A Processing-Based Account for the Preferred Ordering of the Korean Classifier Structures

Kum-Jeong Joo[1] and Kitaek Kim[2*]

[1]*Kwangwoon University*
[2*]*Gyeongin National University of Education*

Kumjeong@hawaii.edu, kitaek@ginue.ac.kr

This study explores whether native Korean speakers have a preference between the two numeral classifier structures, N+NUM+CL and NUM +CLgen+N. According to Hawkins's (2004) domain minimization account, the N+NUM+CL structure would be preferred over the NUM+CLgen+N structure because the former considerably has a bigger IC-to-word ratio than the latter. To test this prediction, we conducted an experiment in which native Korean-speaking adults completed two acceptability judgment tasks, one written (*n = 67*) and one spoken (*n = 46*). The results of the two acceptability judgment tasks indicate that native Korean speakers prefer N+NUM+CL over NUM+CLgen+N, compatible with the prediction of the domain minimization account.

Keywords: *numeral classifier structure, Korean, domain minimization, acceptability judgment task*

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1. Introduction

Korean employs two basic word orders for phrases consisting of numeral classifiers with nouns: N+NUM+CL and NUM+CLgen+N.[1] See (1a-b) for examples (Sohn, 2001, p. 353).

(1)	a.	haksayng student	sey-myeng three-CL	[N+NUM+CL]
	b.	sey-myeng-uy three-CL-GEN	haksayng student	[NUM+CLgen+N]

Previous studies have focused on linguistic analysis on these Korean numeral classifiers (K.-S. Kim, 2010; Y. K. Kim, 2007; J.-B. Kim & Yang, 2007; Lee, 2000, among many others). However, no study to date has experimentally tested which structure is more preferred for native Korean adults. The current study addresses this issue. In this study, we ask the following two questions: Do native Korean speakers have a preference between the two orderings? If so, what is the reason for the preference?

Recently, Joo's (2015) experimental study found that native Korean speakers have noun phrase pattern preferences (e.g., DEM+A+N+NUM over other patterns, e.g., A+DEM+NUM+N). Joo suggested that domain minimization (Hawkins, 2004) might (partly) explain such preferences.[2] In a similar vein, this study experimentally assesses whether native Korean speakers have a preference between the two numeral classifier structures, i.e., N+NUM+CL and NUM+CLgen+N. We then test whether the preference is compatible with the prediction of the domain minimization account.

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[1] Abbreviations used in glosses in the present study are as follows: A: adjective; ACC: accusative; CL: classifier; CLP: classifier phrase; DEM: demonstrative; DP: determiner phrase; GEN: genitive; KP: Korean case phrase; N: noun; NOM: nominative; NUM: numeral; PLU: plural; QP: quantificational phrase; SES: sentence ending suffix;

[2] Joo discussed that semantic compositionality (Groenendijk & Stokhof, 2005) and domain minimization (Hawkins, 2004) together best explain the preference difference. In this study, we do not consider semantic compositionality, which predicts the ordering of two adjacent lexical categories (i.e., A and N in Joo, 2015), because the two numeral classifier structures under investigation include only one lexical category (i.e., N).

2. Domain minimization

According to Hawkins's (2004, p. 3) performance–grammar correspondence hypothesis, "grammars have conventionalized syntactic structures in proportion to their degree of preference in performance, as evidenced by frequency of use and ease of processing." The performance–grammar correspondence hypothesis involves a principle of domain minimization, which states that processing efficiency is increased by minimizing the domains, defined as "the connected sequences of linguistic forms and their conventionally associated syntactic and semantic properties in which relations of combination and/or dependency are processed" (ibid, p. 31). In this regard, he proposed Early Immediate Constituents (EIC), a specific way to calculate the domain size. EIC states that the human processor prefers linear orders that maximize their immediate constituents(IC)-to-word ratios. That is, higher IC-to-word ratio indicates more minimal domain, which in turn increases frequency of use and ease of processing. To explain this, Hawkins gives four possible combinations in the domain of VP (ibid, p. 124).

(1) a. [**went** [**to** the movies]]

IC-to-word: 2/2 = 100%

b. [[the movies **to**] **went**]

IC-to-word: 2/2 = 100%

c. [**went** [the movies **to**]]

IC-to-word: 2/4 = 50%

d. [[**to** the movies] **went**]

IC-to-word: 2/4 = 50%

In this VP domain, the two ICs are V and PP. The four combinations in (2) differ in terms of the number of words from the verb to the preposition: two words (i.e., *went, to*) in (2a) and (2b), and four (i.e., *went, the, movies, to*) in (2c) and (2d). That is, the IC-to-word ratio is 100% (2/2) for (2a–b), but

50% (2/4) for (2c–d).

Hawkins explains some patterns among the world languages. For example, this account can explain why SVO languages have prepositional phrases while SOV languages have postpositional phrases.[3] According to this account, to ease processing, language seeks to minimize the domain (i.e., maximize the IC-to-word ratios). Note that SVO languages (as in (2a)) and SOV languages (as in (2b)) place the preposition close to the verb, with which IC-to-word ratios can be maximized. In terms of frequency of use, Hawkins explains the word order distribution across the languages in the world: Out of 389 languages under his investigation, 365 languages (93%) have their word orders like (2a-b), while only 24 languages (7%) have their word orders like (2c-d).[4]

3. Syntax of classifier stuructures

A *classifier* is a word or morpheme used to classify the referent of a noun. While numeral classifier systems have been widely studied in the languages of Southeast Asia and Oceania, they also commonly occur in the grammars of East Asian languages. In these languages, a numeral is accompanied by a classifier (Aikhenvald, 2000; Simpson, 2005).

With regard to the syntax of classifier structures, many researchers have considered the underlying tree structure below (Li, 1999; Reinhart, 1997,

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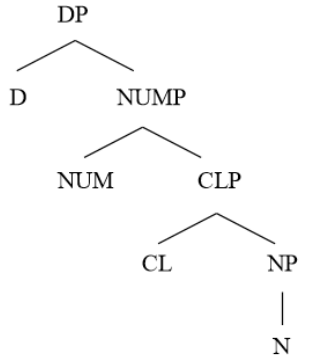
[3] Hawkins was not the first to discuss this typological characteristic. Greenberg's (1975) implicational universals describe the difference as follows: SVO languages have prepositional phrases while SOV languages have postpositional phrases. From the generative point of view, the head-direction parameter describes the word order difference (Pinker, 1994, p. 104). Within an X-bar, head-initial languages place the head (i.e., verb) before the complement (i.e., prepositional phrase) while head-final languages place the head (i.e., verb) after the complement (i.e., postpositional phrase). The head-direction parameter and Greenberg's implicational universals together successfully describe the difference in ordering between English and Korean.

[4] In a similar vein with Hawkins (2004), Gibson (1998, 2000) argued that reduced distance is extremely powerful in language processing. His Dependency Locality Theory deals with the difficulty in sentence parsing, claiming the cost to compute A and B takes place due to the distance, locality.

among many others).

(3)



In (3) functional projections (e.g., DP, NUMP and CLP) dominate NP. Cinque (1980) claims that NPs and clauses can have parallel structures, with functional projections over lexical projections. In this regard, Abney (1987) proposes that DP, a functional projection, dominates NP just like CP (and/or IP) dominates VP. In this regard, the view that CLP dominates NP has been widely adopted in the literature on classifiers (among many others, Y. K. Kim, 2007; Li, 1999; Simpson, 2005; Wu & Simpson, 2001).

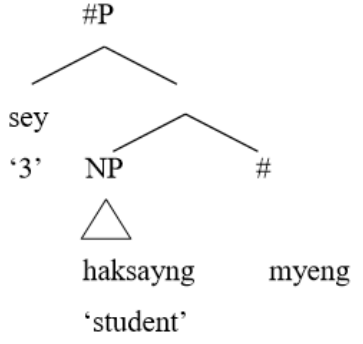
As for the syntactic status of classifiers, there is a consensus that the classifier heads its own projection, i.e., CLP. A debate is about the status of NUM. There are two different views. One view proposes that CL and NUM form a single syntactic unit, labelled CL, NUM or Q (Bhattacharya, 2001; Gil, 1994; Kawashima, 1998; Kitahara, 1993; Muromatsu, 1998; Watanabe, 2004[5]) while the other view considers classifiers and numbers as instantiations of two different functional head positions, NUM and CL (e.g., Li, 1999; Simpson, 2005; Tang, 1990). According to Gil (1994), several observations support the single-head view. First, numbers and classifiers

[5] Watanabe's (2004) suggestion differs from the other proposals, which assume that the numeral and classifier are placed under the head of the CLP. Watanabe postulates that the classifier functions as the head of CLP but the numeral is placed in the specifier position of CLP.

commonly occur together, as observed by Greenberg (1975); second, in many languages, numbers and classifiers appear to be phonologically a single unit; and third, the number and classifier together can be "floated" away from the rest of an NP, suggesting they form a single unit. However, according to Simpson (2005), there are also reasons to support the two-head view. First, classifiers in many languages are phonologically unreduced; the two distinct morphemes occurring in numeral-classifier sequences suggest that two distinct head positions are projected. Second, classifiers have the semantic function of individuating NPs (Cheng & Sybesma, 1999; Muromatsu, 1998). This suggests that classifiers and numerals, having distinct formal functions, serve as different syntactic heads. Third, in certain languages (e.g., Nung), the number 'one' must be separated from the classifier by the noun, while other languages (e.g., Chinese) allow particular adjectives to be placed between the numeral and the classifier; the possibility of an intervening item weakens the single-head view. In this study, we do not take either of these views; but we follow the assumption with consensus, i.e., that the classifier (or the classifier with numeral) heads its own projection, i.e., CLP.

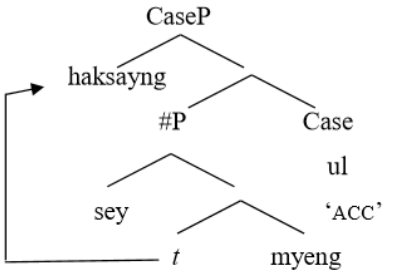
As for the syntactic structure of N+NUM+CL and NUM+CLgen+N phrases, Watanabe (2004, 2008) proposed an explanation. He postulates a five-layered DP structure: $[_{DP}\ [_{QP}\ [_{CaseP}\ [_{\#P}\ [_{NP}\ N]\ \#]\ Case]\ Q]\ D]$. He proposes that in head-final languages the classifier structure is base-generated as in (4).

(4) Base-Generated Classifier Structure



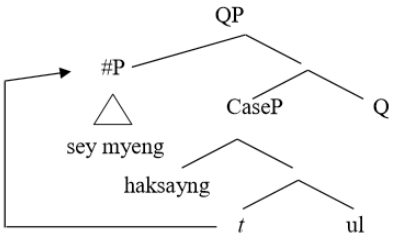
After the merger of Case head, NP moves up to SpecCaseP, as in (5). Watanabe considers this movement to be obligatory. Note that this movement results in the N+NUM+CL ordering.

(5)



#P moves up to SpecQP, giving the structure in (6). When the linker *-uy* GEN is inserted through a morphological readjustment, the result is the NUM+CLgen+N ordering.

(6)



Watanabe's proposal needs several assumptions, such as the presence of both DP[6] and CaseP. These assumptions, however, are not in a consensus. For example, there is controversy over whether Korean has DP (e.g., Y. K. Kim, 1997, 2007) or KP (e.g., Jo, 2000). In addition, there are other views

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[6] In (5) and (6) there is no role for DP. However, Watanabe claims that DP is necessary for the following example. Here CaseP moves up to SpecDP.

(i) haksayng-ul sey-myeng
student-ACC three-CL

on the tree structures of the two classifier patterns. For example, C. Kim (2005) shows NUM+CLgen+N as base-generated and N+NUM+CL as derived by movement. Suh (2007) presents a syntactic tree in which there is no movement for the N+NUM+CL structure.[7]

In this study, we do not follow any specific model for the syntax; instead, we make the following two assumptions regarding the classifier structures in Korean: First, a classifier heads CLP. Second, CLP immediately dominates NP. Note that these two assumptions are in a consensus. The next section uses these two pieces of information to show what the domain minimization principle predicts in terms of preferences between the two Korean numeral classifier structures.

4. Domain minimization and preferences between the two Korean classifier stuructures

Now let us see what prediction the domain minimization account makes with regard to preference between the two Korean classifier phrases. As we discussed in Section 3, we make the following two assumptions: (a) a classifier heads CLP; (b) CLP dominates NP. Notably, the classifier structures in the VP domain can be parallel with prepositional phrases in the VP domain. See (7a-b) and (8a-b).

(7) Revisiting (2b) and (2d)

a. [[NP **P**] **V**] IC-to-word ratio = 100% (2/2)

b. [[**P** NP] **V**] IC-to-word ratio = 50% (2/4) (NP = 2 words; see 2d)

(8) a. [[NP **CL**] **V**] N+NUM+CL

b. [[**CL** NP] **V**] NUM+CLgen+N

In (8), in the VP domain, the two ICs are V and CLP[8]. Note that (8a) and

[7] However, these two studies focus on semantics rather than syntax.

[8] We acknowledge that the syntax of two classifier structures is too simplified. There is no DP or KP in the VP domain. Thus, as one of the reviewers correctly points out,

(8b) are similar with (7a) and (7b), respectively. Note also that the IC-to-word ratio is bigger in (7a) than in (7b), which would suggest that the IC-to-word ratio is bigger in (8a) than in (8b). To figure this out in more details, consider the examples in (9a-b).

(9) a. sakwa twu **kay**-lul mek-ess-ta (N+NUM+CL)
apple two CL ACC eat-PAST-DECL
IC-to-word ratio: 67% (2/3)

b. twu **kay**-uy sakwa-lul mek-ess-ta (NUM+CLgen+N)
two CL-GEN apple-ACC eat-PAST-DECL
IC-to-word ratio: 40% (2/5)

In (9a), there are three words (i.e., *kay, -lul, mek*) from the classifier to the verb, so the IC-to-word ratio is 67% (2/3) in the VP domain. In (9b), there are five words (i.e., *kay, -uy, sakwa, -lul, mek*) from the classifier to the verb, so the IC-to-word ratio is 40% (2/5). The domain minimization account would therefore predict that the N+NUM+CL order (as in (9a)) would be preferred over the NUM+CLgen+N order (as in (9b)).

5. Previous studies on the preference between the two classifier phrases

No previous experimental studies have explored preference between the two Korean classifier phrases. A relevant corpus study, however, was conducted by Park and Kim (1996). They investigated the use of classifier phrases in writing and in speaking. According to the study, native Korean

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our assumption that the two ICs are V and CLP can be controversial, weakening our explanation. However, it is worthwhile to note that Hawkins (2004) also used such simplified structures. For example, he used NP, instead of DP. In the section of General Discussion and Conclusion, we discuss what prediction we get when we consider more complex syntactic structures.

Table 1. Corpus analysis (Park and Kim, 1996)

Corpus type	Genre	Frequency
Written corpus	Novels	N+NUM+CL = NUM+CLgen+N
	Non-novels	N+NUM+CL > NUM+CLgen+N
	Classical writings	N+NUM+CL > NUM+CLgen+N
Spoken corpus	Speech	N+NUM+CL > NUM+CLgen+N

speakers tend to use the N+NUM+CL order more frequently than the NUM+CLgen+N order, in both written and spoken situations. See Table 1 for more detailed results.

In the written corpus, when looking at the results of novels, the frequency distribution of N+NUM+CL and NUM+CLgen+N was the same at 50%. In the case of non-novels, N+NUM+CL was preferred over NUM+CLgen+N but the difference was not significant. In the classical writings, 80% of the use was N+NUM+CL. In the case of a spoken corpus, 60% of the use was N+NUM+CL, while 40% of the use was NUM+CLgen+N.

The corpus finding seems to suggest that N+NUM+CL is more preferred over NUM+CLgen+N for Korean speakers. However, it does not show an obvious preference pattern; for example, in certain genres (e.g., novels and non-novels), there is no significant frequency difference between N+NUM+CL and NUM+CLgen+N. That is, the corpus analysis alone does not suffice to conclude that the N+NUM+CL order is more preferred. Therefore, we conducted an experimental study using acceptability judgment tasks (AJTs). As Park and Kim (1996) analyzed both written and spoken corpora, we conducted two AJTs, one written and one spoken.

6. Experiment 1: Written AJT

The purpose of the off-line judgment task (paper-and pencil study) was twofold: First, it aimed to assess the preference for one classifier structure over the other one. Second, by conducting a written survey, it is possible to compare the results with the findings of a written corpus.

6.1 Participants

The participants were 67 native-Korean-speaking adults, who were all undergraduate or graduate students at a university in South Korea. There were 30 males and 37 females, and their ages ranged from 19 to 32 years old.

6.2 Materials

The written AJT had a 2x2 design, varying classifier phrase type (i.e., position of the classifier within the phrase: N+NUM+CL vs. NUM+CLgen+N) and classifier phrase function (i.e., position of the classifier phrase in the sentence: subject vs. direct object). See (10a-d).

(10) a. N+NUM+CL in the subject position
Sikthak-wiey [pokswunga sey-kay-ka] nohyeiss-ta.
table-LOC peach three-CL-NOM is-SES
There are three peaches on the table.

b. NUM+CLgen+N in the subject position
Sikthak-wiey [sey-kay-uy pokswunga-ka] nohyeiss-ta.
table-LOC three-CL-GEN peach-NOM is-SES
There are three peaches on the table.

c. N+NUM+CL in the direct object position
Halmeni-kkeyse [pokswunga sey-kay-lul] tusyess-ta.
grandmother-NOM peach three-CL-ACC ate-SES
Grandmother ate three peaches.

d. NUM+CLgen+N in the direct object position
Halmeni-kkeyse [sey-kay-uy pokswunga-lul] tusyess-ta.
grandmother-NOM three-CL-GEN peach-ACC ate-SES
Grandmother ate three peaches

We only discussed the predictions in the VP domain in which the classifier structure was placed in the direct object position (e.g., 9a-b). With the

subject position, we make the same prediction (i.e., N+NUM+CL over NUM+CLgen+N), again considering the distance between verb and the classifier. Note that the verb and the subject are also in a domain in which the dependency relation should be processed (e.g., the verb assigns a thematic role to the subject). All sentences used in the experimental materials, including fillers, were similar in length, with 13 to 15 syllables. The sentence patterns were transitive and intransitive. The intransitive sentences included an adverbial phrase in order to make the sentence lengths similar. The task consisted of 48 sentences: 16 critical and 32 fillers. The order was randomized. The participants were asked to rate the acceptability of each sentence on a scale from 0 (sounds completely bad) to 4 (sounds completely okay). The stimuli were presented in a written format.

6.3 Results

As Figure 1 shows, the participants preferred the N+NUM+CL order over the NUM+CLgen+N order, regardless of the position of the phrase in the

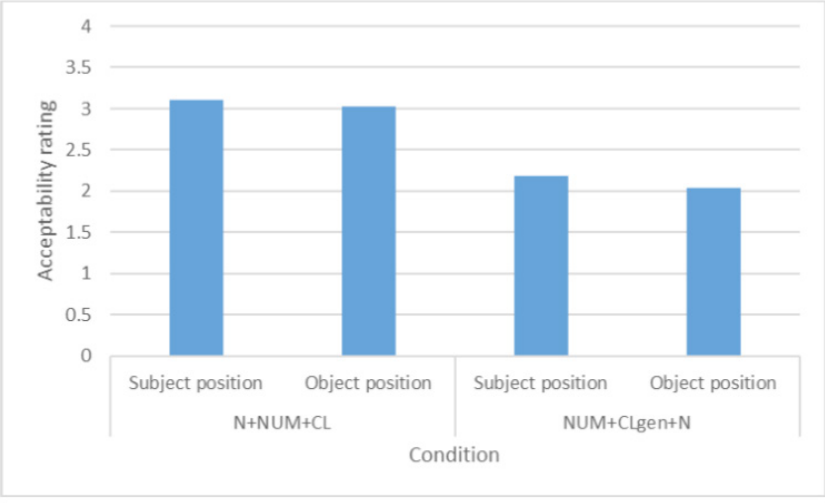

Figure 1. *Acceptability ratings in the four conditions: Written AJT*
Figure 1 shows the acceptability ratings across the four conditions.

sentence. In the subject position, the mean ratings were 3.11(SD = 0.64) for the N+NUM+CL condition and 2.19(SD = 0.75) for the NUM+CLgen+N condition. Likewise, in the direct object position, the mean ratings were 3.03(SD = 0.52) for the N+NUM+CL condition and 2.04(SD = 0.77) for the NUM+CLgen+N condition. A repeated measures ANOVA showed a main effect of classifier phrase type *(*F = 132.7, p < .001), but no main effect of position of the classifier phrase (F = 1.95, p = .16) and no interaction effect (F = .16, p = .69).

To summarize, the written AJT results showed that the participants preferred the N+NUM+CL order over the NUM+CLgen+N order no matter where the classifier phrase appeared in the sentence.

7. Experiment 2: Spoken AJT

7.1 Participants

Forty-six native Korean-speaking adults participated in the spoken AJT. They were undergraduate and graduate students from the same university in Korea who did not participate in the written AJT. There were 25 males and 21 females, with an age range of 21 to 31 years old.

7.2 Materials

The spoken AJT used the same items as the written AJT; the only difference was in the presentation (i.e., spoken rather than written). The items were audio recorded by a trained adult Korean native speaker using the free software *Audacity.* To avoid any effect of intonation, the speaker employed the same stress and same pitch across the items.

7.3 Results

The spoken AJT results were very similar to the written AJT results. See Figure 2. As Figure 2 shows, the participants preferred N+NUM+CL over NUM+CLgen+N regardless of the sentence position in which they occurred. In the subject position, the mean rating was 3.41(SD = 0.55) for

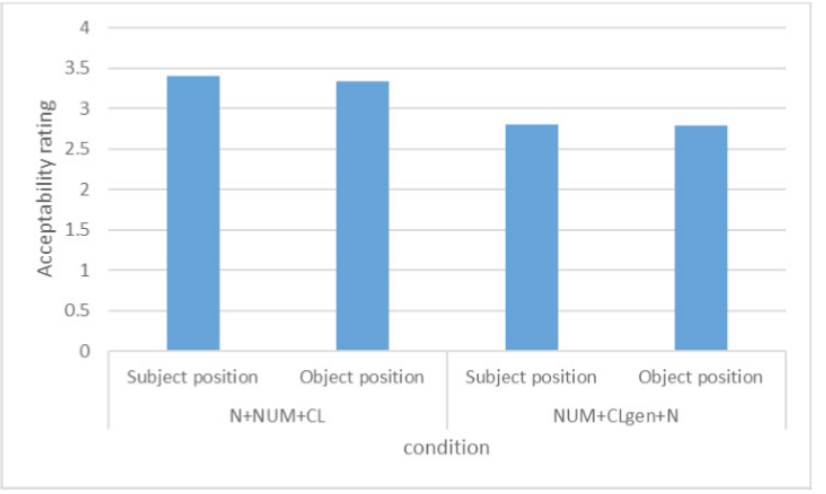

Figure 2. *Acceptability ratings in the four conditions: Spoken AJT*

the N+NUM+CL condition and 2.80(SD = 0.65) for the NUM+CLgen+N condition. Likewise, in the direct object position, the mean rating was 3.34(SD = 0.62) for the N+NUM+CL condition and 2.79(SD = 0.86) for the NUM+CLgen+N condition. A repeated measures ANOVA showed a main effect of classifier phrase type (F = 35.28, p < .001), but no main effect of position of the classifier phrase (F = .06, p = .81) and no interaction effect (F = .01, p = .94).

To summarize, the spoken AJT results, like the written AJT results, showed that the participants preferred the N+NUM+CL order over the NUM+CLgen+N order in either syntactic position.

8. Genenral Discussion and Conclusion

The present study asked whether there is a preference between two Korean classifier structures, N+NUM+CL and NUM+CLgen+N. The results from the two AJTs together show that the participants preferred the N+NUM+CL order over the NUM+CLgen+N order. Based on these results, we conclude that the N+NUM+CL order is the more preferred order for native Korean

speakers. This finding is largely compatible with the corpus findings reported by Park and Kim (1996), which shows a preference tendency of N+NUM+CL over NUM+CLgen+N. However, they reported a genre effect: Among the three genres under investigation (i.e., novels, non-novels, and classical writings), two genres (i.e., novels and non-novels) had no significant frequency difference between the two classifier structures. Although this study did not consider 'genre' as a factor, we believe that the sentences used in this study are close to the sentences used in novels and non-novels rather than in classical writings. This seems to suggest that N+NUM+CL is preferred over NUM+CLgen+N regardless of genres. However, a future study, manipulating the genre factor, should elucidate this issue—i.e., whether there is a genre effect in the preference of the two classifier structures.

We also asked the following question: If there is a preference, what is the reason? In this study, we suggest that the preference can be explained by the domain minimization account (Hawkins, 2004), which, as discussed, would predict that the shorter distance between the verb and the classifier would lead to a preference for the N+NUM+CL structure. This is compatible with Joo's (2015) discussion that domain minimization can be a factor to (partly) explain the preference among the internal orderings of noun phrase.

However, one may raise that the classifier structure that we assume is too simple. We acknowledge that our structure does not include higher functional projections (e.g., DP, KP, CaseP). Thus, it is worthwhile to examine what prediction we get when we consider more complex syntactic structure. To address this issue, let us consider the structures from Watanabe (2008). See (11a-b).

(11) a. [sakwa [twu **kay**]$_{\#P}$-**lul**]$_{CaseP}$ mek-ess-ta (N+NUM+CL)
apple two CL ACC eat-PAST-DECL

b. [[twu **kay**-uy]$_{\#P}$ [sakwa-**lul**]$_{CaseP}$]$_{QP}$ mek-ess-ta (NUM+CLgen+N)
two CL-GEN apple-ACC eat-PAST-DECL

Let us calculate the IC-to-word ratio in the CaseP domain (11a) and the QP domain (11b). In (11a), the two ICs are considerably CLP and the accusative marker *-lul*. There are two words (i.e., *kay, lul*) from the classifier to the accusative marker, so the IC-to-word ratio is 100% (2/2). In (11b) again, the two ICs are considerably CLP and the accusative marker *-lul*. There are four words (i.e., *kay, uy, sakwa, lul*) from the classifier to the accusative marker, so the IC-to-word ratio is 50% (2/4). The domain minimization account would therefore predict that the N+NUM+CL order (as in (11a)) would be preferred over the NUM+CLgen+N order (as in (11b)).[9]

This study has a limitation in that it relied only on offline AJT results. Further study that includes online processing is needed before we can draw solid conclusions regarding native Korean speakers' preference for classifier phrases. Despite this, we believe that the current study is meaningful in that it is the first experimental study to show/explain the preference of native Korean speakers between the two Korean classifiers.

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[9] However, we admit that a more careful approach is needed when calculating the IC-to-word ratio in the nominal domain; in Hawkins (2004) most of the examples deal with the IC-to-word ratio in the VP domain.

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