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Park Sun Hee, Kim Hyunwoo

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SECOND LANGUAGE ACQUISITION AND PROCESSING OF KOREAN LOCATIVE CONSTRUCTIONS BY CHINESE SPEAKERS

By PARK SUN HEE and KIM HYUNWOO

This study investigated offline and online comprehension of Korean locative alternation by Chinese-speaking second language (L2) learners of Korean. An acceptability judgment task and an online self-paced reading task were conducted with Chinese learners of Korean at higher- and lower-proficiency levels along with a control group of native Korean speakers. The outcomes of the acceptability judgment task showed that both L2 groups acquired the knowledge of Korean locative alternation. The results from the self-paced reading task demonstrated that native speakers and highly proficient L2 learners, but not learners with lower proficiency, showed sensitivity to the mismatch between case marking and verb semantics in their processing of locative constructions. These findings suggest that proficient Chinese speakers can process Korean locative constructions in a native-like manner, inconsistent with the claim that L2 processing is substantially different from native speaker processing.

Keywords: Korean locative constructions, second language processing, acceptability judgment task, self-paced reading task

In the literature of second language (L2) research, two main perspectives make different predictions with regard to L2 sentence processing. Some researchers contend that L2 processing is significantly distinguished from its L1 counterpart (Clahsen & Felser 2006). According to this so-called 'fundamental difference'

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perspective, divergence between first language (L1) and L2 processing arises from L2 learners' defective (morpho)syntactic representations, thus preventing learners from engaging in structure-based parsing (e.g., Marinis, Roberts, Felser & Clashen 2005), irrespective of learners' proficiency and proximity of target structures between learners' L1 and L2. Other perspectives claim that L2 processing is guided by a structure-driven mechanism just as in L1 processing (e.g., Omaki & Schulz 2011; Witzel, Witzel & Nicol 2012). This approach claims that L2 learners' non-convergence on native-like processing is mainly due to processing-related factors, such as low proficiency and limited working memory, not necessarily arising from underspecified mental representations in L2 learners.

The current study tested these L2 processing hypotheses by investigating whether Chinese learners of Korean can use morphosyntactic information as efficiently as native speakers during real-time processing of Korean locative constructions. A locative verb projects two arguments, *figure* (object or theme) and *ground* (goal or location), which are combined in distinct syntactic configurations to denote the meaning that a figure is moved (in)to a ground, as in (1) (Pinker 1989: 49).

(1) a. Irv loaded hay$_{figure}$ onto the wagon$_{ground}$. (Figure frame)

b. Irv loaded the wagon$_{ground}$ with hay$_{figure}$. (Ground frame)

In (1a), the transported object or figure *hay* is realized as the verb's direct object, followed by the prepositional phrase that includes the goal or ground *wagon*. Since a figure is realized as a direct object of the verb, this construction will be referred to as *Figure frame* (FF). In (1b), in contrast, the ground *wagon* is projected as the direct object of the verb. This construction will be called *Ground frame* (GF). Based on Larson's (1988) linking theory, FF, which follows a canonical linking pattern of mapping THEME onto an object and LOCATION onto an oblique object, is considered as more canonical and unmarked compared to GF, which maps LOCATION onto the object and THEME onto the oblique object.

Previous studies have explored the acquisition of locative constructions in English (e.g., Bley–Vroman & Joo 2001; Choi & Lakshmanan 2002; Joo 2003) or in Korean (e.g., Juffs 1996a, 1996b; Kim Meesook, et al. 1999; Yi 1997; Lee 2010). However, little is known about how L2 learners of Korean, whose L1 lacks a case marking system, integrate morphosyntactic information from case markers and semantic information from a verb to comprehend locative constructions in real-time sentence processing. In this study, we assessed Chinese speakers' grammatical knowledge of Korean locative constructions via an acceptability judgment task

and explored their facility of knowledge in online processing through a self-paced reading task. We hope that results obtained from the current study will help us to better understand how L2 learners make use of morphosyntactic and semantic information during their processing of Korean locative constructions.

1. LOCATIVE CONSTRUCTIONS IN ENGLISH, KOREAN AND CHINESE

It is assumed that locative alternation is a language-universal phenomenon, explained by both broad-range and narrow-range rules (Pinker 1989). While the broad-range rules account for the common syntactic properties shared across languages, the narrow-range rules are concerned with language-specific characteristics that allow certain verbs to appear exclusively in the Figure frame (FF) or Ground frame (GF). Since the way that lexical information is encoded in the verb differs across languages, the narrow-range classes of locative verbs also vary across languages. For example, Pinker (1989: 126–27) lists three classes of locative verbs in English, depending on whether locative alternation is possible, as illustrated in (2) through (4).

(2) Alternating verbs allowing both FF and GF in English (e.g., pile, spray, scatter, pack, load, etc.)

a. Bill sprayed the red paint onto the wall. [FF]

b. Bill sprayed the wall with the red paint. [GF]

(3) Non-alternating verbs allowing only FF in English (e.g., pour, coil, emit, etc.)

a. Paul poured milk into the glass. [FF]

b. *Paul poured the glass with milk. [GF]

(4) Non-alternating verbs allowing only GF in English (e.g., fill, stain, soak, plug, stud, etc.)

a. *Sarah filled milk into the glass. [FF]

b. Sarah filled the glass with milk. [GF]

As in (2), English has alternating locative verbs that are compatible with both FF and GF constructions. The language also instantiates non-alternating verbs that can only appear in FF (3) and verbs that appear exclusively in GF (4).

Korean also has alternating verbs that allow both FF and GF, as in (5). However, it does not have non-alternating verbs that allow GF. Consider (6), for example.

(5) Alternating verbs in Korean

a.	Paul-i	k'ŏp-e	uyu-rŭl	ch'aewŏssŏyo.	[FF]
	Paul-NOM[1]	cup-LOC	milk-ACC	filled	
	'Paul filled milk into the cup.'				
b.	Paul-i	uyu-ro	k'ŏp- ŭl	ch'aewŏssŏyo.	[GF]
	Paul-NOM	milk-INS	cup-ACC	filled	
	'Paul filled the cup with milk.'				

(6) Non-alternating verbs in Korean

a.	Paul-i	madang-e	mul-ŭl	ppulyŏssŏyo.	[FF]
	Paul-NOM	garden-LOC	water-ACC	sprayed	
	'Paul sprayed water on the garden.'				
b.	* Paul-i	mul-lo	madang-ŭl	ppulyŏssŏyo.	[GF]
	Paul-NOM	water-INS	garden-ACC	sprayed	
	'Paul sprayed the garden with water.'				

As illustrated in these examples, the narrow-range rules of Korean locative constructions require that all non-alternating verbs (e.g., *ppurida* 'spray', *hŭllida* 'drop', *sitta* 'load', *ssatta* 'stock') appear in the canonical structure (i.e., FF), but not in the non-canonical configuration (i.e., GF). Alternating verbs, on the other hand,

[1] The abbreviations in the gloss throughout this paper are as follows: NOM = nominative marker, LOC = locative marker, ACC = accusative marker, INS = instrumental marker.

such as *ch'aeuda* 'fill', *ch'ilhada* 'paint', *tŏp'ta* 'cover', *kamda* 'coil', can appear alternatively in FF or GF.

Chinese is reported to have the same narrow-range rules as Korean (Pinker 1989). Like Korean, Chinese bans non-alternating verbs from appearing in GF but allows alternating verbs to appear in both FF and GF. Note that the Chinese examples in (7) and (8) correspond to their Korean counterparts in (5) and (6) in terms of the condition that the verb is paired with each construction.

(7) Alternating verbs in Chinese

a.	Paul	zai	beizi	guan man-le	niunai.	[FF]
	Paul	in	cup	filled	milk.	
	'Paul filled milk into the cup.'					
b.	Paul	yong	niunai	guan man-le	beizi.	[GF]
	Paul	with	cup	filled	milk.	
	'Paul filled the cup with milk.'					

(8) Non-alternating verbs in Chinese

a.	Paul	wang	yuanlin-li	sa-le	shui.	[FF]
	Paul	to	garden-in	sprayed	water.	
	'Paul sprayed water onto the garden.'					
b.	* Paul	yong	shui	sa-le	yuanlin.	[GF]
	Paul	with	water	sprayed	garden.	
	'Paul sprayed the garden with water.'					

In sum, the distribution of locative verbs in English is different from that of Korean and Chinese, while Korean and Chinese share the same narrow-range rules. Based on these cross-linguistic differences, Kim and colleagues (Kim Meesook, et al. 1999) divided languages into an English- and a Korean-type group (see Table 1). According to this taxonomy, an English-type group includes alternating verbs allowing both FF and GF, non-alternating verbs only allowing FF, and non-alternating verbs only allowing GF. Examples of languages that belong

to this group are English, French, and Spanish. On the other hand, a Korean-type group instantiates alternating verbs allowing for both constructions and non-alternating verbs only allowing FF, but not non-alternating verbs only allowing GF. This group includes languages like Korean, Japanese, Chinese, Thai, and Turkish.

Table 1: Distribution of Locative Verbs in English-Type and Korean-Type Languages

Construction type	English-type (e.g., English, French, Spanish)		Korean-type (e.g., Korean, Japanese, Chinese)	
	Alternating	Non-alternating	Alternating	Non-alternating
FF	√	√	√	√
GF	√	√	√	–

2. DIFFERENT PERSPECTIVES ON L2 SENTENCE PROCESSING

There is no general agreement about how L2 processing diverges from L1 processing. Some researchers claim that L2 processing is fundamentally different from L1 processing, arguing that the former is characterized as meaning-based, shallow processing (Clahsen & Felser 2006). This perspective ascribes the disparity between L1 and L2 processing to L2 learners' deficit in their syntactic representations, which makes it difficult for learners to recruit structure-based parsing, a complex processing mechanism that is assumed to guide L1 processing. According to this perspective, a defective syntactic representation is a general property that applies to L2 learners across the board, regardless of learners' proficiency in a target language or similarities of target structures between learners' L1 and the target language. This hypothesis further assumes that L2 learners compensate for their defective syntactic representation by relying upon meaning-based parsing strategies, which require less computational demands than structure-based parsing (e.g., Marinis, Roberts, Felser & Clashen 2005).

Other perspectives challenge the fundamental difference hypothesis by maintaining that L2 learners do indeed have structural representations, and their processing is guided by a structure-driven mechanism just like in L1 processing. According to these perspectives, L2 learners' failure to converge on native-like processing can result from processing limitations, which hinder learners from making a proper use of linguistic information in processing. Several studies provide empirical support for the claim that L2 learners can engage in structure-based processing during an online task, particularly when cognitive burdens

associated with processing are alleviated or when L2 proficiency is very high (e.g., Omaki & Schulz 2011; Wen, Miyao, Takeda, Chu & Schwartz 2010; Witzel, Witzel & Nicol 2012).

For example, Wen et al. (2010) conducted a self-paced reading task with proficient Japanese- and Chinese-speaking learners of English, who showed sensitivity to structural information, not merely relying on the linear order of words, in their processing of English noun phrases containing number agreement (e.g., these beautiful houses vs. *these beautiful house), when the syntactic complexity of the target noun phrase was mitigated by using structurally simple noun phrases. Similarly, Omaki and Schulz (2011) found that highly proficient L1-Spanish L2-English learners were able to construct filler-gap dependencies in processing a relative clause. In their self-paced reading task, when reading sentences like "The city/The book that the author wrote regularly about was named for an explorer", both L1 and L2 speakers showed an increased reading time on the embedded verb region (e.g., *wrote*) in the presence of an implausible subject (e.g., *the city*) in the matrix clause relative to a plausible subject (e.g., *the book*), indicating their filler-gap integration in this position. However, no such plausibility effect was found when participants read sentences like "The city/The book that the author who wrote regularly saw was named for an explorer", in which the critical verb (e.g., *wrote*) appeared in a deeply embedded relative clause, suggesting that both L1 and L2 readers showed sensitivity to the island effect, which blocks a filler integration in a doubly embedded clause. These findings led the researchers to the conclusion that L2 learners can indeed build abstract structural representations, showing sensitivity to the island restriction, not linearly processing a sentence based on meaning.

In the study reported below, we tested the two hypotheses regarding L2 processing by examining Chinese speakers' ability to use their knowledge of Korean locative constructions in real-time processing. The fundamental difference hypothesis predicts that L2 learners will have difficulty in integrating the necessary information including case markers and verb semantics to process Korean locative constructions in real time. If this hypothesis is correct, L2 learners will fail to demonstrate native-like performance in an online processing task, regardless of their Korean proficiency and the similarities of locative constructions between Korean and Chinese. If L2 processing is not distinct from L1 processing, however, L2 learners, at least those at highly advanced levels, will converge on native-like processing of Korean locative constructions.

3. THE PRESENT STUDY

The current study explored Chinese speakers' knowledge of Korean locative constructions and their facility with this knowledge during real-time sentence processing. We established the following research questions:

1. Can Chinese speakers acquire native-like knowledge of Korean locative constructions?
2. Can Chinese speakers utilize their knowledge of Korean locative constructions in online processing?

To address these research questions, we selected highly proficient learners of Korean who speak Mandarin Chinese. An ideal scenario under the fundamental difference hypothesis will be that regardless of learners' proficiency or L1-L2 similarities of target structures, L2 learners do not engage in syntax-based processing. If these advanced Chinese-speaking learners of Korean show processing patterns distinct from native Korean speakers, the results will be interpreted as strong evidence for the fundamental difference hypothesis. To this aim, we conducted acceptability judgment and self-paced reading tasks with these learners.

3.1 Participants

We recruited fifty-six highly proficient adult Chinese-speaking learners of Korean (mean age in years = 24.1, SD = 2.6) and thirty adult Korean speakers (mean age in years = 26, SD = 3.2) as a control group. The Korean speakers were recruited from the student population at Ewha Woman's University in Korea. The L2 participants were all Mandarin Chinese speakers and majored in the Korean language and business in exchange graduate programs at the same university. Results from a language background survey revealed that none of the L2 participants had any prior exposure to Korean until the age of 18. They reported proficiency in English equivalent to beginner to intermediate levels, but none had any experience or knowledge about other languages than Chinese, Korean, and English. All participants received the Korean equivalent of $10 for their participation.

The L2 learners were divided into two proficiency groups in the following way. First, participants' performance on a Korean C-test (Lee-Ellis 2009) was compared with the performance of the advanced Korean learners in Mueller and Jiang (2013), who scored at least 68% on the same test. We classified the learners who scored higher than 68% as a higher-level group and those with the score

below 68% as a lower-level group. Next, we compared the two proficiency groups in terms of their scores in the Test of Proficiency in Korean (TOPIK), self-reported Korean proficiency, and length of studying Korean. Independent samples t-tests revealed significant group differences in their TOPIK scores ($t(54) = 4.510$, $p < .001$, $d = 1.29$), self-reported proficiency scores ($t(54) = 2.843$, $p = .006$, $d = 0.76$), and mean length of time of studying Korean ($t(54) = 2.619$, $p = .011$, $d = 0.70$). These results confirmed that the two L2 groups were significantly different in their overall proficiency in Korean. Participants' information including their age, language background, and Korean proficiency is summarized in Table 2.

Table 2: Participant Information[2]

Group	Age	Mean years of studying Korean	Self-reported Korean proficiency (0-10)	TOPIK Score (1-6)	C-test score (0-100%)
Native Speakers	26.0 (3.20)	-	-	-	-
Higher-level Learners	25.3 (2.58)	4.3 (2.65)	6.8 (0.81)	5.6 (0.49)	78.3 (6.38)
Lower-level Learners	23.2 (2.60)	2.8 (1.42)	6.2 (0.79)	4.8 (0.76)	54.2 (10.03)

3.2 Acceptability judgment task

3.2.1 Materials

An offline acceptability judgment task was implemented to assess participants' knowledge about Korean locative constructions. Specifically, this task probed whether L2 learners acquired the mapping between morphosyntax and semantics required to properly comprehend locative constructions in Korean. For this task, two types of verbs—alternating and non-alternating—were distributed in two constructions of FF and GF. A total of sixteen experimental items were created, including eight items with alternating and eight with non-alternating verbs. For half of the items, four alternating verbs (*ch'aeuda* 'fill', *ch'ilhada* 'paint', *tŏp'ta* 'cover', *kamda* 'coil') appeared twice across FF and GF; for the other half, four non-alternating verbs (*ssotta* 'spill', *hŭllida* 'drop', *sitta* 'load', *ssatta* 'stock') were used twice across FF and GF. All words including the verbs in the experimental

[2] Values in the parentheses indicate standard deviations.

sentences were carefully selected from the vocabulary lists for beginner to intermediate learners of Korean based on the criteria provided by the International Standard Curriculum of Korean Language (Kim Jungsup, et al. 2011), so that the L2 participants understood the meaning of the words included in the experiment. Samples of the four construction types employed in the acceptability judgment task are listed in (9).

(9) a. Non-alternating verbs in FF [Non-FF]

Yŏnghŭi-ka	t'ŭrŏk-e	sagwa-rŭl	sirŏssŏyo.
Yŏnghŭi-NOM	truck-LOC	apple-ACC	loaded

'Yŏnghŭi loaded apples on the truck.'

b. Non-alternating verbs in GF [Non-GF]

* Yŏnghŭi-ka	sagwa-ro	t'ŭrŏk-ŭl	sirŏssŏyo.
Yŏnghŭi-NOM	apple-INS	truck-ACC	loaded

'Yŏnghŭi loaded the truck with apples.'

c. Alternating verbs in FF [Alt-FF]

Chinsu-ka	tari-e	pungtae-rŭl	kamassŏyo.
Chinsu-NOM	leg-LOC	bandage-ACC	coiled

'Chinsu put bandages around his leg.'

d. Alternating verbs in GF [Alt-GF]

Chinsu-ka	pungtae-ro	tari-rŭl	kamassŏyo.
Chinsu-NOM	bandage-INS	leg-ACC	coiled

'Chinsu wound his leg with bandages.'

Note that only the Non-GF condition (9b) is unacceptable, while the other conditions are felicitous in Korean. It is predicted that if Chinese L2 learners have knowledge of Korean locative constructions, they will show significantly lower acceptance rates for the Non-GF condition than for the other conditions.

The experimental items were counterbalanced across four lists: Each participant encountered only one token per construction in each list. In addition, forty-two sentences were included as fillers. To ensure that participants were exposed to non-canonical structures as well as canonical ones during a task, twelve of the fillers involved sentences with the scrambled order of object-subject-oblique-verb. Half of the fillers were grammatical and half were ungrammatical. Ungrammatical fillers were created by switching case markers for subject and object (e.g., using an accusative case marker for a subject or a nominative case marker for an object), or using an incorrect form of numeral quantifier (e.g., using a quantifier denoting an inanimate object for human reference).

3.2.2 Procedure

The acceptability judgment task was conducted via a web-based questionnaire. Prior to the task, participants completed a language background questionnaire by providing information about their age, years of studying Korean, and self-reported proficiency in Korean. During the task, each item was presented on a single page, and participants judged its acceptability on a Likert scale from 1 (very unnatural) to 4 (very natural). In order to prevent participants from randomly selecting an answer, an additional option of "I don't know" was presented. The overall procedure for the task took approximately twenty minutes.

3.2.3 Results

First, we inspected how often participants chose the "I don't know" option. For the experimental items, participants selected this option 11 times or 0.8% of total responses (1 time from the native speakers, 1 time from the higher-level, and 9 times from the lower-level learners). These data were eliminated for further analysis.

Table 3 presents participants' mean acceptance rates in the acceptability judgment task. Generally, all groups judged non-alternating items in GF to be less acceptable than the other constructions, yet the acceptance rates for this condition were different across groups.

Table 3: Mean Acceptance Rates of Experimental Conditions in the Acceptability Judgment Task[3]

	Non-alternating verbs		Alternating verbs	
Group	Figure frame (k = 4)	Ground frame (k = 4)	Figure frame (k = 4)	Ground frame (k = 4)
Native speakers (n = 30)	3.9 (0.25)	1.2 (0.38)	3.6 (0.38)	3.7 (0.39)
Higher-level learners (n = 28)	3.4 (0.60)	2.1 (0.86)	3.2 (0.60)	3.6 (0.62)
Lower-level learners (n = 28)	3.3 (0.74)	2.5 (0.66)	3.0 (0.65)	3.4 (0.58)

In order to analyze participants' judgment rates in detail, a linear mixed-effects model (Baayen, Davidson & Bates 2008) was conducted. All statistical analyses were conducted using 'R software' (R Development Core Team 2009). To meet the normal distribution requirement, participants' acceptability rates were transformed into z-scores. The z-transformed values were then entered into a linear mixed effects model, which included *Group* (native speakers, higher-level learners, lower-level learners), *Verb type* (alternating vs. non-alternating), and *Construction* (FF vs. GF) as fixed effects, and *participant* and *item* as random effects. The random effects structure was kept maximal with random intercepts and random slopes for all effects (Barr, Levy, Scheepers & Tily 2013).

The model revealed no main effect of *Group* (p = .845), indicating that all groups were comparable in their judgment of the experimental items in general. Instead, there were significant main effects of *Verb type* (p < .001), *Construction* (p < .001), as well as two-way interactions of *Group* and *Verb type* (p < .001), *Group* and *Construction* (p < .001), and *Verb type* and *Construction* (p < .001), and a three-way interaction of *Group*, *Verb type* and *Construction* (p < .001). To unpack these effects and interactions, separate analyses were conducted for each group using the linear mixed effects models with the fixed factors of *Verb type* and *Construction* and the random factors of *participant* and *item* as well as the maximal random effect structure. Table 4 summarizes the results by group.

[3] Values in the parentheses indicate standard deviations. A maximum score for each condition is 4.

Table 4: Results of the Linear Regression Model of Participants' Judgment by Group

	ß	SE	*p*
Native speakers			
Intercept	0.71	0.07	< .001
Verb type	0.29	0.09	= .002
Construction	2.35	0.07	< .001
Verb type × Construction	2.47	0.10	< .001
Higher-level learners			
Intercept	0.21	0.12	= .08
Verb type	0.16	0.12	= .19
Construction	1.11	0.11	< .001
Verb type × Construction	1.54	0.15	< .001
Lower-level learners			
Intercept	0.18	0.11	= .10
Verb type	0.24	0.11	= .03
Construction	0.75	0.11	< .001
Verb type × Construction	1.10	0.15	< .001

First, the native speaker group showed a main effect of *Verb type* (ß = 0.29, SE = 0.09, $p = .002$), suggesting that they generally accepted sentences with alternating verbs more than those with non-alternating verbs across the construction type. There was also a main effect of *Construction* (ß = 2.35, SE = 0.07, $p < .001$), indicating the acceptance rate for FF was higher than for GF. These main effects were qualified by an interaction between *Verb type* and *Construction* (ß = 2.47, SE = 0.10, $p < .001$). Subsequent pair-wise comparisons revealed that the native speaker group accepted FF more than GF for non-alternating verbs ($p < .001$), whereas their acceptance rates for FF and GF were not statistically different for alternating verbs ($p = .067$). These results confirm that in the grammar of native Korean speakers, non-alternating verbs are compatible only with FF, whereas alternating verbs are compatible with both GF and FF, consistent with the narrow-range rules of Korean locative constructions.

Turning to the results of the L2 groups, the model for the higher-level learners demonstrated a main effect of *Construction* (ß = 1.11, SE = 0.11, $p < .001$), which was induced by a higher acceptance rate for FF than for GF. However, there was no main effect of *Verb type* (ß = 0.16, SE = 0.12, $p = .19$). Crucially, an interaction between *Construction* and *Verb type* was found (ß = 1.54, SE = 0.15, $p < .001$), such that the acceptance rate difference between FF and GF was higher for sentences with non-alternating verbs than for those with alternating verbs. Post-hoc tests

showed that the acceptance rate was significantly higher for FF than for GF in sentences with non-alternating verbs ($p < .001$), which is consistent with the results of the native speaker group. Unlike the native speakers, however, who showed little difference in their acceptance of GF and FF for sentences with alternating verbs, the higher-level learners accepted the GF condition more than the FF condition even for sentences with alternating verbs ($p < .001$). Nevertheless, their acceptance rate of FF was still high, indicating that they generally accepted this construction with alternating verbs.

For the lower-level group, the main effect of *Verb type* emerged (ß = 0.24, SE = 0.11, $p = .03$), with a higher acceptance rate for sentences with alternating verbs than for those with non-alternating verbs. There was also a main effect of *Construction* (ß = 0.75, SE = 0.11, $p < .001$), indicating a higher acceptance for FF than for GF. In addition, an interaction of *Verb type* and *Construction* was found (ß = 1.10, SE = 0.15, $p < .001$), which was driven by a greater difference in the acceptance rate between FF and GF for sentences with non-alternating verbs than for sentences with alternating verbs. Post-hoc tests revealed that the acceptance rate was higher for FF than for GF in sentences with non-alternating verbs ($p < .001$), and the acceptance rate was higher for GF than for FF in sentences with alternating verbs ($p = .024$), a result comparable to that of the higher-level group.

Taken together, both native speakers and L2 learners demonstrated a similar pattern in their acceptability of locative constructions: All groups tended to accept FF but rejected GF with non-alternating verbs, and generally accepted both FF and GF with alternating verbs. These findings suggest that the L2 groups had knowledge of Korean locative constructions, including knowledge about the lexico-semantics of the verbs, use of appropriate case markers matching each construction, and mapping verbs onto appropriate constructions. These results provide a good testing ground for investigating whether these learners can utilize the knowledge of locative constructions in sentence processing. In the experiment reported below, we conducted a self-paced reading task to measure learners' reading times while they read the target constructions in real time.

3.3. Self-paced reading task

3.3.1 Materials

The sixteen experimental items used in the acceptability judgment task were adopted for the self-paced reading task with a minor modification. The modification was made by inserting an additional clause following each sentence, which served to accommodate for any spill-over effects. For example, the

sentences in (10) were followed by a conjunction -sŏ ('and') and a clause *pogi-e chohassŏyo/nappassŏyo* ('it looked good/bad'), which denotes the speaker's overall impression of the event. These additional words allow us to capture any effect delayed due to a task-induced button-press rhythm (Just, Carpenter & Woolley 1982). The experimental items were intermixed with forty-two fillers adopted from those in the acceptability judgment task.

As shown in (10), each target sentence consisted of six regions: subject (R1), ground-figure or figure-ground (R2 and R3), verb-*and* (R4), spill-over (R5), and sentence-final (R6) regions.

(10)	Yŏnghŭi-ka (R1)	t'ŭrŏk-e (R2)	sagwa-rŭl (R3)	siro-sŏ (R4)
	Yŏnghŭi-NOM	truck-LOC	apple-ACC	loaded-and
	pogi-e (R5)	chohassŏyo (R6).		
	looking	good		

'Yŏnghŭi loaded apples on the truck, and they looked good.'

The current study predicts that for non-alternating verbs, native speakers of Korean will show an increased reading time in the critical (R4) or spill-over regions (R5) in GF compared to FF, since non-alternating verbs are incompatible with GF construction in Korean. For alternating verbs, in contrast, there will be little difference between the reading times for GF and FF since both constructions are allowed in sentences with alternating verbs. If Chinese-speaking L2 learners are able to apply their knowledge of Korean locative constructions in real-time processing, they will show the same reading time pattern as native speakers of Korean. Otherwise, their reading times on R4 or R5 will not be significantly different between the FF and GF conditions for sentences with non-alternating verbs.

3.3.2 Procedure

The self-paced reading task was run on Linger, a software program developed by the MIT Media Lab (Warren & Gibson 2002). Prior to the experiment, participants were given instructions on the task, followed by four practice trials. During the task, participants individually read sentences that randomly appeared on a computer screen in a non-cumulative moving window manner. At the beginning of each trial, dash lines appeared on the screen and then were replaced

by a word with each press of the spacebar. Participants read each word in a self-paced manner, during which the program automatically recorded a reading time spent on each word. Each sentence was followed by a yes/no comprehension question, prompting participants to answer by pressing buttons labeled "yes" and "no" on the keyboard. For example, after the sentence (10), a question appeared "*Yŏnghŭi-ka t'ŭrŏk-e orenji-rŭl sirŏnnayo*? [Did Yŏnghŭi load oranges onto the truck?]" for which the correct answer is "no". These follow-up questions served to draw participants' attention to the semantic content of the sentences. The entire task took approximately twenty-thirty minutes.

3.3.3 Results

Prior to data analysis, we examined participants' accuracy rates on the comprehension questions. All participants scored at least 71% (mean accuracy of 84% for the native speaker group; 82% for the higher-level group; 81% for the lower-level group), indicating that they generally paid attention to the meaning of the sentences during the task. A one-way ANOVA showed that accuracy rates were significantly different between the groups, $F(2, 85) = 3.587$, $p = .032$). Tukey HSD tests revealed a significant difference between the native speaker and lower-level groups ($p = .031$), but there was no difference between the native speaker and higher-level groups, or between the two L2 groups.

Next, participants' reading times (RTs) were trimmed in two steps. First, RTs shorter than 100 ms and longer than 10000 ms were eliminated as outliers, which affected 1.27% of the entire data. Then, RTs longer or shorter than two standard deviations from the mean (5.68% of the data) were also removed. The trimmed RTs were analyzed with linear mixed-effects models separately for each verb type (alternating and non-alternating), which included the fixed effects of *Group* (native speakers, higher-level learners, lower-level learners), and *Construction* (FF, GF), and the random effects of *participant* and *item* with a maximal random effects structure. Tables 5, 6 and 7 present mean RTs and standard deviations in each region for the three groups.

Table 5: Mean RTs and Standard Deviations (ms) in the Native Speaker Group[4]

Condition	R1 subject	R2 ground/ figure	R3 figure /ground	R4 Verb -and so	R5 (it) looked	R6 good/bad
Non-FF	564 (504)	581 (400)	554 (314)	540 (261)	452 (157)	543 (231)
Non-GF	503 (211)	629 (487)	612 (396)	748 (575)	511 (233)	456 (149)
Alt-FF	512 (275)	628 (342)	605 (370)	609 (370)	479 (183)	532 (225)
Alt-GF	500 (200)	559 (309)	526 (219)	617 (298)	463 (154)	496 (171)

Table 6: Mean RTs and Standard Deviations (ms) in the Higher-Level Group

Condition	R1 subject	R2 ground/ figure	R3 figure /ground	R4 Verb -and so	R5 (it) looked	R6 good/bad
FO-FF	879 (352)	1269 (593)	1195 (534)	1022 (393)	700 (145)	758 (385)
FO-GF	964 (437)	1377 (641)	1394 (682)	1336 (617)	707 (264)	795 (338)
GO-FF	1059 (486)	1227 (451)	1051 (483)	947 (432)	696 (221)	769 (280)
GO-GF	1020 (472)	1346 (753)	1207 (615)	1016 (529)	646 (155)	760 (360)

Table 7: Mean RTs and Standard Deviations (ms) in the Lower-Level Group

Condition	R1 subject	R2 ground/ figure	R3 figure /ground	R4 Verb -and so	R5 (it) looked	R6 good/bad
FO-FF	1295 (587)	1694 (704)	1575 (625)	1317 (520)	732 (192)	829 (373)
FO-GF	1222 (500)	1899 (675)	1660 (696)	1460 (523)	718 (186)	743 (270)
GO-FF	1353 (622)	1789 (784)	1301 (445)	1157 (374)	730 (154)	752 (292)
GO-GF	1206 (468)	1773 (654)	1506 (461)	1168 (451)	745 (196)	732 (291)

[4] Non = Non-alternating; Alt = Alternating; FF = Figure frame; GF = Ground frame

In Region 1 (subject), there was a main effect of *Group* for both alternating (ß = 689.87, SE = 103.07, $p < .001$) and non-alternating verbs (ß = 770.60, SE = 96.57, $p < .001$): The native speaker group read this region significantly faster than the two learner groups. Other than this effect, there was no main effect of *Construction* or any interaction of the factors in this region.

The same result was obtained for Regions 2 (ground or figure) and 3 (figure or ground). A main effect of *Group* was found for both alternating (ß = 1148.76, SE = 137.84, $p < .001$ for Region 2; ß = 817.25, SE = 100.17, $p < .001$ for Region 3) and non-alternating verbs (ß = 1147.86, SE = 138.74, $p < .001$ for Region 2; ß = 1001.38, SE = 130.42, $p < .001$ for Region 3), again indicating that the native speaker group was significantly faster than the learner groups in these regions. Other than the main effect of *Group*, there was no other effect or interaction.

In Region 4 (verb-*and*), which is the critical region, the main effect of *Group* emerged for both non-alternating (ß = 739.83, SE = 114.05, $p < .001$) and alternating verbs (ß = 557.91, SE = 89.80, $p < .001$). Importantly, a main effect of *Construction* was found for non-alternating verbs (ß = 201.67, SE = 50.58, $p < .001$), but not for alternating verbs (ß = 35.68, SE = 40.15, $p = .375$). To unpack the effect of *Construction* for non-alternating verbs by group, we conducted separate analyses for each group, which demonstrated that the native speaker and higher-level groups spent a significantly longer time in GF than in FF (ß = 182.50, SE = 64.74, $p = .005$ for the native speaker group; ß = 284.47, SE = 90.34, $p = .002$ for the higher-level group), yet the lower-level group had the same RTs in both constructions (ß = 142.91, SE = 105.47, $p = .177$). These results suggest that the native speaker and higher-level groups, but not the lower-level group, demonstrated sensitivity to the unacceptability of the non-alternating verbs in GF in this region.

In Region 5 (spill-over region), the main effect of *Group* emerged both for non-alternating (ß = 231.61, SE = 44.19, $p < .001$) and alternating verbs (ß = 267.71, SE =38.28, $p < .001$), again indicating shorter RTs for the native speaker group than for the two learner groups. Unlike in the previous region, however, there was no main effect of *Construction* or an interaction between *Group* and *Construction* in this region. The same results were obtained for the final region (Region 6), in which there was only a main effect of *Group* for both non-alternating (ß = 297.57, SE = 67.78, $p < .001$) and alternating verbs (ß = 254.42, SE = 58.96, $p < .001$) with a faster RT for the native speaker group compared to the two learner groups.

In sum, the results of the self-paced reading task demonstrated that the native speaker and higher-level groups showed sensitivity to the infelicitous locative construction (i.e., GF with non-alternating verbs), as indicated by an increased RT in the critical region (Region 4) for this condition. Although the higher-level

group was generally slower in their processing speed than the native speaker group, these learners showed native-like performance by applying relevant knowledge about Korean locative constructions in real-time processing. The lower-level group, in contrast, did not show any increased RTs for this condition, indicating that they failed to integrate relevant knowledge to process the locative constructions in real time. In the discussion section below, we discuss possible explanations for the observed differences in group performance in the tasks.

4. GENERAL DISCUSSION

The present study tested whether Chinese-speaking learners of Korean can use their knowledge of locative alternation in online processing. The results from the acceptability judgment and self-paced reading tasks diverged. While both learner groups performed in a native-like manner in the acceptability judgment task, only the higher-level group was able to use the information in the self-paced reading task. These results imply several interesting possibilities in terms of the acquisition and processing of Korean locative constructions.

The outcomes of the self-paced reading task did not support the fundamental difference hypothesis, which claims that L2 learners have limited abilities to use syntactic information in online processing, regardless of proficiency and L1-L2 similarities of target structures (Clahsen & Felser 2006). The higher-level learners successfully applied their knowledge about locative constructions in real-time processing: They showed elevated RTs in the infelicitous sentences where non-alternating verbs appeared in GF. These findings suggest that the native-like processing of Korean locative constructions was attainable at least for these highly proficient learners.

The outcomes from the proficient Chinese speakers in the self-paced reading task leads to a question regarding what led them to achieve their native-like processing of locative constructions. One explanation can be found in the transfer of relevant knowledge from the learners' L1. Recall that Chinese and Korean share the same narrow-range rules for locative verbs allowing and disallowing locative frames: Both languages allow alternating verbs in FF and GF and disallow non-alternating verbs in GF. If we assume that the Chinese speakers carried over the information from their L1 in the processing of the Korean sentences, we may explain the native-like performance of the higher-level learners in the self-paced reading task. However, an L1 transfer does not fully account for the different processing patterns between the higher- and lower-level learners. If the lower-level learners had benefited from the similarities of locative

constructions between Korean and Chinese, they should also have been able to show native-like processing in the self-paced reading task. The fact that the two proficiency groups showed different processing patterns suggests that L1 transfer may not be the sole factor responsible for the observed group differences.

Rather, it appears reasonable to assume that the Chinese learners were influenced by several factors in their processing of the target constructions, including their L1, proficiency, and cognitive abilities. For example, the non-convergence of the lower-proficiency group may indicate that either this group had incomplete target-language representations regarding the locative constructions (e.g., Marinis, Roberts, Felser & Clashen 2005), or they established the fully specified representations but showed limited performance on the task due to processing problems associated with low proficiency (e.g., Hopp 2010). The former possibility appears less plausible, considering that this group demonstrated a native-like knowledge of the locative constructions in the acceptability judgment task. The performance of this group in the self-paced reading task, therefore, may not be ascribed to representational deficits. In this regard, the different processing patterns between the two proficiency groups may be accounted for by their proficiency and/or cognitive abilities to process the target sentences. Although it remains unclear as to the relevant weighting of factors contributing to the L2 processing of Korean locative constructions, our findings do not point to the role of any defective representations in L2 syntax, constituting counterevidence to the fundamental difference hypothesis. Future studies are needed to tease apart the respective role of these factors and investigate whether the limited processing of the lower-proficiency group resulted from their relatively lower proficiency, limitations in working memory, or any effect of L1.

Our findings provide implications for teaching Korean constructions to L2 learners. Despite the same distribution of locative verbs across Korean and Chinese, the lower-level learners were unable to apply their knowledge to online sentence processing. Given that these learners' proficiency was considered quite advanced as indicated by their TOPIK scores, their nonnative-like performance in the self-paced reading task suggests that real-time use of the target constructions is challenging even for some advanced learners. In particular, it is assumed that learners have difficulties in learning alternating constructions where the same verb can appear in different syntactic structures through alternation. This indicates a need for incorporating constructions that allow alternation in Korean language classes. For example, once L2 learners acquire syntactic and semantic knowledge of target constructions, they need to be trained to use various instances of alternation in daily activities so that they acquire not just (explicit) declarative knowledge of target structures but also procedural knowledge to comprehend and

produce them in real time. Part of such efforts may be achieved by providing learners with an abundant amount of natural input containing the target constructions or allowing learners diverse opportunities to engage in a conversation using the target structures.

5. CONCLUSION

This study provides evidence that knowledge about Korean locative constructions can be available in online processing, at least for a highly proficient learner group. These findings suggest that L2 learners can process Korean locative constructions in a native-like manner, and this ability is found to be associated with L2 proficiency.

In addition to the findings and implications of this study, we also note some of its limitations, which may require further research. First, further enhancement is needed to manipulate the word order of the target sentences. Throughout the tasks, we held the word order of the experimental sentences constant by involving only canonical configurations. Although we included non-canonical scrambled sentences among the fillers, it may be desirable to systematically manipulate the order of arguments in the locative constructions to test whether Chinese speakers still have correct interpretations for non-canonical constructions. This manipulation may offer an opportunity to explore any potential L1 influence since the locative constructions in Chinese only allow canonical configurations. Another limitation of this study can be found in the relatively small number of locative verbs used for the experiments. We used four non-alternating and four alternating verbs twice for Figure-Frame and Ground-Frame constructions respectively. While each use of the same verb involved different lexical items for a figure and a ground, it may be necessary to use a different lexical verb for each item in order to generalize our findings with a variety of locative verbs. This point should definitely be taken into consideration in further studies. Lastly, future studies should consider more ecologically valid measures to investigate learners' online processing. Our self-paced reading method, albeit widely adopted for sentence processing research, has been criticized for its unnaturalness in terms of reading a sentence. While word-by-word sentence reading allows us to scrutinize incremental processing for each region, this process is far from the way that a reader processes a sentence under normal circumstances. In this regard, additional measures that allow for more natural sentence processing, such as eye-tracking, need to be adopted as alternatives to the self-paced reading method.

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PARK SUN HEE (sunheepark@ewha.ac.kr) *is an associate professor in the Department of Korean Studies, Ewha Womans University, Korea.*

KIM HYUNWOO (hyunwoo2@hawaii.edu) *is a Ph.D. student in the Department of Second Language Studies, University of Hawai'i, USA.*

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