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Distance Matters in the L2 Processing of English Oblique RCs

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This study examines whether second language (L2) learners of English have difficulty in processing two types of English oblique relative clauses (RCs) with different lengths of filler-gap dependency (FGD). Traditional comparison (subject RC vs. object RC) is problematic due to the uncontrolled animacy of the head nouns. Therefore, this study used the oblique RCs to test a pure length effect between the filler and the gap when L2 learners read sentences with oblique RCs, involving two types of RCs: (1) oblique RCs with short FGDs; (2) oblique RCs with long FGDs. The study examines the comprehension accuracy and total reading times of 27 L2 learners of English. They all read 16 critical sentences with 32 filler items in a self-paced reading task. The results supported the distance effect because Both high-(N=13) and intermediate-proficiency (N=14) groups spend longer reading times in processing oblique RCs with long FGDs than oblique RCs with short FGDs. These results indicate the distance effect of the FGD; greater length between the filler and the gap result in L2 processing difficulty.

[L2 processing/filler-gap dependency/oblique RCs]

I. INTRODUCTION

Previous research (Jeon & Kim, 2007; J. H. Kim, 2010, 2013) on relative clauses (RCs) processing by second language (L2) learners have focused on two typical types of RCs, subject and direct object RCs, as shown in (1).

(1) a. Subject RC: the musician [that _ praised the director]
b. Direct object RC: the musician [that the director praised _]

In both (1a) and (1b), the head noun *the musician* is called the 'filler' and the empty position the 'gap.' The head noun comes from the subject position of the embedded clause in (1a), whereas the head noun comes from the direct object position of the embedded clause in (1b). Examples (1a) and (1b) have the same lexical items, however, (1a) is easier to process and comprehend than (1b) in first language (L1) sentence processing area (Wanner & Maratsos, 1978; Frazier & d'Arcais, 1989; King & Just, 1991; Gibson, 1998; Traxler et al., 2002; Gennari & MacDonald, 2008). Previous researchers believe that RCs have complex structures because they have long-distance dependencies between the filler and the gap.

(2) a. Subject RC: the musician [that _ praised the director]
|_____0__|
b. Direct object RC: the musician [that the director praised _]
|_____1_____2___|

Gibson (1998, 2000), in particular, provides the 'Dependency Locality Theory' (DLT) in his work to count lexical materials (e.g., NP, V) which have an effect on processing English RCs. As shown in (2a) and (2b), subject RCs have no intervening material between the filler and the gap, whereas there are two intervening lexical materials (e.g., *director*, *praised*) in direct object RCs. As might be expected, (2b) produces a much more burden on working memory before the filler is resolved in the gap position than (2a). Therefore, direct object RCs require a longer time to connect the filler with the empty position in the embedded clause compared to subject RCs.

However, various research on RCs processing in psycholinguistics have signified that subject-direct object comparison can be problematic because they have an issue on animacy of head nouns (Traxler et al., 2002; Mak et al., 2002; Warren & Gibson, 2002; Grodner & Gibson, 2005; Reali & Christiansen, 2007; Kim, 2013, 2015a, 2015b, 2015c, 2016).

(3) a. Subject RC: the musician [that _ praised the director]
b. Direct object RC: the music [that the director praised _]

As shown in (3b), crucially, direct object RCs in actual speech have an inanimate head noun, however, the subject in human language is animate as in (3a) (Aissen, 2003). To explain the processing asymmetries in RCs due the length of the filler-gap dependency, it is necessary to take head nouns with the same animacy because there is a high possibility that direct object RCs with animate head nouns are more arduous to process than direct object RCs with inanimate head nouns.

Kidd et al. (2007), in particular, pointed that resolving the filler-gap dependency will take longer in direct object RCs than in subject RCs when the head noun is animate because readers fail to relate the filler with the animacy of the head nouns in direct object RCs. Gennari and MacDonald (2008) also prove that the direct object RCs are easier to process when they take the inanimate head noun such as (3b). However, Kim & O'Grady (2016) suggest that comparing (3a) and (3b) still takes compounding factors because (3b) needs no syntactic knowledge to resolve the filler and the gap due to irreversibility. This means that readers can interpret (3b) without syntactic information, but infer the meaning from lexical items because the directors can praise music, but not vice versa. For this reason, RCs with an inanimate head nouns like (3b) do not require the full syntactic resources of English, and hence readers may not fully use them for syntactic processing.

In L1 processing literature, Kim (2015b) seeks to manipulate length between the filler and the gap using a self-paced reading task. Also she controls animacy-based expectations comparing subject and indirect object RCs, both of which mostly take animate head nouns, as exemplified in (4a) and (4b).

(4) a. Subject RC: the musician [that _ sent the book to the director]
|_____0__|

b. Indirect object RC: the musician [that the director sent the book to_]
|_____1_____2_____3____|

Forty-two native speakers of English took longer total reading times in the relative clause regions and the main verb regions in the indirect object RC condition than in the subject RC condition. Kim's (2016) data were collected from thirty-one Korean EFL college students, using the same task. The findings showed that no difference is founded in the comprehension scores of two (intermediate- and high-) proficiency groups between the two types of RCs. However, the reading time data reveal that L2 learners from two groups had more difficulty in processing indirect object RCs than subject RCs. Altogether, comparing subject and indirect object RCs in L1 and L2 sentence processing supports the distance effect (Hawkins, 1999, 2004; O'Grady, 2011, p. 22) of the filler-gap dependency. O'Grady (2011) suggested that the difficulty of processing RCs increases with the length of the FGD. Thus, the longer dependencies in the indirect object RCs with three intervening materials (e.g., *director, sent, book*) as shown in (4b) lead to greater syntactic complexity which provokes difficult processing.

Some works (Kim & O'Grady, 2016; Kim, 2015b) showed that this contemporary comparison is still problematic because of canonical word-order issue.

(5) a. Subject RC: the musician [that _ sent the book to the director]
S V DO IO

b. Indirect object RC: the musician [that the director sent the book to_]
S IO V DO

As in (5a), while subject RCs follow English canonical word order (S-V-DO), indirect object RCs do not, as in (5b). Some works on child language acquisition of English RCs (Diessel & Tomasello, 2000, 2005) support the Canonical Word Order Hypothesis, which provides that the linear sequence of arguments and the verb in subject RCs is closer to the basic SVO order. The fact that the indirect object RC exhibits a non-canonical word order pattern signifies a possible alternative explanation for the difficulty of indirect object RCs.

To disconnect the canonicity from the distance, Kim (2015b) compares the difficulty in processing two types of English oblique RCs, as in (6a) and (6b). Two conditions imply a directional prepositional phrase.

(6) a. Oblique RC with a short FGD:
the car [that the boy walked to _ from the church]

b. Oblique RC with a long FGD:
the church [that the boy walked to the car from _]

This study examines to test an uncontaminated distance effect by controlling the possible roles of factors such as animacy and word order. As in (6a) and (6b), both types of oblique RCs take inanimate heads (e.g., *car, church*) and they have similar non-canonical word order patterns. Both have a directional prepositional phrase (*to/from*), however, they differ in the distance of the filler-gap dependency as in (7).

(7) a. Oblique RC with a short FGD:
the car [that the boy walked to _ from the church]
|_____1____2_____|

b. Oblique RC with a long FGD:
the church [that the boy walked to the car from _]
|_____1____2_____3_____|

Two lexical materials (e.g., *boy, walked*) occur between the filler and the gap in the oblique RC with a short FGD; however, three lexical items (e.g., *boy, walked, car*) are intervened between the filler and the gap in the oblique RC with a long FGD. Therefore, the distance hypothesis supposes that (7a) will be easier to process than (7b). To see the distance effect in RC processing, Kim (2015c) tested 40 adult native English speakers

using a self-paced reading task. The results showed that the L1 speakers had lower accuracy scores on the oblique RCs with a long FGD than on the oblique RC with a short FGD. The readers had more difficulty in processing the oblique RCs with a long FGD because they spent much longer time compared to the oblique RCs with a short FGD.

The purpose of the present study is to investigate whether L2 learners indicate any difference in the processing difficulty of oblique RCs with different lengths of FGD. It can be essential to use the purer items to see the distance effect in second language processing. The present study is conducted to investigate how Korean EFL learners process two oblique RCs differently and how English proficiency affects processing patterns. The following research questions are investigated:

1. Do Korean EFL learners manifest difference between the oblique RC with a short FGD and the oblique RC with a long FGD? If so, which type of oblique RCs is more difficult to process for L2 learners?
2. Does language proficiency have any effect on processing two types of oblique RCs?
3. Are L1 and L2 speakers' processing patterns of two types of oblique RCs (dis)similar?

The predictions for three research questions are as follows. First, the comprehension scores and total reading time data will show that Korean L2 learners of English have greater difficulty in comprehending the oblique RC with a long FGD than the oblique RC with a short FGD, as predicted by the distance hypothesis. Second, it can be predicted that the high-proficiency group will have less difficulty in reading oblique RCs than the intermediate-proficiency group. Third, to see whether L2 data show (dis)similar processing pattern, Kim's (2015c) L1 data will be recalled.

II. METHOD

1. Participants

Twenty-seven Korean learners of English (n = 27) enrolled in a university in Seoul participated in this study. All were born and raised in Korea, and learned English as a foreign language. There were 13 males and 14 females, all of whom were majoring in English language and literature. The age of the participants ranged from 19 to 25 years with a mean of 21.25. Their English proficiency was measured by a C-test (Schulze,

2006). Their scores ranged from 23 -35 out of 40, with a mean of 29.44. The participants were divided into two groups: the intermediate-proficiency group (14 participants: below the mean score) and the high-proficiency group (13 participants above the mean score).

2. Materials

In the experiment, all participants read sentences containing oblique RCs. Sixteen sets of test items were prepared, each with two conditions as in Table 1. Half of the critical items were oblique RCs with a short FGD and half were oblique RCs with a long FGD. The sentences in the two conditions have the same lexical elements but differ in the order of the words in the RCs. The length between the filler and the gap position was an independent measure for the experiment. To make participants unnoticed what the experiment is about, 32 filler items were contained with the critical items. All filler items were as complex as the critical items.

TABLE 1

Sample Test Item

Region	Oblique RCs with a short FGD	Oblique RCs with a long FGD
R1	the	the
R2	church	car
R3	that	that
R4	the	the
R5	boy	boy
R6	walked	walked
R7	to	to
R8	from	the
R9	the	church
R10	car	from
R11	was	was
R12	very	very
R13	large	large

As in Table 1, in both types of test items, the subjects in the embedded clauses were animate and human (e.g., *boy*) and the noun phrases in the relative clauses were inanimate and locatives for the event indicated by the verb in the sentences (e.g., *church*, *car*).

3. Procedure

A self-paced moving-window reading task (Just et al., 1982) is widely used in psycholinguistic to see how subjects parse various types of sentences. In the task, non-cumulative and word-by-word reading task was adopted. Participants had one word at a time (see Table 1) and read a whole sentence by pressing the button. To test whether L2 learners have more difficulty in reading oblique RCs with a long FGD than oblique RCs with a short FGD, (1) comprehension questions were given to participants after the last words of each sentence; and (2) reading times at all regions in the sentences were recorded for further analysis. Participants were in a quiet place for the experiment.

After the reading task, the participants took a C-test consisting of two short texts with 40 blanks. As the last step, the participants filled out a language background questionnaire to ask their self-rated English proficiency (speaking, reading, listening, and writing).

III. RESULTS

1. Comprehension Score

The mean scores for two conditions are shown in Table 2. The overall score on all comprehension questions was 69.45% for the intermediate-proficiency group and 71.7% for the high-proficiency group. Comprehension accuracy for the intermediate-proficiency group in the oblique RCs with short FGDs and the oblique RCs with long FGDs was 72% and 66.9%, respectively; while for the high-proficiency group, it was 70.4% and 73%, respectively. Overall, these results indicate that L2 leaners in the intermediate-proficiency group comprehended oblique RCs with a short FGD better than oblique RCs with a long FGD. The distance between the filler and the gap and the proficiency of the L2 leaners were used as two independent variables, with comprehension scores as a dependent variable. A two-way ANOVA with a group as the between-subject factor and the distance between the filler and the gap as the within-factor showed no significant effect of the distance and no main effect of group (high > intermediate). These results demonstrate that the mean scores for both RCs by all L2 learners were similar and offer that the EFL learners comprehended two types of oblique RCs at a similar level. However, the difference between two conditions for the intermediate-proficiency group is numerically larger than for the high-proficiency group.

TABLE 2
Comprehension Accuracy

Proficiency group	OBL RCs with Short FGDs	OBL RCs with Long FGDs	Total
Intermediate	72%	66.9%	69.45%
High	70.4%	73%	71.7%

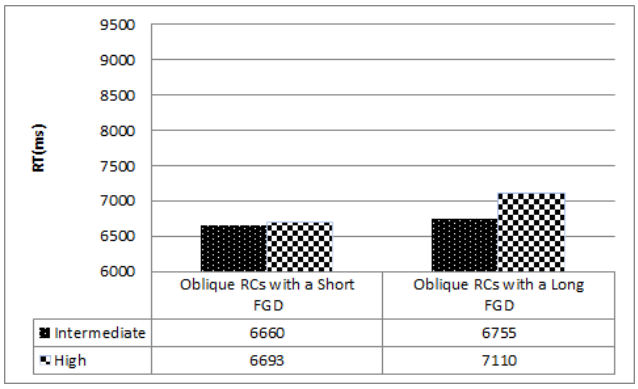
(The mean scores represent the percentage of correct answers.)

2. Total Reading Times

The means of the total RTs for the two types of oblique RCs were interpreted to prove whether the RTs for each condition were different. For analyzing the total RTs, 2.5 SD of the mean per word position was a cutoff value for data trimming. Four sets of regions were calculated: (1) R1-R10; (2) R1-R11; (3) R1-R12; and (4) R1-R13.

(8) a. Oblique RC with short FGD:
the church [that the boy walked to _ from the car]
b. Oblique RC with long FGD:
the car [that the boy walked to the church from _]

FIGURE 1
Total RTs in ms from R1-R10



The first analysis looked at the RTs for R1-R10; and (8a) and (8b) show the words from the head noun to the end of the embedded clause. The results are presented in Figure 1. The distance effect was tested for significance with a two-way mixed model ANOVA with group (intermediate/high) as the between-subject factor and the length between the filler and the gap (short FGD/long FGD) as the within-subject factor. The total RTs from R1 to R10 for the oblique RC with a short FGD were numerically shorter

than the RTs for the oblique RC with a long FGD (6660 ms vs. 6755 ms) for the intermediate-proficiency group; however, this difference was larger for the high-proficiency group (6693 ms vs. 7110 ms). The comparison shows an astonishing asymmetry in total RTs between the two conditions for the high-proficiency group. The analysis showed no a significant main effect of the distance (oblique RC with a short FGD > oblique RC with a long FGD: $F(1,26) = 1.98.$, $p = .48$); however, there was main effect of group (intermediate > high: $F(1,26) = 2.53$, $p < .05$). In addition, there was no a significant interaction between group and gap position, confirming that the difference between two types of oblique RCs was equally large for the intermediate group and the high group.

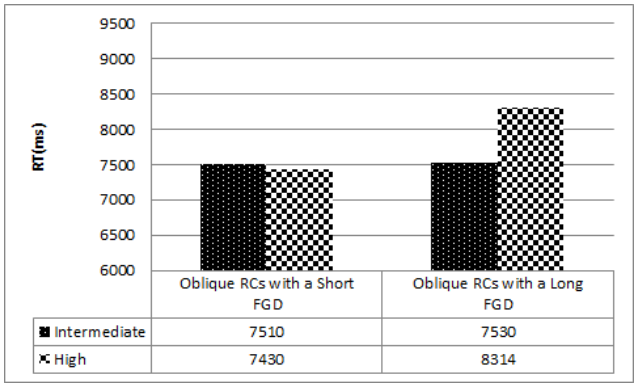
Next, total RTs in regions 1-11 as exemplified in (9), which include the main verb region (R11), were analyzed.

(9) a. Oblique RC with short FGD:
the church [that the boy walked to _ from the car] was

b. Oblique RC with long FGD:
the car [that the boy walked to the church from _] was

FIGURE 2

Total RTs in ms from R1-R11



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 previous analysis of region 1-10. The total RTs from R1 to R11 for the oblique RC with a short FGD were numerically shorter than the RTs for the oblique RC with a long FGD (7510 ms vs. 7530 ms) for the intermediate group; this difference was much larger for the high group (7430 ms vs. 8314 ms). The analysis revealed a significant main effect of the distance (oblique RC with a short FGD > oblique RC with a long FGD: $F(1,26) = 2.24$, $p = .025$); also,

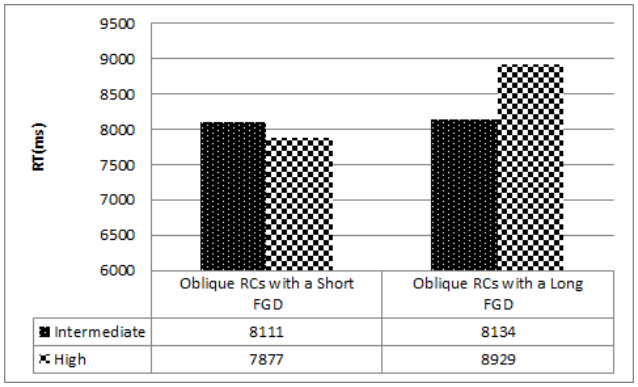
there was main effect of group (intermediate > high: $F(1,26) = 5.32$, $p < .05$). Also, there was significant interaction between group and the distance factor, confirming that the difference between two conditions was larger for the high-proficiency group than the intermediate-proficiency group ($F(1,26) = 3.12$, $p < .05$) .

As the third analysis, total RTs in regions 1-12, which include the adverb region (R12) as exemplified in (10), were analyzed. The total RTs for the third analysis are shown in Figure 3.

(10) a. Oblique RC with a short FGD:
the church [that the boy walked to _ from the car] was very
b. Oblique RC with a long FGD:
the car [that the boy walked to the church from _] was very

FIGURE 3

Total RTs in ms from R1-R12



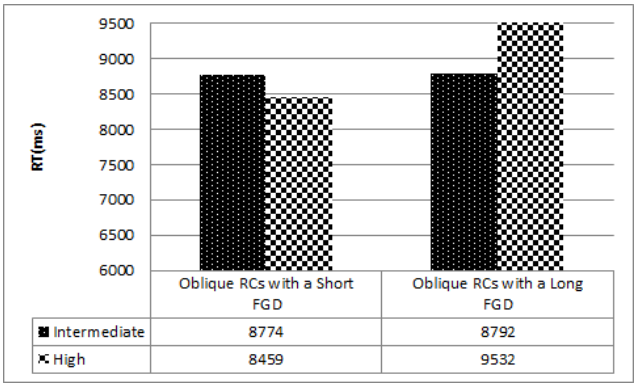
The total RTs from R1 to R12 for the oblique RC with a short FGD were also much shorter than the RTs for the oblique RC with a long FGD (8111 ms vs. 8134 ms) for the intermediate group; this difference was smaller for the high group (7877 ms vs. 8929 ms). The analysis of the total RTs from R1 to R12 revealed a significant main effect of distance (oblique RC with a short FGD > oblique RC with a long FGD: $F(1,26) = 1.85$, $p = .02$); also, there was main effect of group (intermediate > high: $F(1,26) = 7.05$, $p < .05$). There was significant interaction between group and the distance factor, confirming that the difference between two conditions was larger for the high-proficiency group than the intermediate-proficiency group ($F(1,26) = 2.05$, $p < .05$).

The fourth analysis was conducted on the total RTs for regions 1-13, as exemplified in (11). The results are shown in Figure 4.

(11) a. Oblique RC with a short FGD:
the church [that the boy walked to _ from the car] was very large
b. Oblique RC with a long FGD:
the car [that the boy walked to the church from _] was very large

FIGURE 4

Total RTs in ms from R1-R13



The total RTs from R1 to R13 for the oblique RC with a short FGD were also much shorter than the RTs for the oblique RC with a long FGD (8774 ms vs. 8792 ms) for the intermediate group; this difference was smaller for the high group (8459 ms vs. 9532 ms). The analysis revealed a significant main effect of the distance (oblique RC with a short FGD > oblique RC with a long FGD: $F(1,26) = 1.98$, $p = .025$); also, there main effect of group (intermediate > high: $F(1,26) = 7.6$, $p < .05$). In addition, there was significant interaction between group and the distance factor, confirming that the difference between two conditions was larger for the high-proficiency group than the intermediate-proficiency group ($F(1,26) = 2.95$, $p < .05$).

In sum, all the total RT data showed that the EFL learners read the oblique RCs with a short FGD faster than the oblique RCs with a long FGD. Generally, it was more difficult for all the L2 learners to read the oblique RCs with a long FGD than the oblique RCs with a short FGD. This difficulty is observed within the RCs, becomes larger at the main verb region, and continues until the end of the sentence, revealing the main effect of type of RC. These total reading time data suggest that L2 proficiency is related to the processing of English oblique RCs, with both proficiency groups having more difficulty with oblique RCs with a long FGD. The results of the total RTs demonstrated significant effect of the two-way interaction among the distance between the filler and the gap in English oblique RCs and proficiency level.

IV. CONCLUSION AND IMPLICATIONS

The research investigated the EFL learners' reading oblique RCs pattern regarding their language proficiency and the followings are the results of three research questions.

The first question asked whether the Korean learners of English would show any difference in processing of two oblique RC. The results of the comprehension accuracy scores showed no difference between the two conditions, the total RTs indicated that it is easier for L2 learners to process the oblique RC with a short FGD than the oblique RC with a long FGD. The L2 learners across the different proficiency levels revealed longer total RTs on the oblique RCs with a long FGD than on the oblique RCs with a short FGD. The current findings suggest that all of the L2 learners in the present 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.

TABLE 3

RTs Difference for Each Condition by Group

	Intermediate	High
R1-10	95	417
R1-11	20	884
R1-12	23	1052
R1-13	18	1073

The second 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. The L2 learners showed significantly faster total RTs with the oblique RCs with a short FGD than the oblique RCs with a long FGD from R1-13. However, difference of the total reading times is larger in the high-proficiency group than in the intermediate-proficiency group. As seen in Table 3, differences of RTs for two conditions were much larger in the high-proficiency group than the intermediate-group; also, the difference got bigger from R11 and continued gradually until R13. The high-proficiency group showed significantly faster total RTs with the oblique RC with a short FGD than the oblique RC with a long FGD, whereas the intermediate-proficiency group showed a numeral difference between the two conditions from R1-R13.

The last research question requires comparison the results of the study with the results of L1 processing study. Kim (2015c) used the same comparison (oblique with a short FGD vs. oblique RC with a long FGD) with 40 English native speakers. The L1 study found that comprehension scores showed significant difference between the two types of oblique RCs, and the oblique RCs with a long FGD were more difficult to process than

the oblique RCs with a short FGD. The high-proficiency group showed similar RTs patterns (i.e., larger RTs difference); however, the intermediate group showed no big RTs difference. This finding is consistent with a previous study on L2 processing, which suggested that higher proficiency L2 groups show similar processing patterns as L1 groups (Dussias, 2003; Dekydspotter et al., 2006). In addition, because there was no significant difference between two conditions for the intermediate-proficiency group, their L2 processing can be considered 'shallow processing' (Felser et al,, 2003; Clahsen & Felser, 2006; see Kim, 2016).

In addition, the fact that L2 learners demonstrated asymmetrical patterns in processing two oblique RCs is consistent with previous findings from an L1 acquisition study with English-speaking kids and adults (Kim, 2013). Kim used an elicited production task with children (5;0-6;10, mean = 6;3) and adult control group. Both the children and the adults showed strong preference for oblique RCs with a short FGD over oblique RCs with a long FGD. The results of the present study confirm Kim's L1 work demonstrating that L1 speakers have greater difficulty in comprehending oblique RCs with relatively longer filler-gap dependencies. The Korean EFL learners showed longer total RTs in the oblique with a long FGD, thus, the results support the distance hypothesis as L1 study reported (Kim, 2015c).

English oblique RCs are infrequently used in English L1 and L2 speech (see Kim 2013). In addition, English grammar materials focus on subject and direct object RCs more than other types of RCs. Infrequent use in both actual speech and L2 classroom may cause difficulty in comprehending English oblique RCs by L2 learners. Therefore, in the L2 grammar classroom it is required to give a lesson on English relative clauses to students to make them identify different types of relative clauses within a text or isolated sentences. When students have a basic understanding of oblique relative clauses, they need a speaking or writing activity in which they can produce a sentence in the form of English oblique relative clauses (Suh, 2004).

This study has several limitations. First of all, the test items in the study are highly infrequent in actual speech. To control animacy and the word-order canonicity, two oblique RCs with different length of filler-gap dependency were used, however, it may cause the difficulty of processing, not just from the length of filler-gap dependency but from infrequent usage of oblique RCs. Secondly, all test items used in the study have two directional prepositional phrases (goal-source); however English also allows S-V-OBL (source)-OBL (goal) because two elements can be ordered with respect to each other. Therefore, to confirm the distance effect it is needed to consider the question of whether PP order affects processing English oblique RCs.

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Examples in: English
Applicable Language: English
Applicable Levels: Secondary, College, Higher

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