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FORWARD AND BACKWARD FEATURE AGREEMENT: EVIDENCE FROM KOREAN NUMERAL CLASSIFIER CONSTRUCTIONS*

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This paper investigates the processing of semantic feature agreement between classifiers (specific vs. general) and associated nouns in two constructions, prenominal vs. postnominal. To examine this, two experiments were conducted. Results from an off-line judgment experiment show that phrases containing specific classifiers and associated nouns sound more natural than phrases containing a general classifier and associated nouns. This supports the hypothesis that the expectation of semantic information at specific classifiers helps to relatively facilitate the processing of associated NPs, compared to that at a general classifier. Results from the self-paced reading experiment show that semantically related information helps to reactivate preceding associated nouns in postnominal constructions, whereas it fails to facilitate processing of following associated nouns in prenominal constructions. Findings indicate that postnominal constructions are easier to comprehend because the expectation triggered by specific classifiers helps to reactivate the preceding nouns, compared to the condition with specific classifiers in prenominal constructions. This study supports the predictions of expectation-based theories.

1. INTRODUCTION. Previous studies in psycholinguistic research have shown that semantically associated information facilitates parsing of upcoming words, while it hinders processing of unexpected words (Federmeier and Kutas 1999; Kamide, Scheepers, and Altmann 2003; Schwanenflugel and LaCount 1988). Kamide et al. (2003), for example, found that syntactic and semantic information was used to predict the subsequent input. The approach taken by these studies is similar to several information theoretical perspectives on sentence processing, including the *surprisal* hypothesis and expectation-based accounts (Gennari and MacDonald 2008; Levy 2008; Nakatani and Gibson 2010); highly expected material is read more quickly than less expected material. In particular, Levy (2008) proposed the surprisal hypothesis, a theory of expectations based on structural frequencies. According to this hypothesis, because object relative clauses are relatively infrequent, they are harder to process than subject relative clauses. Findings from Gennari and MacDonald 2008 and from Nakatani and Gibson 2010 showed that, in frequent structures, expectation facilitated processing of upcoming words, but uncertainty in infrequent structures caused comprehension difficulty. Many studies have tested the expectation-based accounts in syntactically complex but unambiguous structures (e.g., object relative clauses), but few studies have tested different unambiguous structures (e.g., numeral classifier constructions). This paper attempts to fill the gap in the literature of expectation-based accounts by employing Korean numeral classifier constructions that include semantic feature agreement between the numeral classifiers and the associated NPs. Two experiments were conducted. First, an off-line judgment task investigated the acceptability of classifiers and associated NP pairs. Although there are different degrees of expectation from the two types of classifiers—specific vs. general classifiers—each predicts the semantic class of nouns, thus the highly expected words are read quickly. Next, a self-paced reading experiment was conducted to confirm the results from the off-line judgment task.

The paper is organized as follows. Section 2 describes the phenomenon focused on in this paper in terms of semantic and syntactic properties. Sections 3 and 4 present results from the two experiments. Section 5 discusses the implications of the experimental results. Section 6 is the conclusion.

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2. NUMERAL CLASSIFIER CONSTRUCTIONS IN KOREAN. This section will describe the two types of classifiers from a semantic perspective and the two types of constructions from a syntactic perspective. According to Unterbeck (1994), Korean has several classifiers, which are divided into several semantic subgroups; the choice of classifier depends on the semantic class of the noun. That is, the classifier that is used depends on semantic feature agreement with associated NPs. For example,

(1) a. sey **myeng**-uy **haksayng**-i sakwa-lul mek-nun-ta.
three **CL$_{people}$**-GEN student-NOM apple-ACC eat-PRES-DECL
'Three students eat apples.'

b. * sey **pel**-uy **haksayng-i** sakwa-lul mek-nun-ta.
three **CL$_{clothing}$**-GEN student-NOM apple-ACC eat-PRES-DECL
*'Three students eat apples.'

The classifier *myeng* (a classifier for people), as in (1a), is used only to classify people, while the classifier *pel* (a classifier for clothing), as in (1b), is used only to classify clothing. Therefore, the sentence in (1b) is ungrammatical because the classifier *pel* cannot occur with the associated NP ('student'). Example (1) shows that there is semantic agreement between classifiers and associated NPs.

Korean classifiers are of two types according to the degree of semantic relatedness between the classifiers and associated NPs: specific classifiers and a general classifier. (2) provides an example of each type:

(2) a. haksayng-i twu **kwen**-uy **chayk-ul** sass-ta.
student-NOM two **CL$_{specific}$**-GEN book-ACC bought-DECL
'A student bought two books.'

b. haksayng-i twu **kay**-uy **chayk-ul** sass-ta.
student-NOM two **CL$_{general}$**-GEN book-ACC bought-DECL
'A student bought two books.'

As seen in (2a), *kwen* (a classifier for books) is a specific classifier that can be used only for the semantically associated NP ('book'), whereas *kay* (a classifier for inanimate entities), which appears in (2b) as a substitute for the specific classifier, is a general classifier. To summarize, Korean classifiers agree semantically with associated NPs, and the semantic relatedness between specific classifiers and associated NPs is much closer than that between general classifiers and associated NPs. Specific classifiers, for example *kwen* (a classifier for books), easily predicts associated nouns (e.g., books or magazines), whereas a general classifier, *kay*, less easily predict associated nouns (e.g., all possible inanimate entities).

From the syntactic perspective, there are two types of Korean numeral classifier constructions depending on the position of the numeral classifier: prenominal constructions and postnominal constructions. These are shown in table 1. In the examples in (3), a numeral classifier ('two') appears before the associated noun ('book') with a genitive marker *uy*; this is called the prenominal construction. In the examples in (4), the numeral classifier ('two') follows the associated noun ('book') without a genitive marker *uy*; this is called the postnominal construction (Sohn 1999).

TABLE 1. Two types of Korean numeral classifier constructions.

Prenominal Constructions [Numeral + Classifier] + (GEN) + Noun	Postnominal Constructions Noun + [Numeral + Classifier]
(3) a. twu kwen-uy chayk two CL$_{book}$-GEN book 'two books'	(4) a. chayk twu kwen book two CL$_{book}$ 'two books'
b. sey myeng-uy haksayng three CL$_{people}$-GEN student 'three students'	b. haksayng sey meyng student three CL$_{people}$ 'three students'

Prenominal constructions optionally have the genitive marker *uy* between the numeral classifier and the associated NP; there is no discernable semantic difference in meaning between sentences with or without the genitive marker. Also, as examples (5a) and (5b) show, modifiers (e.g., adjectives) such as 'pretty' can intervene between numeral classifiers and associated NPs. However, a numeral classifier sequence such as *twu myeng* ('two') in either of the two constructions cannot be split by an intervening word, as seen in (5c) and 5(d).

(5) a. **twu myeng-uy** yeyppun haksayng
two CL_{people}-GEN pretty student

b. yeyppun haksayng **twu myeng**
pretty student two CL_{people}

c. * yeyppun **twu** haksayng **myeng**
pretty two student CL_{people}
'*Two pretty students'

d. ***twu** yeyppun haksayng **myeng**
two pretty student CL_{people}
'*Two pretty students'

In (3), the numeral classifier modifies the associated NP *chayk* ('book'), whereas in (4), the numeral classifier *twu kwen* ('two') is floated—that is, it appears after the associated NP ('book'). There remain many unresolved theoretical issues about how prenominal constructions differ structurally from post-nominal constructions, but these matters are beyond the scope of this paper.

3. EXPERIMENT 1: AN OFF-LINE JUDGMENT EXPERIMENT. To test the effect of expectation on two types of classifiers, two experiments were conducted. First, an off-line judgment experiment was designed to investigate how natural the choice of specific classifiers and associated NPs is, compared to the choice of general classifiers and associated NPs. Results indicate that semantic information from the relationship between classifiers and associated NPs is enough to trigger the expectation of the particular nouns.

3.1 METHOD. Twenty native speakers of Korean participated in the off-line judgment experiment. The design of this task used two types of classifiers (specific vs. general) × one type of condition (prenominal). Two lists in a Latin square design were presented to participants. This experiment was conducted by using a web-based judgment task. It consisted of twenty-four noun phrases with no filler phrases. Participants were asked to sit in front of a computer, and then to rate the naturalness of each phrase (n=24) containing classifiers and associated nouns on a scale of 1 (very unnatural) to 5 (very natural). Each phrase, as in (6), appeared on the computer screen when participants selected one of scale points 1 to 5. The task lasted less than 15 minutes. An example set of experimental conditions used in experiment 1 is shown in (6):

(6) a. sey calwu-uy kitalan nolansayk yenphil
three $CL_{specific}$-GEN long yellow pencil

b. sey kay-uy kitalan nolansayk yenphil
three $CL_{general}$-GEN long yellow pencil
'three long, yellow pencils'

3.2 RESULTS. Table 2 shows the average ratings of the naturalness of the classifiers and associated NPs. Average ratings of twelve specific classifiers with associated nouns range from 3.9 to 2.9 out of 5. The total average rating in the condition with specific classifiers is 3.44 out of 5, while the total average rating in the condition with general classifiers is 2.82 out of 5. This task shows that even though the rating of naturalness of all NPs with classifiers is low, the choice of a specific classifier and associated nouns seems to be relatively natural compared to that of a general classifier and nouns. A paired *t*-test shows the significant difference between conditions: $t(19) = -3.834$, $p < .001$ by subject analysis; $t(23) = -6.351$, $p < .001$ by item analysis. If it is true that specific classifiers sound more natural with particular head nouns

than general classifiers do, as the ratings in table 2 indicate, it makes sense to think that they will more strongly evoke or activate those nouns as well.

TABLE 2. Average rating of the naturalness of classifiers with NPs.

		Rating	
Classifier	Type (CL-NPs)	Mean	*SD*
Specific	kok (song)	3.9	1.02
	phyen (film)	3.85	1.04
	calwu (pencil)	3.7	0.98
	tay (car)	3.75	1.02
	pyeng (beer)	3.6	1.1
	kwen (book)	3.6	1.1
	cang (paper)	3.5	1.15
	pel (shirt)	3.35	1.14
	can (coffee)	3.15	1.14
	kulwu (tree)	3.05	1.23
	songi (flower)	2.95	1
	thong (bucket)	2.9	0.97
	Total	3.44	
General	kay	2.82	1.14

The semantic expectation triggered by specific classifiers should quickly predict the following associated nouns; therefore, upcoming words, such as associated NPs, should be read quickly. To confirm the effect of expectation depending on types of classifiers, a self-paced reading experiment was conducted.

4. EXPERIMENT 2: A SELF-PACED READING EXPERIMENT. Based on the results from experiment 1, a self-paced reading experiment was designed to test the role of semantically related information in processing the two different types of constructions. When people are processing phrases of numeral classifiers and associated NPs, the expectation from the different types of classifiers should lead to different effects on the comprehension of the sentences. In the forward prediction process in prenominal constructions, highly expected information should facilitate parsing of associated nouns. In the backward retrieval process, highly expected information from specific classifiers also should help processing preceding associated nouns. During this retrieval process, interference might appear in postnominal constructions when information of preceding associated nouns needs to be retrieved. It might lead to generally longer reading times in postnominal constructions, compared to those in prenominal constructions.

4.1 PREDICTIONS. The differences in expectations generated by the two types of classifiers lead to two different predictions. Table 3 shows a sample set of prenominal constructions. At region 3, the reading times in the condition with a specific classifier are faster than those in the condition with a general classifier, because a specific classifier triggers a small number of specific associated nouns in comprehenders' minds, whereas a general classifier, lacking particular associations, triggers a much greater number of general associated nouns. The first prediction for this experiment is that when participants encounter an associated NP (e.g., 'pencil') after passing the numeral classifier, the reading time for region 5 (e.g., 'pencil') in the condition with a specific classifier will be faster than the reading time in the condition with a general classifier, because the expectation that originates at the specific classifier (region 3) facilitates the processing of the upcoming associated NP. Due to the comprehenders' prediction of a particular head noun after the specific classifier, but not after the general classifier, the

activation toward target nouns is triggered faster in the condition with a specific classifier than in the condition with a general classifier.

TABLE 3. A sample set of experimental conditions in prenominal constructions.

1	2	3	4	5	6	7
A. Prenominal, Specific classifier						
sonyen-i	ecey	sey calwu-uy	kitalan nolan-sayk	yenphil-lul	mwunpangkwu-eyse	sass-ta
boy-NOM	yesterday	three $CL_{specific}$ –GEN	long, yellow-color	pencil-ACC	stationery store-LOC	bought
B. Prenominal, General classifier						
sonyen-i	ecey	sey kay-uy	kitalan nolan-sayk	yenphil-lul	mwunpangkwu-eyse	sass-ta
boy-NOM	yesterday	three $CL_{general}$ –GEN	long yellow-color	pencil-ACC	stationery store-LOC	bought

'A boy bought three long, yellow pencils at a stationery store yesterday.'

The second prediction for this experiment is that in postnominal constructions, as seen in table 4, the reading time for region 5 (e.g., 'three') in the condition with a specific classifier will be faster than that in the condition with a general classifier, because the specific classifier is much more strongly related with an associated NP (e.g., 'pencil') than the general classifier is. That is, semantically related information that originates at the specific classifier (region 5) triggers the retrieval of the preceding associated nouns (region 3), so the reactivation of previous information is triggered faster in the condition with a specific classifier than in the condition with a general classifier. The self-paced reading task was conducted in order to test these two predictions.

TABLE 4. A sample set of experimental conditions in postnominal constructions.

1	2	3	4	5	6	7
C. Postnominal, Specific classifier						
sonyen-i	kitalan nolan-sayk	yenphil-lul	ciwukay-wa hamkkey	sey calwu-lul	mwunpangkwu-eyse	sass-ta
boy-NOM	long, yellow-color	pencil-ACC	eraser-and together	three $CL_{specific}$–ACC	stationery store-LOC	bought
D. Postnominal, General classifier						
sonyen-i	kitalan nolan-sayk	yenphil-lul	ciwukay-wa hamkkey	sey kay-lul	mwunpangkwu-eyse	sass-ta
boy-NOM	long, yellow-color	pencil-ACC	eraser-and together	three $CL_{general}$-ACC	stationery store-LOC	bought

'A boy bought three long, yellow pencils with an eraser at a stationery store.'

4.2 METHOD. Forty-three native speakers of Korean participated in the self-paced reading experiment. They were paid five dollars each for their participation in the experiment.

The design of the experiment used two types of classifiers (specific vs. general) × two types of constructions (prenominal vs. postnominal). Four lists in a Latin square design were presented to participants. Tables 3 and 4 show one set of the four conditions used in this experiment. The results of a pilot study showed that there was no difference in reading times for prenominal and postnominal constructions for sentences in which the classifiers were closely adjacent to the associated NPs. This indicates the possibility that readers do not have time enough to predict or retrieve the semantic feature agreement between the classifier and the NP. That is, readers easily ignore this agreement in real time. Therefore, test sentences manipulated the distance between the classifiers and associated NPs across the two constructions.

As shown in table 3, while the direct object (region 5) remains the same in the conditions with a specific and with a general classifier, the numeral classifiers (region 3) vary in the degree of their semantic relatedness to the direct object. Adjectives as modifiers intervene between numeral classifiers and associated NPs to increase the distance between them. In table 4, the choice of numeral classifiers and associated NPs is the same as in table 3, but the associated NPs occur before the numeral classifiers. As table 4 shows, sentences with the postnominal construction included local nouns (e.g., 'eraser') as distractors intervening between associated NPs and classifiers. As explained by the dependent locality

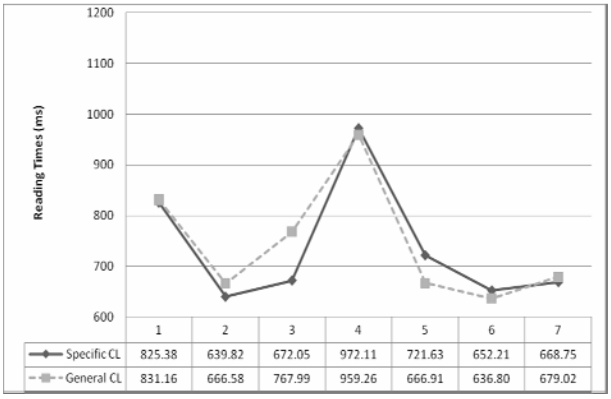
theory (Gibson 1998) or the theory of working memory retrieval (Lewis and Vasishth 2005), these distractors should increase the processing load during the retrieval process in postnominal constructions. The local nouns (e.g., 'eraser') inserted in the postnominal constructions belong to the same semantic group as the preceding associated NPs (e.g., 'pencil'), but do not match categorically with the following specific classifiers. This triggers the retrieval process for checking semantic agreement of classifiers with the preceding associated NPs—that is, the two nouns in the postnominal constructions compete to agree with classifiers in terms of semantic feature agreement between specific classifiers and associated NPs.

In this experiment, twelve different types of specific classifiers and one general classifier, *kay*, were employed; each specific classifier appeared twice in each list, while the general classifier appeared twelve times.[1] Each list included twenty-four target sentences with forty-eight filler sentences. Filler sentences did not include any numeral classifiers. The experiment was conducted on a computer running E-prime (Version 2.0) at the University of Hawai'i. Each sentence was presented one region at a time on the computer screen, left to right, in a noncumulative, moving-window manner as a participant pushed the space bar (Just, Carpenter, and Woolley 1982). Participants were asked to read as naturally as possible, and then to answer a yes/no comprehensive question to ensure that they attended to the stimuli. All reading times for each region were recorded, along with responses to comprehensive questions. The entire experiment lasted less than 30 minutes.

4.3 RESULTS. Analyses were conducted on comprehension task response accuracy and reading times as dependent measures. All data from participants whose accuracy was less than 70% were excluded. Three participants (7%) were excluded, leaving 40 participants' data to be included in the analysis. Reading times more than 2.5 standard deviations above or below the mean were removed; this affected 8.07% of the data. The analyses presented below are based on the remaining items. Among participants included in the analysis, the average comprehension accuracy is 86%. The average correct response percentage does not differ significantly in postnominal constructions, but average comprehension accuracy differs significantly in prenominal constructions.[2] Results of reading times in prenominal and postnominal constructions will be reported in order.

FIGURE 1. Reading times for two constructions with specific/general classifiers.

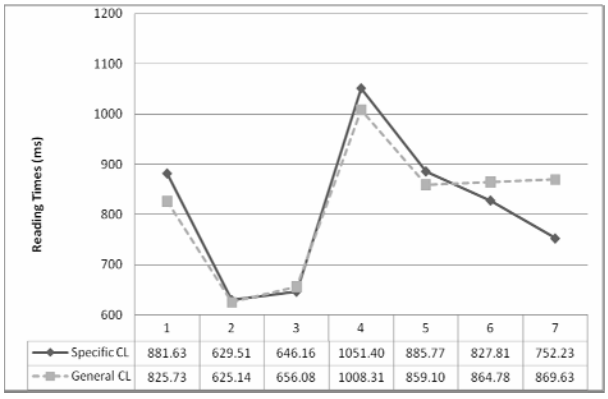
(a) Prenominal constructions



	1	2	3	4	5	6	7
Specific CL	825.38	639.82	672.05	972.11	721.63	652.21	668.75
General CL	831.16	666.58	767.99	959.26	666.91	636.80	679.02

Sub-NOM1/ Adverb2/ Num+CL-GEN3/ Adjective 4/ Associated NP-ACC5/ Loc-DAT6/ Verb7

(b) Postnominal constructions



	1	2	3	4	5	6	7
Specific CL	881.63	629.51	646.16	1051.40	885.77	827.81	752.23
General CL	825.73	625.14	656.08	1008.31	859.10	864.78	869.63

Sub-NOM$_1$/ Adjective$_2$/ AssociatedNP-ACC$_3$/ LocalNP$_4$/ Num+CL-ACC$_5$/ Loc-DAT$_6$/ Verb$_7$

[1] All specific classifiers are used as counters for inanimate entities.

[2] In the prenominal construction, the average correct response percentage is 67% in the condition with the general classifier, compared to the average correct response percentage of 98% in the condition with a specific classifier. This indicates that participants might be less sensitive to general classifiers.

Reading times for prenominal constructions are shown in figure 1a. At region 3 (numeral classifier sequence), reading times in the condition with a general classifier are numerically slower than those in the condition with a specific classifier. At region 5 (associated NP), the reading times in the condition with a specific classifier are numerically slower than those in the condition with a general classifier (F_1 (1,36) = 9.641, $p < .004$; F_2 (1,21) = 1.415, $p < .2$). This is not consistent with the first prediction, regarding prenominal constructions, but rather is the opposite effect than what was predicted. Reading times for postnominal constructions are shown in figure 1b. At region 5 (numeral classifier), the reading times did not differ in the two conditions, but the reading times for region 7 (verb) in the condition with a specific classifier are significantly faster than those in the condition with a general classifier, as predicted (F_1(1,39) = 5.863, $p < .02$; F_2(1,23) = 4.739, $p < .05$). The main finding from this experiment is that semantically related information that originates at a specific classifier (region 5) facilitates the backward retrieval process much more easily than partially related information that originates at the general classifier does when a retrieval process is needed.

5. GENERAL DISCUSSION. It is clear that semantic feature agreement between classifiers and associated NPs does occur in real time. Results from the off-line judgment task provide evidence that the degree of expectation on specific classifiers is stronger than that on a general classifier. This finding was supported by the results of the self-paced reading experiment. In the backward retrieval process, semantically related expectation that originates at specific classifiers facilitates the retrieval process relatively easily when something needs to be retrieved from working memory. This is consistent with the expectation-based accounts, in that the highly expected information helps in reading the associated words quickly. Moreover, it supports predictions of the memory-based accounts—that is, new input associated with memory leads to faster reactivation of previous information during reading (McKoon, Gerrig, and Greene 1996; van den Broek, Rapp, and Kendeou 2005).

The results of the self-paced reading experiment raise the question of why semantically related information helps to process more easily the preceding nouns in a backward retrieval process. One factor is expectation on frequent structures. A corpus study was conducted, using data from one general corpus, the *Sejong* Corpus (2,050,000 spoken words).[3] Table 5 summarizes the distributional pattern of specific and general classifiers across the two constructions. It shows that sentences containing numeral classifiers at the direct object occur rarely across the two constructions. However, most classifiers appear in postnominal constructions, and specifically, all the specific classifiers that were used in experiment 2 occur only in postnominal constructions. The findings from the corpus study suggest that postnominal constructions with specific classifiers are comprehended more easily, due to their frequent use, than prenominal constructions with specific classifiers. Generally longer reading times in postnominal constructions result from interference, which increases the processing load during the retrieval process. Subsequent input associated with memory leads to reactivation of previous information because the processing load during the retrieval process is heavier than during predictive process.

[3] Since 1998, a national project has aimed at building an information technology system for the Korean language. This has produced the *Sejong* Corpus, the largest corpus of Korean language data as of 2004 (Bley-Vroman and Ko 2005: 258).

TABLE 5. Frequency of specific/general classifiers in two constructions

Classifiers		**Prenominal**	**Postnominal**	**%**
Specific CL	calwu (pencil)	0	2	0.000098
	can (cup)	0	24	0.001171
	pel (clothing)	0	11	0.000537
	pyeng (bottle)	0	14	0.000683
	kwen (book)	0	15	0.000732
	songi (flower)	0	2	0.000098
	tay (car)	0	9	0.000439
	phyen (film)	0	11	0.000537
	kok (song)	0	23	0.001122
	kulwu (tree)	0	0	0
	cang (paper)	0	34	0.001659
	thong (bucket)	0	0	0
General CL	kay	122	308	0.024585

6. CONCLUDING REMARKS. In this paper, I reported on a test, using Korean numeral classifier constructions, of previous findings on sentence processing. The on-line experiment found that the retrieval process in postnominal constructions with specific classifiers is easier to comprehend than prenominal constructions with specific classifiers, which is reasonable due to the frequent use of specific classifiers in postnominal constructions. In particular, the semantically related expectation at the specific classifiers facilitates the processing of semantic feature agreement. The overall results provide empirical evidence in support of expectation-based theories.

At the same time, the question remains why semantically related information that originates at the specific classifier does not help facilitate the forward prediction process any more than the partially related information that originates at the general classifier does. One possible answer has to do with the effect of frequency. As the corpus study shows, specific classifiers in prenominal constructions rarely occur, whereas the general classifier *kay* frequently occurs in these constructions. Associated NPs in the condition with a general classifier are read as quickly as in the condition with specific classifiers due to expectation on frequent structures. The effect of semantic expectation at the specific classifiers may be weaker than the effect of expectation in frequent structures.

Another possible answer is related to the interaction of syntactic and semantic information (see Kaiser et al. 2009). Kaiser et al. (2009) explored how different information interacts during reference resolution. Results showed that the relative strength of syntactic and semantic information affect reference resolution. From this perspective, in prenominal constructions, the conflict of semantic and syntactic information originating at the specific classifier might hinder parsing of upcoming associated NPs—that is, when encountering classifiers with the genitive case marking *-uy*, Korean native speakers expect the semantic class of upcoming noun while building a syntactic structure of NPs at the same time. The two factors are activated simultaneously. At the position of associated NPs, the competition between semantic expectation and syntactic expectation costs more in the condition with specific classifiers than it does in the condition with a general classifier, because the degree of semantic information at specific classifiers is stronger than that at a general classifier. This heavier processing load results in the relative slowdown at the associated NPs in the condition with specific classifiers. In order to examine this possibility, further research should be conducted with more fine-grained materials so as to provide evidence for how syntactic and semantic information affect the processing of Korean numeral classifier constructions.

Moreover, further research on the interaction of the locality effect and the degree of expectation will help to evaluate this possibility.

REFERENCES

BLEY-VROMAN, ROBERT, and HYUN SOOK KO. 2005. *Corpus linguistics for Korean language learning and teaching*. Honolulu: University of Hawai'i Press.

FEDERMEIER, KARA, and MARTA KUTAS. 1999. A rose by any other name: Long-term memory structure and sentence processing. *Journal of Memory and Language* 41:469–95.

GENNARI, SILVIA, and MARYELLEN MACDONALD. 2008. Semantic indeterminacy in object relative clauses. *Journal of Memory and Language* 58:161–87.

GIBSON, EDWARD. 1998. Linguistic complexity: Locality of syntactic dependency. *Cognition* 68:1–76.

JUST, MARCEL A.; PATRICIA A. CARPENTER; and JACQUELIN D. WOOLEY. 1982. Paradigms and processing in reading comprehension. *Journal of Experimental Psychology: General* 111:228–38.

KAISER, ELSI; JEFFREY RUNNER; RACHEL SUSSMAN; and MICHAEL TANENHAUS. 2009. Structural and semantic constraints on the resolution of pronouns and reflexives. *Cognition* 112:55–80.

KAMIDE, YUKI; CHRISTOPH SCHEEPERS; and GERRY T. M. ALTMANN. 2003. Integration of syntactic and semantic information in predictive processing: Cross-linguistic evidence from German and English. *Journal of Psycholinguistic Research* 32:37–55.

LEVY, ROGER. 2008. Expectation-based syntactic comprehension. *Cognition* 106:1126–77.

LEWIS, RICHARD, and SHRAVAN VASISHTH. 2005. An activation-based model of sentence processing as skilled memory retrieval. *Cognitive Science* 29(3):375–419.

MCKOON, GAIL; RICHARD J. GERRIG; and STEVEN B. GREENE. 1996. Pronoun resolution without pronouns: Some consequences of memory-based text processing. *Journal of Experimental Psychology* 22:919–32.

NAKATANI, KENTARO and EDWARD GIBSON. 2010. An on-line study of Japanese nesting complexity. *Cognitive Science* 34:94–112.

SOHN, HO-MIN. 1999. *The Korean language*. Cambridge, UK: Cambridge University Press.

SCHWANENFLUGEL, PAULA J. and KATHY L. LACOUNT. 1988. Semantic relatedness and scope of facilitation for upcoming words in sentences. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 14: 344–54.

UNTERBECK, BARBARA. 1994. Korean classifiers. In *Theoretical issues in Korean linguistics*, ed. by Young-Key Kim-Renard, 367–86. Stanford: CSLI Publications.

VAN DEN BROEK, PAUL; DAVID N. RAPP; and PANAYIOTA KENDEOU. 2005. Integrating memory-based and constructionist processes in accounts of reading comprehension. *Discourse Processes* 39:299–316.

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