak.han so.nyeon* ‘good boy,’ ‘a good boy’). Next, while an adverbial/oblique modifying the verb is connected to the VP node (12, Cho, 1990:52), those modifying the whole clause are connected to the CP (13). Last, a negating word behaves the same as an adverb (14).

Word order was taken into consideration: scrambled word order, holding the same case markers, may change the hierarchical relationship. In (15) and (16) (from Cho, 1990:60-62), relative order between ‘ball’ and ‘Keonwoo’ determines the topicalized argument. When the object is topicalized (15), it comes out of the VP and lies higher in the tree than the subject; when the subject is topicalized (16), it is higher than the object.



3. Clausal Boundaries in Combined Clauses

Combined clauses are categorized into two: (i) one clause governed by another clause (17, 18) and (ii) the two clauses independent of each other. The first type boundary is predicted to be closer to the arguments of another clause. The first group includes complement clauses (17) and relative clauses (18). In (17), ‘that she had been a genius’ is governed by the matrix clause and assumes one syntactic role of the matrix.

Finiteness elements can be omitted, i.e., *-yeoss* ‘PST’, *-eoss* ‘PST’ (17, 18). The second group includes coordinate clauses and adverbial clauses. One coordinate clause is: *[[pa.lam-i pul(-eoss)]-ko]CP [pi-ka nae.li-eoss-ta]CP* ‘wind-NOM blow(-PST)-and rain-NOM come.down-PST-DCL ‘It was windy and it rained.’ See relevant conjoining morphemes in NIKL (2005:109-190) and Nam & Ko (2011:383-436).

- (17) [S DO V]_{CP}
 [S V]_{CP}
[keu-neun [[keu.nyeo-ka tseon.jae(-yeoss)]-ta.ko] saeng.kak.h-aess-ta].
 3MSG-TOP 3FSG-NOM genius(-PST)-COMP think-PRS-DCL
 ‘He thought that she had been a genius.’

- (18) [S DO V]_{CP}
 [S DO V]_{CP}
[keu-neun [[Ø Ø a.kki(-eoss)]-teon] kkot.pyeong-eul kkae-ss-ta.]
 3MSG_i-TOP Ø_i Ø_j cherish(-PST)-ADJ vase_j-ACC break-PST-DCL
 ‘He_i broke the vase which (he_j) cherished.’

III. Method

1. Defined Syntactic Boundary Hierarchy

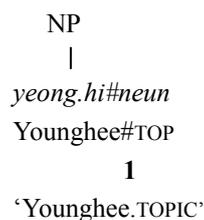
Based on the so far described morphosyntactic distribution and assignment of syntactic roles, eight syntactic boundary levels (Level 1 through 8) are defined for current purposes. The higher numbers mean more distant boundaries in hierarchical tree structure. Level 1 is the level where a pause is least predicted and level 8 is where it is most predicted, with the increasing numbers in between representing gradual increscent of the probability of a pause. The first level is between words within one *eujeol* ‘word-phrasal unit’ (spacing unit in orthography, Name & Ko, 2011:35-38) and syntactic bond weakens towards the eighth level, which is across sentences.

1) Boundary Level 1

The first-level boundaries are between morphemes within one *eoujeol* ‘word-phrasal unit.’ This is the lowest level boundary between words. A set of two words behaves as a single syntactic unit, getting one syntactic role as subject or object and moving around in a fixed order. Although Korean allows free word order, switching the order within this unit is strictly prohibited (**neun#yeong.hi* ‘TOP#Younghee’). This level includes

boundaries between a noun and a postposition. Postpositions include a topic marker (19), a case marker (e.g., *seon.saeng-nim#kke.seo* ‘teacher-HON#NOM.HON,’ ‘teacher.NOM’), a location-referring postposition (e.g., *hwe.sa#e* ‘company#to,’ ‘to work.N’), and emphasizing postposition (e.g., *na#man* ‘1SG#only,’ ‘only me’).

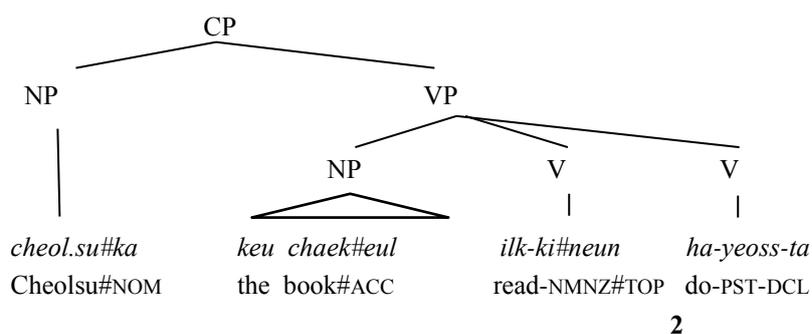
(19) Noun & Topic marker



2) Boundary Level 2

The second-level boundaries are between words that belong to separate *eoujeol* ‘word-phrasal units.’ Two words together get one syntactic role. Subject, IO, or DO for *sa.lam-teul* in *jeo sa.lam-teul* ‘that person-PL ‘those people’; predicate in 20 or in *an ja-ss-ta* ‘NEG sleep-PST-DCL’, ‘did not sleep’. Relative order of the two words is fixed, thus switching the order is ungrammatical. Different from Level 1, switched order does not make the individual words ill-formed. **jassta an* ‘slept NEG’ and **hayeossta ilkkineun* ‘did reading’ are ungrammatical but each word form is grammatical.

(20) Verb & Verb



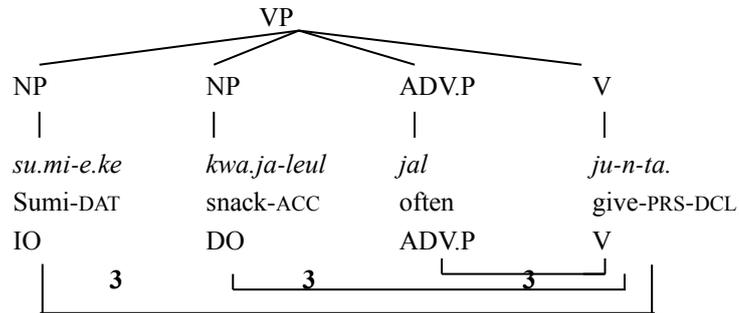
‘Cheolsu did read the book (while he might not have e.g. bought it).’

3) Boundary Level 3

Words here can freely change their relative order and get separate syntactic roles. Each

of the IO, DO, ADV.P, and the predicate in 21 forms a separate ‘word-phrase units,’ and gets a separate syntactic role. Switching the relative order is free and grammatical. Distinguished from Level 4, the two words are of one maximal node, where one of the words is the head of that maximal projection. Three such boundaries are between IO and V, between DO and V, and between ADV.P and V. The NPs and the ADV.P are subsumed under the VP while V is the head of that VP.

(21) IO | DO | ADV.P & Predicate

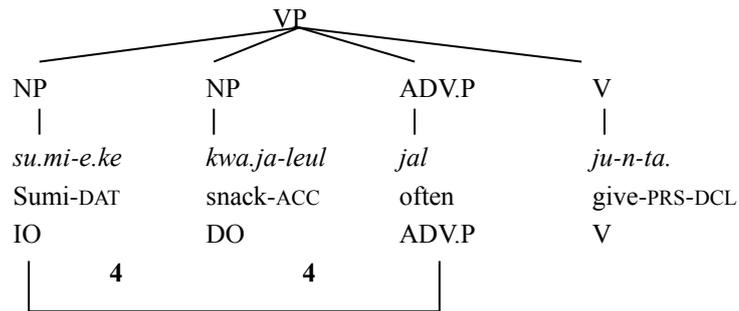


‘(Someone) often give(s) snacks to Sumi.’

4) Boundary Level 4

Here the two words are under a maximal projection where neither of the words are the head. Members include boundaries at IO-DO, DO-ADV.P, IO-ADV.P. (22), and subject-predicate (as in *mul-I heu.reu-n.ta* ‘water-NOM flow-PRS-DCL,’ ‘water flows’).

(22) IO & DO; DO & ADV.P; IO & ADV.P



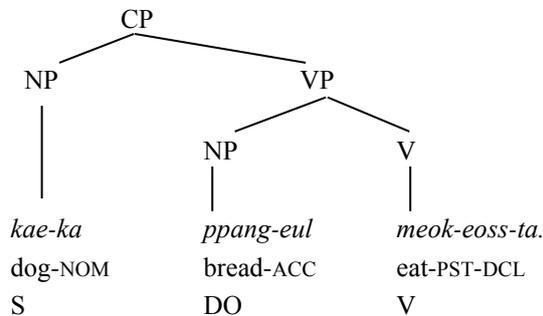
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‘(Someone) often give(s) snacks to Sumi.’

5) Boundary Level 5

One (or both) of the words is/are outside/above the branching node that the other word is governed by. In (23) and (24), ‘bread’ and ‘Junho’ are additionally governed by VP and C’ respectively, which does not govern ‘dog’ or ‘in the morning’. The two words, however, still belong to the same clause. The same is true for a topic (as *na-neun* in [*na-neun* [*meo.li-ka a.ph-eu-ta*]_{CP}]_{CP} ‘1SG-TOP head-NOM be.sick-PRS-DCL’ ‘I have a headache’) and any immediately following argument (e.g., *meo-li*).

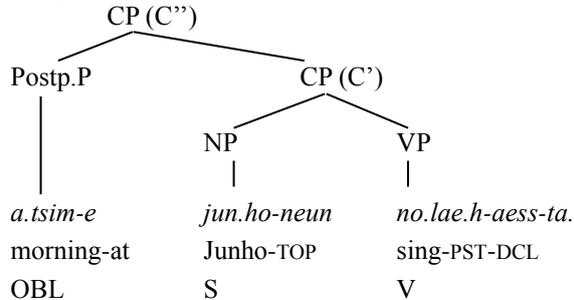
(23) Subject & Object



5

‘The dog ate the bread’

(24) Postpositional Phrase or Adverbial Phrase & Subject



5

‘In the morning, Junho sang.’

6) Boundary Level 6

From this level are across clauses. This level involves the first group of the combined clauses (See 2.3). While other things being the same, switching the order is not allowed,

the beginnings and the endings of all the sentences (1) through (26) are such boundaries.

2. Speech Collection

1) Participants

Two Korean adult native speakers participated in the experiment: a male (age 28) and a female (age 26). They were born and raised in Korea and speak standard-Korean Seoul dialect.

2) Material

A picture book, *Frog, Where are You?* (written by Mayer, 1969), was used to elicit speakers' spontaneous story telling. The book consists of 29 pages of whole-page pictures around a single theme, without any words. It was considered a good medium to elicit a single story and later to compare stories in L2 by the same speakers.

3) Procedure

Participants took part in the experiment individually with the same researcher, following the same procedure. At the start of the experiment, the participants were told, after taking sufficient time to understand the storyline of the picture book, they would be asked to tell a story in Korean, their native language, at whatever length and at whatever speech rate they would feel comfortable.

Next, each participant was asked to plan a story while looking at the pictures in the book. Sufficient time was given to look at the pictures as much as each participant needed. They were also allowed to go back and forth in the book while silently planning a story in their mind.

Then, spoken stories were recorded. Participants started telling a story once they signaled they were ready. Their speech was recorded in mono setting with a sampling frequency of 44,100 Hz via *Praat* wave recording software in a Mac laptop. The same and constant distance was ensured between the microphone and mouth and within and across participants.

4) Measurement, Coding, and Analysis

The obtained stimuli were measured and analyzed as follows: Firstly, a Korean native speaker who did not participate in the experiment transcribed the recorded speech

including speech errors. He was a 29-year-old standard-Korean speaker.

Secondly, based solely on the transcription, without listening to the recording, the researcher did a syntactic analysis as described in 3.1. All sentences were numbered: the male participant's sentences were numbered as M1, M2, and so forth and the female's as F1, F2, and so on. Next, the researcher glossed each morpheme, did structural analyses, and then assigned syntactic boundary levels. Pauses from speech errors were coded (as number 9) separately from the ones at grammatical syntactic boundaries.

Thirdly, the researcher measured the actual pauses in the speakers' production using *Praat* software. A pause was any silent (or non-speech) duration longer than 180 ms in the *Praat* edit script. Numbers were rounded off to whole numbers in milliseconds. Pitch was set from 75 Hz to 500 Hz for the male voice and from 120 Hz to 500 Hz for the female voice. All the other settings were default. Fillers such as /a/, /ʌ/, and /ə/ were included in pauses, considering them as voiced (planning-) pauses that signal boundaries. This can be conceivable if we consider fillers like English *well* and *um* come in the boundaries rather than within a constituent. By contrast, speech errors, including pronunciation errors, morphological errors, and lexical substitutions, were treated as part of speech (or story). They were defined as signals to the start of the following speech. For example, in M20, a speech error *ttang* 'ground' in *ttang ttang-kul-e* 'ground ground-tunnel-at' was taken as the start of the next unit.

Finally, a univariate analysis of variance tested the effect of syntactic boundary level (with 8 levels, 1 ~ 8) on pause duration (i.e., mean pause duration per boundary level in milliseconds). Associated post-hocs referred to Bonferroni to test the group differences. Alpha was adjusted to maintain the probability of Type I error at .05. The analyses were in SPSS 22.0 for Mac OS.

IV. RESULTS

A descriptive analysis found a total of 385 pauses out of 99 sentences. 226 pauses were from the male speaker's production of 63 sentences and 159 were from the female's 33. Excluding 76 from speech errors ($M = 1112.1$ ms, $SD = 741.87$), 309 pauses were at the eight syntactic-boundary levels. Table 1 gives the descriptive statistics. As shown in Figure 1, pauses were shorter to a similar degree at syntactic boundaries Level 1 through 6, and statistically significantly longer at Level 7 and significantly longer at Level 8.

Table 1.
Descriptive Statistics for Pause Duration (ms) by Syntactic Boundary Level

Syntactic Boundary Level	<i>n</i>	<i>M</i>	<i>SD</i>
1	1	503.0	N/A
2	10	484.2	353.74
3	21	471.8	290.40
4	46	558.4	359.26
5	52	587.8	327.81
6	60	618.6	416.18
7	63	1530.7	1823.19
8	56	2289.2	1659.42
Total	309	1078.5	1306.92

Note. The distribution of pause durations is symmetrical with no outliers.

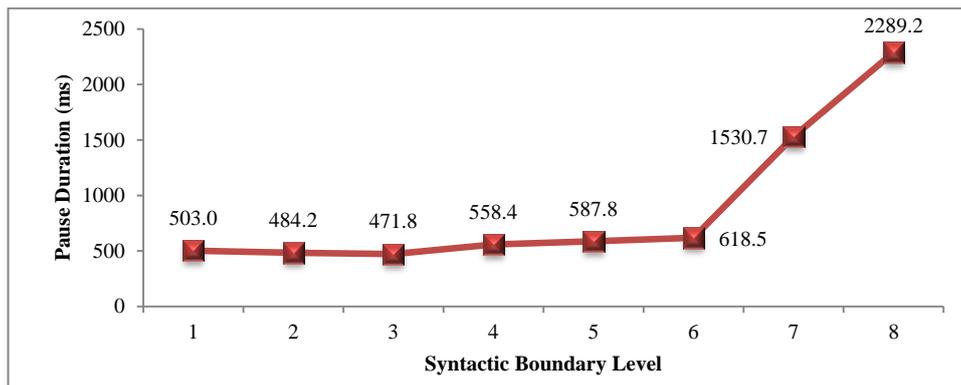


Figure 1.
Average Pause Duration (ms) by the Eight Syntactic Boundary Levels

A univariate analysis of variance supported a significant effect of syntactic boundary level on pause duration, $F(7, 301) = 16.24, p < .01$ (Table 2). For post-hocs, we excluded the first two levels because they left empty cells (Level 1 pauses only by the first participant and Level 2 pauses by the second participant.) The remaining 298 cases were included in the post-hoc. Again, the syntactic boundary level significantly predicted the group differences in pause duration, $F(5, 292) = 21.51, p = .000$. A Bonferroni supported that Level 3, 4, 5, and 6 were statistically the same ($p = 1.000 > .01 = .05/5$, using a corrected alpha criteria), and all these four levels are different from Level 7 and from Level 8 ($p < .01$); Level 7 and 8 are also statistically significantly different ($p < .01$). Pauses before speech errors were longer than those at Level 1 ~ 6 ($p < .01 = .05/6$), but

shorter than those at Level 7 and 8 ($p < .01 = .05/6$).

Table 2.

Univariate Analysis of Variance Summary for the Effects of Syntactic Boundary Level on Pause Duration

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>
Syntactic Boundary Level	7	144213630.00	20601947.10	16.24*
Error	301	381861147.00	1268641.69	
Total	308	526074777.00		

* $p < .05$.

V. DISCUSSION

The results of the study suggested that syntactic hierarchical structure predicted (only) global trend in the phonological/prosodic structure while most within-matrix-clause hierarchies were not realized in prosodic structure in Korean. The incrementally increasing differences in syntactic complexity were not fully realized in phonological hierarchies. First, all the three types of clausal boundaries differed in pause duration: dependent < independent < sentence. Korean speakers paused the shortest amount of time at boundaries between a dependent clause (i.e., a complement clause or a relative clause) and its matrix clause; significantly longer between two independent clauses; even longer than the previous two boundaries when between two sentences. By contrast, all the within-clause boundaries did not significantly differ from one another. The within-clause pauses were long enough to be a pause (longer than 200 ms as defined in Chafe, 1987), but the distribution was not consistent.

What is most interesting, however, is that the dependent-matrix clausal boundary (Level 6) induced statistically the same pause duration as within-clause boundaries (Level 3 ~ 5). Different from English speakers, who would likely break at a relative clause boundary, Korean speakers produced the relative clauses just as other in-clause arguments. The pause durations did not differ. It may be that, because Korean language can and usually do omit arguments when they are recovered from discourse context, the speakers might have treated the relative clauses as simple adjectives. For instance, in the data, speakers did not even pause at all between *tam-kyeo.jyeo-iss-teo-n* and *yu.li-pyeong-e.seo* in *tam-kyeo.jyeo-iss-teo-n yu.li-pyeong-e.seo mol.lae na-o-Ø -p.ni-ta* ‘contain-PSSV-be-PST-ADJ glass-bottle-in secretly out-come-PRS-PLT-DCL, (Froggy) secretly comes out from glass bottle that (it) was being contained’ or between *e.ti-ka sa-neu-n* and *jip-e* in *e.ti-ka sa-neu-n jip-e* ‘Eddy-NOM live-PRS-ADJ house-at, the house that Eddy lives.’

Conclusively, we can say the following patterns are supported: (i) Korean adults, during spontaneous story telling in Korean (L1), paused the longest before starting a new sentence (Level 8, $M = 2289.2$ ms, $SD = 1659.42$); (ii) they did not pause as this long when they parsed their speech between two independent clauses within a sentence, such as between two coordinate clauses or before/after an adverbial clause (Level 7, $M = 1530.7$ ms, $SD = 1823.19$); (iii) they paused very short between an embedded clause and its matrix or between any of the arguments within a matrix clause (Level 3 ~ 6, $M = 576.9$ ms, $SD = 363.75$). Table 3 summarizes the eight syntactic levels and three corresponding levels of prosodic structure. Figure 2 grasps the three-way distinction in phonological structure in spoken Korean.

Table 3.

Eight Syntactic Levels with respect to Three Phonological Levels: the Phonological Levels are Marked by Graded Gray Background

Syntactic Level	Number of Word-Phrasal Unit	Switching Word Order	Number of Syntactic Roles	Syntactic Relationship
1	1	**	1	e.g., 'me-TOP'
2	2	*	1	e.g., 'NEG sleep-PST-DCL'
3	2	Grammatical	2	One word is the head of that branching node (Within-Clause)
4	2	Grammatical	2	None are the head. Sisters of the branching node (Within-Clause)
5	2	Grammatical	2	The node governs one word but not the other (Within-Clause)
6	2	Grammatical	2	Words from two interdependent but separate clauses (Across-Clause)
7	2	Grammatical	2	Words from independent and separate clauses (Across-Clause)
8	2	Grammatical	2	Words from separate sentences (Across-Clause)

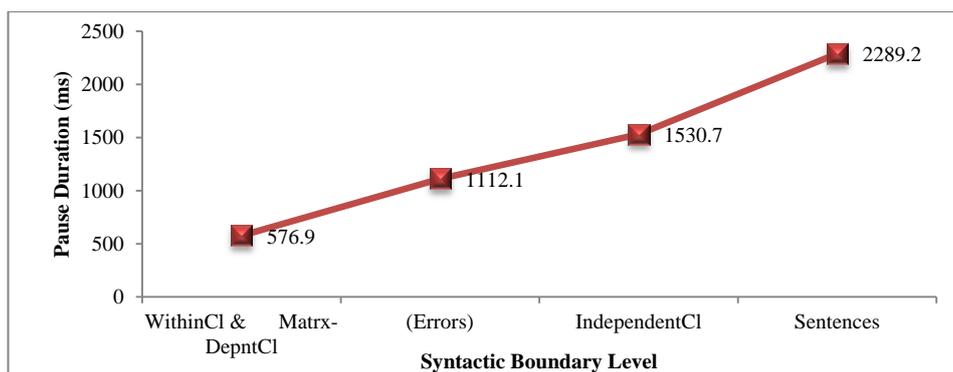


Figure 2.

Average Pause Duration (ms) by Structural Boundary Levels

Considering intonational phrases being planning units, Korean native speakers seem to plan an utterance mostly clause by clause and thus speak the whole clause at a time, then moving onto planning the next clause during a pause and so on. Planning an associated clausal meaning (pauses at Level 7) appears to be easier, requiring relatively less time, while planning a clause which is less associated with and independent from the previous utterance (pauses at Level 8) should require more time to plan. They not only paused longer at the clausal boundaries but also paused frequently there. This yet needs further examination with more data.

Within a clause, speakers do not seem to need different amount of time to plan a subject, an object, a topic, etc., regardless of the type of or relationship between within-clause units. More (instances/numbers of) pauses were observed as the syntactic boundary level increases, so the general trend is shown. However, the differences show only overall trend and are small. More importantly, the statistical analyses did not support the significance of the durational differences within-clauses.

We also suspected that the speakers treated all the subunits of a matrix clause the same manner. That is, regardless of whether the unit is something smaller than a CP (as all the within-clause units) or a whole CP (like dependent clauses taking a syntactic role as complement clauses or modifying an argument as relative clauses). In terms of grammatical relations or propositions, complement clauses and relative clauses do not add a syntactic role or form another full CP proposition.

Mismatches between syntactic and phonological structures have already been widely observed crosslinguistically. Despite the overall high predictability for prosody by syntactic hierarchy, discrepancies have frequently observed but yet to be answered (Ferreira, 1991; Jun, 2005; Pan & McKeown, 1999; Shattuck-Hufnagel & Turk, 1996).

Some linguists and psychologists suspected discourse and cognitive factors of possible causes for the prosodic variation (Chafe, 1987; Shattuck-Hufnagel & Turk, 1996; Pan & McKeown, 1999; Ferreira & Swets, 2002) Traditional literature, however, did not seem to have yet come to a consensus as to whether and how such factors would account for the currently unpredictable prosodic properties.

In second language researches, L1 interference effect has been suggested as a possible cause. Juffs and Harrington (2005) discussed for Chinese speakers English word order, which is different from their L1 Chinese, could have been a negative factor that led to the L2 readers' errors in comprehending English relative-clause sentences.

VI. Conclusion

The current study, being only a start to see how Koreans parse Korean sentences in their spontaneous speech, leaves much room for further research. Modification to the

experimental design may reveal different or more interesting results. Two speakers were not appropriate to run statistical analyses for or draw generalized conclusions as to the pattern. Refining the syntactic boundary levels, e.g., merging level 1 and 2 and/or other intermediate levels of 3, 4, 5, and 6, might also give a different picture. Additionally, it would be important to incorporate speech rate for durational measures and the ratio of the pauses out of the total number of syntactic boundaries per level for frequency measures. For instance, if speakers pause longer at a boundary but rarely pause, then we should not interpret the boundary as significant one. Furthermore, to have better contribution to the literature, it also would be important to compare the results to other languages and other models. For example, considering the fact that the same proposition can be morphosyntactically marked as a clause or a phrase, it would be interesting to look at how Koreans realize such formal differences in English, if they do.

Follow-up studies should specifically look at how the same Korean native speakers intonationally parse Korean (L1) and English (L2) sentences, with respect to the same syntactic boundary levels. Korean learners of English might show different pausing patterns respectively for the two languages. We might need to analyze other phonological properties that may mark syntactic/phonological boundaries, such as pitch rise and final lengthening.

Considering the vast literature findings that advanced learners of a second language demonstrate nativelike strategies and processing patterns (e.g., Juffs & Harrington, 2005), gradually as their L2 proficiency increases, we should keep investigating aspects of crosslinguistic interfaces and develop pedagogical strategies to facilitate second language acquisition.

From an educational and crosslinguistic perspective, some of what we can expect in Korean speakers' utterances are: longer pauses may signal a new clause, or say a new propositional meaning, is coming up; the longer the pauses become, the more number of clauses/propositions or the less related propositional meanings are coming; Korean speakers of English might not parse English sentences in such incremental manner especially for within-clause units or relative clauses as do native English speakers.

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