English Language & Literature Teaching, Vol. 22, No. 1 Spring 2016

A Subject–Indirect Object Asymmetry in L2 Processing of English RCs

Chae-Eun Kim
(Korea Institute for Curriculum and Evaluation &
Korea University)

Kim, Chae-Eun (2016). A subject-indirect object asymmetry in L2 processing of English RCs. *English Language and Literature Teaching*, *22*(1), 45-64.

This study investigates whether second language (L2) learners of English indicate any difference in the processing difficulty of subject and indirect object relative clauses (RCs). Previous work on sentence processing has shown that native English speakers read subject RCs faster than direct object RCs; however, the comparison is problematic due to the uncontrolled animacy of the heads. This study therefore examines the effects of gap types in English subject relative clauses and indirect object relative clauses on comprehension accuracy and total reading times. The study further investigates whether any such effects are correlated with L2 English proficiency. A total of 31 Korean college EFL learners participated in an on-line reading task. Their English proficiency was measured by a C-test. The analysis found no difference in the comprehension scores of either intermediate-proficiency or high-proficiency groups between the two types of relative clause. However, the reading time data demonstrate that all the L2 learners, regardless of English proficiency, had more difficulty processing indirect object RCs than subject RCs. These results support the distance effect of the filler-gap dependency; the longer dependencies in the indirect object clauses result in greater syntactic complexity and thus make processing more difficult.

[relative clause (RC)/L2 sentence processing/filler-gap dependency/animacy]

I. INTRODUCTION

Second language (L2) learners show a subject–object asymmetry in processing relative clauses (Jeon &; Kim, 2007; J. H. Kim, 2010, 2013). Consider the two types of RCs in (1).

(1a) Subject relative clause:
The reporter [that _ attacked the senator] disliked the editor.

(1b) Direct object relative clause:
The reporter [that the senator attacked _] disliked the editor.

Both sentences are grammatical and share the same lexical properties. The head noun *the reporter* originates from the subject position of the embedded clause in (1a), and from the object position of the embedded clause in (1b). A great amount of previous research has shown that first language (L1) adult speakers perform differently on these two types of relative clauses (for English: Frazier & d'Arcais, 1989;Wanner & Maratsos, 1978; King & Just, 1991; Gibson, 1998; Traxler et al., 2002; Gennari & MacDonald, 2008; for Korean: Kwon et al., 2006, 2013; Kwon & Polinsky, 2008; Kim, 2010; for Chinese: Hsiao & Gibson, 2003; Gibson & Wu, 2010; for Japanese: Miyamoto & Nakamura, 2003). Most of these studies indicate that subject RCs are easier to process and comprehend than direct object RCs. Previous studies on first language acquisition have shown that children acquire subject relative clauses before object relative clauses (S. Cho, 1999; Diessel & Tomasello, 2000, 2005; Hamburger & Crain, 1982; Zukowski, 2009; Kim, 2015a). Hence, English-speaking children acquire more complex syntactic structures, such as direct object RCs, in later stages of their language development.

Young children learning Korean or English as an L1 have more trouble comprehending and producing direct object RCs (for English: Diessel & Tomasello, 2000, 2005; Hamburger & Crain, 1982; Zukowski, 2009; for Korean: Cho, 1999; Kim, 2015a, Kim, 2004; Suh, 2004). To illustrate, (2a) and (2b) present direct object RCs in English and Korean, respectively.

(2a) Direct object RCs in SVO
the woman [that the man sees _]

(2b) Direct object RCs in SOV

[namca-ka _	po-nun]	yeca
man-Nom	see-RC.Prs	woman

'The woman who the man sees'

L2 learners of English also comprehend and produce subject RCs more easily than direct object RCs (Doughty, 1991; Eckman, Bell, & Nelson 1988; Gass, 1979; Wolfe-Quintero, 1992). Second language acquisition studies on English RCs have shown that L2 learners have trouble producing and understanding all types of English RCs, in particular when the L1 and L2 differ greatly (J. H. Kim, 2013; Lightbown & Spada,

2006), as described in (2a-b). Previous studies in both L1 and L2 research have used a variety of methodologies to compare subject and direct object RCs, as these are the first two types of RCs to be acquired by children and second language learners. The research in general has concluded that there is a hierarchical order in the L1/L2 acquisition of the relative clauses (subject > direct object > indirect object >…) suggested by Keenan and Comrie (1977); in other words, direct object RCs are acquired only after subject RCs are acquired (Comrie, 2007).

Some recent L1 studies have attempted to explain the subject–direct object RC asymmetry by testing the effects of the length between the filler and the gap in RCs while controlling three factors: (1) animacy of the head noun, (2) word-order canonicity, and (3) frequency of the RC type (C. E. Kim, 2013; Kim & O'Grady, 2015; Kim, 2015b, 2015c). However, no research so far has addressed the L2 processing of English RCs by controlling possible factors in processing difficulty.

The purpose of the present study is thus to fill a gap in the literature by investigating the distance factor in L2 English RC processing. It seeks to understand the nature of the effects of syntactic complexity in second language processing, asking why adult L2 English learners have more difficulty comprehending certain RC structures and how English proficiency affects their processing patterns. In addition, it considers how the processing patterns of adult L2 speakers are similar to or different from those shown by adult native speakers. To address these questions, this study tested how accurately L2 learners of English comprehend indirect object RCs and subject RCs, both of which typically have animate head nouns. A self-paced reading task was used to examine the difficulty of processing RCs with different lengths of filler-gap dependency.

This paper is organized as follows. Section 2 introduces several factors affecting the processing of English RCs that have been proposed in the literature, and reviews previous work on L2 RC processing. Section 3 describes the methods and procedure of the present study. Section 4 discusses the results of the study and the implications of the experimental outcomes, and compares the results with those from research on L1 RC processing. Section 5 is the conclusion.

II. RELATIVE CLAUSE PROCESSING

1. Factors affecting the difficulty of RCs: The distance factor

The complexity, and consequent processing difficulty, of direct object RCs comes from properties of their syntax, which can be explained in terms of the length between the filler and the gap (Gibson, 1998; Traxler et al., 2002; Warren & Gibson, 2002;

Hawkins, 2004). The sentences in (3) show the difference in the length of the filler-gap dependency between subject and direct object RCs.

(3a) Subject relative clause:
The reporter [that _ attacked the senator]

(3b) Direct object relative clause:
The reporter [that the senator attacked _]

A variety of accounts have been proposed for the subject–object asymmetry; however, most studies concentrate on the length of the filler-gap dependency between the head noun and the gap of the unfolding clause. For example, according to the filler-gap dependency hypothesis, subject RCs, as in (4a), are acquired faster than direct object RCs, as in (4b), because of the distance between the head noun *reporter* and the gap in the relative clauses.

(4a) Subject relative clause:
The reporter [that _ attacked the senator] disliked the editor.
|_____0__|
(4b) Direct object relative clause:
The reporter [that the senator attacked _] disliked the editor.
|_____1____2_____|

More specifically, Gibson's (1998) Dependency Locality Theory (DLT) explains that dependencies occurring between lexical materials are connected to memory storage and integration costs. The direct object relatives take more resources to process than the subject relatives, because they have a higher integration cost when the parser links the filler to the gap position. The parser is required to cover the inserted subject noun phrase – an extra discourse referent – in the direct object relatives. The extra discourse elements are mainly NPs and verbs because they put forward discourse referents such as events and entities. O'Grady (2011)[1] proposed that processing difficulty increases when a relative clause has a longer distance between the filler and the gap site, as described in (5).

(5) The distance factor (O'Grady, 2011, p. 22)

[1] O'Grady (1997) suggested that the structural distance between the head and the gap is the source of the processing difficulty in relative clauses.

> The difficulty of processing a relative clause increases with the length of the filler-gap dependency.

O'Grady's distance factor can explain why the direct object RC in (4b) is more difficult to process than the subject RC in (4a). There are no intervening elements between the head noun *reporter* and the gap in (4a); however, the sentence (4b) includes new discourse referents (the NP *senator* and the verb *attacked*) between the filler and the gap. Readers can process the subject RCs with a minimum load on working memory, but the intervening materials (i.e., the new discourse referents) in the direct object RCs create a greater working memory load, which leads to a delay in resolving the filler-gap dependency. Sentence processing studies that explore cognitive factors consider the factor of working memory to be highly connected with storing and operating certain information (Hawkins, 1999). Thus, the filler-gap dependency in the subject relatives can be resolved with less difficulty because it causes less burden on working memory than the dependency in the direct object relatives.

2. The animacy factor

The common comparison between subject and direct object RCs, as in (6a) and (6b), however, is problematic because most direct object relatives in authentic speech have an inanimate head noun, as in (7).

(6a) Subject relative clause:
The reporter [that _ attacked the senator]

(6b) Direct object relative clause with an animate head noun:
The reporter [that the senator attacked _]

(7) Direct object relative clause with an inanimate head noun:
The report [that the senator submitted _]

Kidd et al. (2007) reported that direct object relatives with an animate head like (6b) are an infrequent pattern in both child speech and child-directed speech. However, most of the research has used materials in which the direct object RCs have animate head nouns, which might be the source of their reported processing difficulty (Aissen, 2003; Traxler et al., 2002; Mak et al., 2002; Reali & Christiansen, 2007; Gibson, 2000; Grodner & Gibson, 2005; Kim, 2015b, in progress). The processing difficulty of the filler-gap dependencies in direct object relatives might be reduced when the head noun is

inanimate as in (7). Hence, comparison between the two types of RCs with animate head nouns in both, as in (6a) and (6b), is not the best way to test their complexity.

Kim (2015b) conducted an L1 processing study in which animacy was controlled in order to disentangle the distance effect from the animacy of the head noun in English RCs. The study compared subject relatives with indirect object relatives as exemplified in (8).

(8a) Subject relative clause:
The scientist [that _ gave the document to the soldier]
|_____0__|

(8b) Indirect object relative clause:
The scientist [that the soldier gave the document to _]
|_____1____2_____3_____|

Because both subject and indirect object are typically animate nouns in speech, these structures provide a way to make a neutral comparison. The length effect between the filler and gap can be tested because the indirect object RC condition has three more discourse referents (*soldier, gave, document*) between the filler and the gap than the subject RC condition, which has none.

Kim's (2015b) data were collected from 42 native speakers of English, using a self-paced reading task. The findings indicated no difference in comprehension scores for the two types of RC; however, total reading times in the relative clause regions and the main verb regions were longer in the indirect object RC condition than in the subject RC condition. The study therefore concluded that native speakers have more difficulty processing indirect object RC clauses than subject RC clauses. In addition, an earlier L1 child acquisition study that compared subject and indirect object RCs using an elicited production task showed that native English-speaking children preferred subject over indirect object RCs (C. E. Kim, 2013).

3. L2 relative clause processing

J. H. Kim (2010, 2013) investigated a possible correlation between the effect of gap length in English relative clauses and L2 English proficiency. An offline questionnaire tested L2 learners' sensitivity to types of gap in relative clauses; however, the test items were subject and object RCs. Kim found, as other studies have shown for L1 English speakers, that Korean L2 learners of English also had lower accuracy scores on the direct object RCs than on the subject RCs. In addition, the lower proficiency L2 learners had

greater difficulty in processing object RCs. A study by Lee (2014) focused on the length of dependencies in English *wh*-questions. Lee (2010, 2014) found that object *wh*-questions, with their longer dependencies, are more difficult for L2 learners of English to comprehend than subject *wh*-questions. However, no studies have yet investigated the effect of distance between the filler and the gap in L2 RC processing while controlling the animacy of the head.

4. Research questions

The research questions stimulating the present study are as follows:

1) Do adult Korean-speaking L2 learners of English differentiate between subject and indirect object RCs when they read sentences with the two structures? If so, which type of RC is easier for them to process?
2) Is there any relationship between Korean EFL learners' language proficiency and their processing of English subject and indirect object RCs?
3) Are L1 speakers' and L2 learners' patterns of processing the two types of RCs similar or different?

The predictions for these research questions are as follows. For the first question, it is predicted that the comprehension scores and RT data of the Korean L2 learners of English will show overall greater difficulty with the English indirect object RCs than with the English subject RCs, as predicted by O'Grady's distance factor. For the second research question, it is predicted that the intermediate-proficiency group will show more difficulty in their comprehension and have longer total RTs for indirect object RCs than the high-proficiency group. To address the third research question, the results of the present study will be compared to the results of the L1 processing study that Kim (2015b) conducted.

III. METHOD

1. Participants

The participants for this study were 31 Korean EFL learners attending a university in Seoul, South Korea (13 male and 18 female; age range 19–26 years; average age 22.5 years). All participants used Korean as a first language and were formally educated in Korea, learning English as a foreign language. Some had lived abroad in English-

speaking countries, and some of them had participated in English-language programs or in undergraduate programs as exchange students, in all cases for less than one year. They were all majoring in English language and literature at the time of the experiment; however, their English education backgrounds varied. Therefore, their English proficiency was measured by a C-test, which was adopted from Schulz (2006). Their scores ranged from 21 to 35 out of 40, with a mean of 28.38. The mean was used as a cut-off point for group division.

2. Target structure and design

Sixteen sets of sentences were made, each with the two conditions in (9a) and (9b). The sentences in the two conditions have the same number of lexical items but differ in the order of the words in the RCs (see all test items in Appendix A). Thus, the gap position in the unfolding clause was manipulated for the experiment. Two lists in a Latin-square design were used to test how the participants processed sentences with the two types of RCs. Thirty-two filler items (e.g., sentences with negation, quantifiers, and embedded clauses) were combined with the critical items to keep the participants from becoming aware of the focus of the experiment.

TABLE 1
Sample Test Items

	(9a) Subject RC	(9b) Indirect object RC
R1	the	the
R2	musician	musician
R3	that	that
R4	sent	the
R5	the	director
R6	book	sent
R7	to	the
R8	the	book
R9	director	to
R10	was	was
R11	in	in
R12	the	the
R13	headline	headline

3. Tasks and procedures

1) Self-paced reading task

The participants' ability to process the two types of RCs was measured by a self-paced reading task, which is widely used in psycholinguistics research (Just, Carpenter, & Woolly, 1982). The task used the E-Prime experimental software package on a PC to present the materials in a non-cumulative and word-by-word moving display on a screen. All participants had a training session until they fully understood how the task would be conducted. Participants sat in a quiet computer booth and read the sentences by pressing a button to move to the next word. When they pressed the button, the word on the screen disappeared, and a new word appeared. After reading each critical test item, they answered a yes-no question or a wh-question about its content. All reading times at each region were automatically recorded for reading time analysis. For future analysis, each word was considered a region (R), as described in table 1.

2) Language proficiency test and background questionnaire

The participants' L2 proficiency level was measured using a C-test, as mentioned in section 3.1. The C-test consisted of two short texts including a total of 40 blanks, each of which followed the first half of a word, requiring the participants to complete the words. Next, the participants were asked to fill out a language background questionnaire. The questionnaire was designed to exclude participants who could not understand the test sentences and/or had an L1 other than Korean. It included items about the four language skills in English (speaking, reading, listening, and writing); participants rated these items on a 5-point scale where higher scores indicated higher proficiency.

IV. RESULTS AND DISCUSSION

1. Comprehension accuracy

The mean scores for the subject and indirect object relative clause conditions are shown in table 2. The overall mean score on all comprehension questions was 97.25% for the intermediate-proficiency group and 97% for the high-proficiency group. Comprehension accuracy for the intermediate group in the indirect object RC and subject RC conditions was 98% and 97%, respectively; while for the high group, it was 97% in both conditions. The grammatical function of the gap (subject vs. indirect object) and the proficiency of the L2 learners were used as two independent variables, with comprehension score as a dependent variable. A two way ANOVA with group as the between-subject factor and gap position as the within-subject factor showed no significant effect of gap position (subject > indirect object) and no main effect of group

(high > intermediate). These results indicate that the mean scores for both the subject RCs and the indirect object RCs by all L2 learners were high and suggest that the Korean L2 learners comprehended the two types of RCs equally well.

TABLE 2
Comprehension Accuracy

Proficiency group	Subject RCs	Indirect object RCs	Total
Intermediate	98%	97%	97.25%
High	97%	97%	97%

(The mean scores represent the percentage of correct answers.)

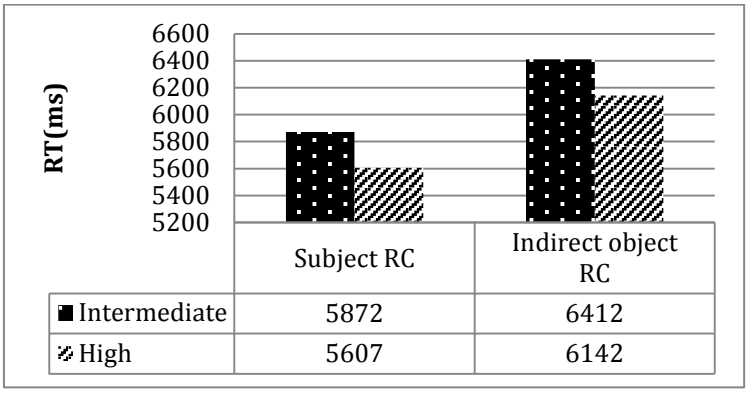
2. Total reading times (RTs)

The means of the total reading times (RTs) for the two conditions were analyzed to examine whether the RTs for each condition were significantly different. In a process of data trimming, RTs for each region higher or lower than 2.4 standard deviations (*SD*) of the mean were substituted by a cutoff value. Four different analyses were conducted on the total RTs from (1) R1–9; (2) R1–10; (3) R1–11; (4) R1–13.

First, a comparison of the two groups' RTs for regions 1–9, as shown in (10a) and (10b), is presented in figure 1.

(10a) Subject RC: the musician [that _ sent the book to the director]
(10b) Indirect object RC: the musician [that the director sent the book to _]

FIGURE 1
Total RTs in ms from R1–9



The comparison shows a striking asymmetry in total RTs between the two conditions for both groups. These effects were tested for significance with a two-way mixed model

ANOVA with group (intermediate/high) as the between-subject factor and gap position (subject/indirect object) as the within-subject factor. The analysis revealed a significant main effect of gap position (subject > indirect object: $F(1, 30) = 4.627$, $p < 0.05$); however, there was no main effect of group (high > intermediate: $F(1, 30) = 1.144$, $p = 0.28$). In addition, there was no significant interaction between group and gap position, confirming that the difference between the indirect object condition and the subject condition was equally large for the intermediate group and the high group.

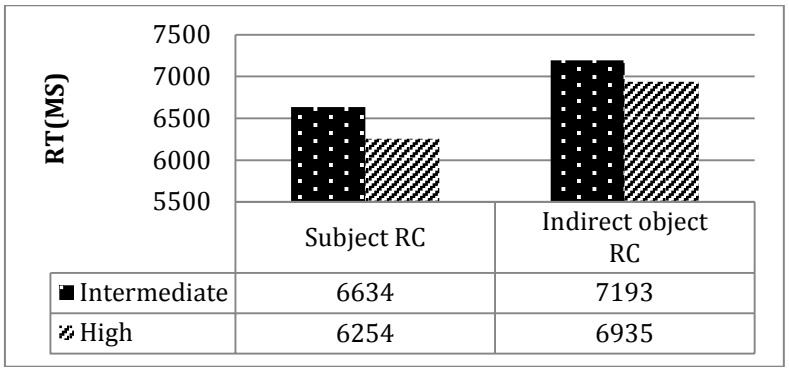
Next, total RTs in regions 1–10, which include the main verb region (R10) as exemplified in (11a) and (11b), were analyzed.

(11a) Subject RC: the musician [that _ sent the book to the director] was
(11b) Indirect object RC: the musician [that the director sent the book to _] was

The total RTs for the second analysis are shown in figure 2. The analysis including the main verb region revealed effects similar to those in the analysis of regions 1–9. There was a main effect of grammatical function of the gap.

FIGURE 2

Total RTs in ms from R1–10



The total RTs from R1 to R10 for the subject RC condition were also much shorter than the RTs for the indirect object RC condition (6634 ms vs. 7193 ms) for the intermediate group; this difference was smaller for the high group (6254 ms vs. 6935 ms). The analysis revealed a significant main effect of gap position (subject > indirect object: $F(1, 30) = 5.427$, $p < 0.05$); however, there was no main effect of group (high > intermediate: $F(1, 30) = 1.432$, $p = 0.232$). In addition, there was no significant interaction between group and gap position, confirming that the difference between the

indirect object gap condition and subject gap condition was equally large for the intermediate group and the high group.

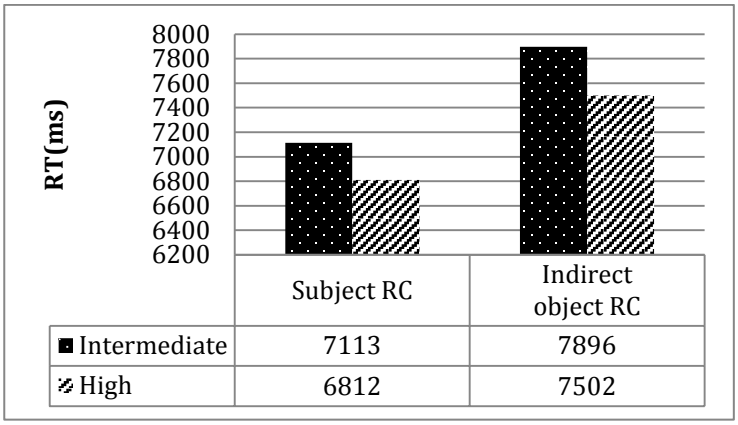
As the third analysis, total RTs in regions 1–11, which include the preposition region (R11) as exemplified in (12a) and (12b), were analyzed. The total RTs for the third analysis are shown in figure 3.

(12a) Subject RC: the musician [that _ sent the book to the director] was in

(12b) Indirect object RC: the musician [that the director sent the book to _] was in

FIGURE 3

Total RTs in ms from R1–11



The analysis of the total RTs from R1 to R11 revealed a significant main effect of gap position (subject > indirect object: $F(1, 30) = 7.06$, $p = 0.008$); however, there was no main effect of group (high > intermediate: $F(1, 30) = 1.572$, $p = 0.21$). There was no significant interaction between group and gap position, confirming that the difference between the indirect object gap condition and subject gap condition was equally large for the two groups.

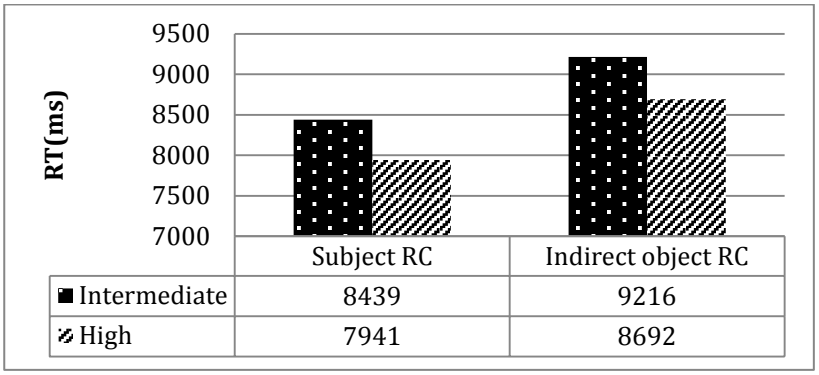
The fourth analysis was conducted on the total RTs for regions 1–13, as exemplified in (13a) and (13b). The results are shown in figure 4.

(13a) Subject RC: the musician [that _ sent the book to the director] was in the headline.

(13b) Indirect object RC: the musician [that the director sent the book to _] was in the headline.

FIGURE 4

Total RTs in ms from R1–13



	Subject RC	Indirect object RC
Intermediate	8439	9216
High	7941	8692

The analysis revealed a significant main effect of gap position (subject > indirect object: $F(1, 30) = 6.618$, $p = 0.01$); however, there was also a marginal main effect of group (high > intermediate: $F(1, 30) = 2.96$, $p = 0.086$). No significant interaction between group and gap position was found, confirming that the difference between the indirect object gap condition and subject gap condition was again equally large for both the intermediate group and the high group.

In sum, all the total RT data showed that the L2 learners generally read the subject relatives faster than the indirect object relatives. The results of individual analyses found no participant who read subject RCs more slowly than indirect object RCs. In other words, it was more difficult for all the L2 learners to read the indirect object RCs than the subject RCs, regardless of L2 proficiency level. This difficulty is observed within the RCs, becomes larger at the main verb region, and continues until the end of the sentence, revealing a main effect of type of RC. These total reading time results suggest that in general, L2 proficiency is unrelated to the processing of English relative clauses, with both proficiency groups having more difficulty with indirect object RCs. The results of the total RTs demonstrated no significant effect of the two-way interaction among RC type and proficiency level.

V. CONCLUSION

This study explores whether the distance factor proposed by O'Grady (2011) affects L2 RC processing, especially when the animacy of heads is controlled in order to tease apart the length between the filler and the gap from the animacy issue by using subject and indirect object RCs as critical items. The findings will be discussed here in terms of

the research questions. The first research question asked whether the Korean learners of English would show any difference in their processing of subject and indirect object RCs. As reported earlier, while the results of the comprehension accuracy questions showed no difference between the two conditions, the total RTs indicated that it is easier for L2 learners to process subject RCs than indirect object RCs. The L2 learners across the different proficiency levels revealed longer total RTs on the indirect object RCs than on the subject RCs. The current findings suggest that all of the L2 learners in the study tended to comprehend the two types of RC differently, demonstrating that the distance factor plays a crucial role in second language processing of English RCs.

The second research question asked whether English proficiency matters in processing the two types of RCs. To address this question, the study first used a C-test to assess participants' proficiency levels. Recall that there was a statistically significant main effect for RC type on learners' reading time data, irrespective of the proficiency level. The intermediate-proficiency group showed significantly faster total RTs with subject than indirect object RCs, just as the high-proficiency group did. The results of the present study therefore show no positive correlation between RC type and the proficiency of L2 learners of English.

To respond to the last research question, the current study's results are compared to the results of Kim's (2015b) L1 processing study, which made the same comparison (subject vs. indirect object RCs) with 42 English native speakers. The L1 study found that although comprehension scores showed no difference between the two types of RCs, the indirect object RCs were more difficult to process than the subject RCs; the native speakers spent much longer processing indirect object RCs than subject RCs. Overall, then, the earlier L1 study and the present L2 study demonstrate similar patterns by native speakers of English and L2 learners across different proficiency levels. This finding is consistent with a previous study on L2 processing by Dekydspotter, Schwartz, and Sprouse (2006), which suggested that higher proficiency L2 groups show similar processing patterns as L1 groups.[2]

In addition, the fact that L2 learners demonstrated asymmetrical patterns in processing subject and indirect object RCs is consistent with previous findings from an L1 acquisition study with English-speaking children (Kim & O'Grady, 2015). Kim and O'Grady used an elicited production task with children whose ages ranged from 5;0 to 6;10 (mean = 6;3) and an adult control group, demonstrating that the children had a

[2] Dekydspotter, Schwartz, and Sprouse (2006) argued that the fundamental mechanisms of L1 and L2 processing are the same, whereas other researchers have claimed that the mechanisms are fundamentally different (Dussias, 2003; Felser et al., 2003; Papadopoulou & Clahsen, 2003). According to Clahsen and Felser (2006), the traditional view is that L2 learners have processing difficulty in target language grammar, but that both similarities (e.g., in subdomains) and differences (e.g., in complex syntax) exist between L1 processing and L2 processing.

strong preference for subject RCs over indirect object RCs, and even the adult native-speakers preferred to produce subject RCs.

The present study is significant in that it replicates the subject–indirect object asymmetry indicated by Kim (2015b). The results of the present study confirm Kim's results of the relatively greater difficulty of indirect object RCs with longer Filler-gap dependencies (FGDs) in comparison to subject RCs with shorter FGDs. The Korean EFL learners showed longer total RTs in the former condition, leading to the conclusion that the length between the filler and the gap matters in L2 processing, just as Kim reported for L1 processing. However, the current study has several limitations. First of all, this study did not include region-by-region analyses. A future study will be conducted to investigate at which region L2 learners actually start to have processing difficulty; the results should provide information that can be used to help L2 learners gain a better understanding of English RCs in the L2 classroom. Second, more research is still needed on RC processing; it is possible to conclude from the current study's results that the subject RC is easier to process than the indirect object RC because the former follows a canonical word order in English, but the latter does not. Previous studies investigating RCs have found that several factors including word-order canonicity (Diessel & Tomasello, 2000, 2005) might influence the ease of producing and comprehending RCs. For this reason, some research has used RCs involving non-canonical word order to examine the effects of the distance factor in the processing of English RCs by native speakers (see Kim & O'Grady, 2015; Kim in progress). Therefore, the next step is to investigate whether the distance effect is present in second language processing, by using the same materials with a similar online methodology with non-native-speaker participants. Third, to check whether there is an L1 effect on L2 processing, a future study on subject and indirect object RCs in Korean is planned. Korean, like English, shows different patterns in length between the filler and the gap. If, among the factors in RC processing, distance has the most crucial effect, then Korean indirect object RCs should be easier to process than subject RCs. Therefore, the results of future research might shed light on the difficulty of RCs in both English and Korean.

REFERENCES

Aissen, J. (2003). Differential object marking: Iconicity vs. economy. *Natural Language & Linguistics Theory, 21*(3), 435-483.

Cho, S. (1999). *The acquisition of relative clauses: Experimental studies on Korean*. Unpublished doctoral dissertation, University of Hawaii at Manoa, HI.

Clahsen, H. & Felser, C. (2006). Grammatical processing in language learning. *Applied*

Psycholinguistics, 27(1), 3-42.

Comrie, B. (2007). Acquisition of relative clauses in relation to language typology. *Studies in Second Language Acquisition, 29*(2), 301-309.

Dekydspotter, L. Schwartz, B. D., & R. A. Sprouse. (2006). The comparative fallacy in L2 processing research. In M. G. O'Brien, C. Shea, and J. Archibald. (Eds.), *Proceedings of the 8th Generative approaches to second language acquisition conference*. 33-40. Somerville, MA: Cascadilla Proceedings Project.

Diessel, H. & Tomasello, M. (2000). The development of relative clauses in English. *Cognitive Linguistics, 11(2),* 121-151.

Diessel, H. & Tomasello, M. (2005). A new look at the acquisition of relative clauses. *Language, 81*(4), 882-996.

Doughty, C. (1991). Second language instruction does make a difference: Evidence from an empirical study of SL relativization. *Studies in Second Language Acquisition, 13*(4), 431-469.

Dussias, P. (2003). Syntactic ambiguity resolution in second language learners: Some effects of bilinguality on L1 and L2 processing strategies. *Studies in Second Language Learning, 25*(4), 529-557.

Eckman, F., Bell, L., & Nelson, D. (1988). On the generalization of relative clause instruction in the acquisition of English as a second language. *Applied Linguistics, 9*(1), 1-20.

Felser, C. Roberts, L., Marinis, T., & Gross, R. (2003). The processing of ambiguous sentences by first and second language learners of English. *Applied Psycholinguistics, 24*(3), 453-489.

Frazier, L. & G. B. F. d'Arcais. (1989). Filler driven parsing: A study of gap filling in Dutch. *Journal of Memory and Language, 28*(3), 331-344.

Gass, S. (1979). Language transfer and universal grammatical relations. *Language Learning, 29*(2), 327-344.

Gennari, S. & M. MacDonald. (2008). Semantic indeterminacy in object relative clauses. *Journal of Memory and Language, 58*(2), 161-187.

Gibson, E. & H. H. Wu. (2010). Processing Chinese relative clauses in context. *Language and Cognitive Processes, 28*(1), 125-155.

Gibson, E. (1998). Linguistic complexity: Locality of syntactic dependencies. *Cognition, 68*(1), 1-76.

Gibson, E. (2000). The development of locality theory: A distance-based theory of linguistic complexity. In M. Alec, M. Yasuhi, & O. Wayne (Eds.), *Image, language, brain* (pp. 95-126). Cambridge, MA: MIT Press.

Grodner, D. J. & E. Gibson. (2005). Consequences of the serial nature of linguistic input for sentential complexity. *Cognitive Science, 29*(2), 261-290.

Hamburger, H. & Crain, S. (1982). Relative acquisition. *Language development, 1*, 245-274.

Hawkins, J. A. (1999). Processing complexity and filler-gap dependencies across grammars. *Language, 75*, 44-85.

Hawkins, J. A. (2004). *Efficiency and complexity in grammars*. Oxford: Oxford University Press.

Hsiao, F. & E. Gibson. (2003). Processing relative clauses in Chinese. *Cognition, 90*, 3-27.

Jeon, K., & Kim, H. (2007). Development of relativization in Korean as a foreign language: The noun phrase accessibility hierarchy in head-internal and head-external relative clauses. *Studies in Second Language Acquisition, 29*(2), 253-276.

Just, M. A, P. A. Carpenter, & J. D. Woolley. (1982). Paradigms and processes in reading comprehension. *Journal of Experimental Psychology: General, 111*(2), 222-238.

Keenan, E. & B. Comrie. (1977). Noun phrase accessibility and universal grammar. *Linguistic Inquiry, 8*(1), 63-99.

Kidd, E., S. Brandt, E. Lieven, & M. Tomasello. (2007). Object relatives made easy: A cross-linguistic computation of the constraints influencing young children's processing of relative clauses. *Language and Cognitive Processes, 22*(6), 860-897.

Kim, C. E. (2013). *Asymmetries in the production of relative clauses: First and second language acquisition*. Unpublished doctoral dissertation, University of Hawaii at Manoa, HI.

Kim, C. E. & W. O'Grady. (2015). Asymmetries in children's production of relative clauses: data from English and Korean. *Journal of Child Language*, Retrieved August 12 from the Word Wide Web: http://www.dx.doi.org/10.1017/S0305000915000422.

Kim, C. E. (2015a). Korean children's acquisition of relative clauses. *Language Research, 51*(2), 421-441.

Kim, C. E. (2015b). Processing subject and indirect object relative clauses. *The Journal of Studies in Language, 31*(3), 583-604.

Kim, C. E. (2015c). The distance effect in the processing of English oblique RCs. *Language Research, 51*(3), 517-535.

Kim, C. E. (in progress). Processing direct object and oblique relative clauses.

Kim, J. H. (2010). The influence of sentence complexity and working memory on relative clause ambiguity resolution. *Language & Linguistics, 48*, 1-26.

Kim, J. H. (2013). L2 learners' sensitivity to gap position in English relative clauses. *Eoneohak, 66*, 31-50.

Kim, J.-T. (2004). *Wh*-movement in the L2 learner's initial syntax. *English Language & Literature Teaching, 10*(2), 1-23.

King, J. & M. A. Just. (1991). Individual differences in syntactic Processing: The role of working memory. *Journal of Memory and Language, 30*(5), 580-602.

Kwon, N., M. Polinsky, & R. Kluender. (2006). Subject preference in Korean. In D. Baumer, D. Montero, & M. Scanlon (Eds.), *Proceedings of the 25th west coast conference on formal linguistics* (pp. 1-14). Somerville, MA: Cascadilla Press.

Kwon, N. & M. Polinsky. (2008). What does coordination look like in a head-final language? In B. Lewandowska-Tomaszczyk (Ed.), *Asymmetric events: Converging evidence in language and communication research* (pp. 97-102). Amsterdam: John Benjamins.

Kwon, N., R. Kluender, M. Kutas, & M. Polinsky. (2013). Subject/object processing asymmetries in Korean relative clauses: Evidence from ERP data. *Language, 89*(3), 537-585.

Lee, J. H. (2010). A subject-object asymmetry in the comprehension of *wh*-questions by Korean learners of English. *Applied Linguistics, 31*(1), 136-155.

Lee, J. H. (2014). Working memory and a subject-object asymmetry in L2 processing of English long-distance *wh*-questions. *Korean Journal of Applied Linguistics, 30*(4), 115-139.

Lightbown, P. M., & Spada, N. (2006). *How languages are learned* (3rd ed.). Oxford: Oxford University Press.

Mak, W. M., W. Vonk, & H. Schriefers. (2002). The influence of animacy on relative Clause processing. *Journal of Memory and Language, 47*(1), 50-68.

Miyamoto, E. & M. Nakamura. 2003. Subject/object asymmetries in the processing of relative clauses in Japanese. In G. Garding &M. Tsujimura (Eds.), *Proceedings of the 22th west coast conference on formal linguistics* (pp. 342-355). Somverville, MA: Cascadilla Press.

O'Grady, W. (2011). Relative clauses: Processing and acquisition. In E. Kidd (Ed.), *The acquisition of relative clauses: Processing, typology and function* (pp. 13-38). Amsterdam: John Benjamins.

O'Grady, W. (1997). *Syntactic development*. Chicago: University of Chicago Press.

Papadopoulou, D. & Clahsen, H. (2003). Parsing strategies in L1 and L2 sentence processing: A study of relative clause attachment in Greek. *Studies in Second Language Acquisition, 24*(4), 501-528.

Reali, F. & M. H. Christiansen. (2007). Processing of relative clauses is made easier by frequency of occurrence. *Journal of Memory and Language, 57*(1), 1-23.

Schulz, B. (2006). *Wh-scope marking in English interlanguage grammars: Transfer and processing effects on the second language acquisition of complex wh-questions*.

Unpublished doctoral dissertation, University of Hawaii at Manoa, HI.

Suh, J.-S. (2004). What do our students and teachers believe about grammar in EFL context? *English Language & Literature Teaching, 10*(1), 23-52.

Traxler. M. J., R. K. Morris, & R. E. Seely. (2002). Processing subject and object relative clauses: Evidence from eye movements. *Journal of Memory and Language, 47*(1), 69-90.

Wanner, E. & M. Maratsos. (1978). An ATN approach to comprehension. In M. Halle, J. Bresnan, & G. Miller (Eds.), *Linguistic theory and psychological reality* (pp. 119-161). Cambridge: Cambridge University Press.

Warren, T. & E. Gibson. (2002). The influence of referential processing on sentence complexity. *Cognition, 85*(1), 79-112.

Wolfe-Quintero, K. (1992). Learnability and the acquisition of extraction in relative clauses and *wh*-questions. *Studies in Second Language Acquisition, 14*(1), 39-70.

Zukowski, A. (2009). Elicited production of relative clauses in children with William syndrome. *Language and Cognition Process, 24*(1), 1-42.

APPENDIX A.

Test items of the self-paced reading task

(1a) The musician that sent the book to the director was in the headlines.
(1b) The musician that the director sent the book to was in the headlines.
(2a) The actor that lent the jewelry to the journalist died last Friday night.
(2b) The actor that the journalist lent the jewelry to died last Friday night.
(3a) The scientist that gave the document to the soldier was on television show.
(3b) The scientist that the soldier gave the document to was on television show.
(4a) The teacher that showed the list to the student works at our school.
(4b) The teacher that the student showed the list to works at our school.
(5a) The employee that offered the drink to the banker stayed at home longer.
(5b) The employee that the banker offered the drink to stayed at home longer.
(6a) The girl that sold the radio to the boy was not very healthy.
(6b) The girl that the boy sold the radio to was not very healthy.
(7a) The psychologist that handed the magazine to the lawyer lives near the airport.
(7b) The psychologist that the lawyer handed the magazine to lives near the airport.
(8a) The farmer that threw the ball to the woman went to the hospital.
(8b) The farmer that the woman threw the ball to went to the hospital.
(9a) The executive that mailed the present to the pilot arrived at the store.
(9b) The executive that the pilot mailed the present to arrived at the store.

(10a) The guide that brought the wine to the reporter went to the café.
(10b) The guide that the reporter brought the wine to went to the café.
(11a) The spy that explained the plan to the mayor worked at another company.
(11b) The spy that the mayor explained the plan to worked at another company.
(12a) The pilot that passed the ball to the fireman came from New Jersey.
(12b) The pilot that the fireman passed the ball to came from New Jersey.
(13a) The man that read the book to the child stayed in the classroom.
(13b) The man that the child read the book to stayed in the classroom.
(14a) The editor that repaid the loan to the poet went bankrupt in 2009.
(14b) The editor that the poet repaid the loan to went bankrupt in 2009.
(15a) The gentleman that rented the house to the teacher had many famous friends.
(15b) The gentleman that the teacher rented the house to had many famous friends.
(16a) The singer that leased the car to the manager had a hit son.
(16b) The singer that the manager leased the car to had a hit son.

Examples in: English
Applicable Language: English
Applicable Level: College/Higher

Chae-Eun Kim
Korea Institute for Curriculum and Evaluation
Jeongdong Building, 21-15 Jeongdong-gil, Jung-gu, Seoul (04518), Korea
Department of English Language and Literature
Korea University
Anam-dong 5Ga, Seongbuk-Gu, Seoul, 136-701, Korea
Email: alohachaeeun@gmail.com

Received in January 15th, 2016
Reviewed in February 26th, 2016
Revised version received in March 5th, 2016