Sentence Processing of EFL Learners in English Relative Clause Attachment*

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Park, Boon-Joo. 2010. Sentence Processing of EFL Learners in English Relative Clause Attachment. *The Linguistic Association of Korea Journal.* 18(2). 69-88. This study investigates the sentence processing in English with Korean EFL learners who have limited language exposure compared to the environment of the first language acquisition and the second language learning. The goals are to explore whether EFL learners show the same NP attachment preference as native speakers of English have shown and whether the syntactic priming effect will occur with EFL learners. Two experiments were conducted to answer the two research questions. The results showed that EFL learners preferred HA for relative clause(RC) attachment, contrary to the results in the previous studies with native speakers of English. Also, syntactic priming effects were observed in RC attachment: robust effect in HA and weak effect in LA.

Key Words: sentence processing, relative clause attachment, syntactic priming effect, EFL learners

1. Introduction

Numerous studies have explored the sentence processing on attachment preferences in ambiguous structures containing a complex noun phrase(NP) followed by a relative clause(RC) which modifies either of two nouns in the complex NP. The sentence having complex noun phrase (e.g. 'Someone shot the

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servant of the actress who was on the balcony.') can be ambiguous concerning the attachment of the relative clause(hereafter RC). The RC can attach either the NP1('the servant'), which is known as *high* attachment(HA), or the NP2 close to the RC('the actress'), which is known as *low* attachment(LA). There have been studies about how this kind of ambiguous structure can be processed differently in the cross-linguistic perspective and between L1 speakers and L2 learners.

The present study aims to explore the sentence processing in English with Korean EFL learners. The purpose of the current study is two-fold: whether EFL learners show the same NP attachment preference as native speakers of English have shown and whether the syntactic priming effect occurs with EFL learners. The significant aspect of the current study lies in the facts that the processing of NP attachment is based more on syntactic information than on lexical information (Desmet & Declercq, 2006) and the participants are EFL learners, who have limited language exposure compared to the environment of the first language acquisition and the second language learning.

2. Literature Review

2.1 Relative Clause Attachment Preference

Ambiguous relative clause construction with complex NP has been implemented in several studies to investigate sentence processing and parsing strategies not only in English but also in other languages.

Various studies conducted to investigate cross-linguistic differences in NP attachment preferences. Low attachment preferences have been found in several languages such as English (Cuetos & Mitchell, 1988), Norweigian, Romanian, and Swedish (Ehrlich, Fernandez, Fodor, Stenshoel, & Vinereanu, 1999). On the other hand, HA preferences have been observed in numerous languages not only in head-initial languages such as Dutch (Brysbaert & Mitchell, 1996), French (Pynte, 1998), German (Konieczny & Hemforth, 2000), Italian (Frenck-Mestre & Pynte, 2000), but also in head-final languages such as Japanese (Kamide & Mitchell, 1997) and Korean (Jun, 2003; Lee & Kweon, 2004; Kim, 2009) However, Kim (2009) found HA preference in Korean with

more complex RC whereas LA preference was found in less complex RC, suggesting that sentence complexity effects involved as a factor.

Early studies have been focused on the universal stands that parsing strategies are essentially the same for all languages. Garden-path theory is the most widely discussed universal concept for parsing (Frazier 1979, Frazier & Rayner, 1982). Garden-path theory explains that a processor assumes particular meaning of a word or a phrase in an ambiguous sentence but discovers later that the assumption is incorrect and the processor backtracks and reinterprets the sentences. The main point is that at the first stage of analysis, computational effort is dedicated exclusively to the interpretation selected from the conflict-resolution device. Within this framework, several principles have been discussed such as Minimal attachment (Frazier, 1979; Frazier & Rayner, 1982), Late Closure (Frazier, 1987; Frazier & Fodor, 1978; Kimball, 1973), Relativized Relevance (De Vincenzi & Job, 1995), Construal principle (Gilboy, Sopena. Clifton & Frazier, 1995), and Implicit Prosody Hypothesis(Fodor, 1998).

2.2 Syntactic Priming Effect

Syntactic priming effect is a tendency that speakers are more likely to use the syntactic structure in the case that the same structure was used in a preceding sentence compared to the case in which a different syntactic structure was used in a preceding sentence. McDonough and Trofimovich (2009) define that the priming phenomena are types of repetition priming. Repetition priming can occur when language user's preceded experiences related to the language forms facilitate the processing of the phonological or syntactic structures (Ellis & Ellis, 1998; Kirsner, 1998).

For example, Levelt and Kelter(1982) conducted telephone surveys, in which the researcher asked the clerk two forms of questions: one with a prepositional phrase ('*At* what time does your shop close?) and the other with a noun phrase ('What time does your shop close?). This sociolinguistic study found that the forms in the questions are carried over in the answers, such as '*At* what time does your shop close? – *At* five o'clock,' and 'What time does your shop close?- Five o'clock.'(Levelt & Kelter 1982). Hence the phenomenon that the structure is

carried over to the other utterance appears during the conversational exchanges (Levelt & Kelter, 1982).

A variety of grammatical structures in the research on syntactic priming effect have been implemented on the syntactic priming research. With regard to the essential requirement for potential target structures in syntactic priming research, the same meaning is carried onto an alternative structure. Meeting with this requirement, numerous studies have used target structures such as transitive alternations (active vs. passive) and dative alternations(prepositional datives vs. double object datives) (Bock, 1986; Bock, 1989; Bock & Griffin, 2000; Bock & Loebell, 1990; Branigan, Pickering, & Cleland, 1999, 2000; Corley & Sheepers, 2002; Hartsuiker & Kolk, 1998a, 1998b; Hartsuiker, Pickering, & Veltkamp, 2004; Pickering, Branigan, & McLean, 2002; Potter & Lombardi, 1998; Park, 2008a, 2008b, 2008c; Schoonbaert, Hartsuiker, & Pickering, 2007).

L2 studies on priming effect have been interested in the question whether second language learners show the same representations and mechanisms as the L1 speakers show or whether they show differently from the L1 speakers do. A number of studies have conducted the research on L2 priming effects (Bernolet, Hartsuiker, & Pickering, 2007; Bird & Williams, 2002; Favreau & Segalowitz, 1983; Frenck-Mestre & Prince, 1997; Grices & Wulff, 2005; Kim & McDonough, 2008; McDonough, 2006; McDonough & Mackey, 2008; Schoonbaert, Hartsuiker, & Pickering, 2007; Park, 2008a, 2008b, 2008c; Trofimovich, 2005; Trofimovich & Gatbonton, 2006, Trofimovich, 2008).

For example, Gries & Wulff(2005) conducted a written sentence completion task for syntactic priming research. 64 university students of native speakers of German who speak English as L2 participated. They found priming effects for both double-object and prepositional dative structures. However, with respect to the task for priming study, McDonough (2006) emphasized on the interaction with native speakers in L2 development. The syntactic priming effect was considered as one of several facilitators such as negative feedback, enhancing salience of positive evidence, and raising learners' awareness. She implemented the scripted technique which had been used by Branigan and colleagues (Branigan, Pickering, & Cleland, 2000; Hartsuiker et al., 2004). The participants in her study were second language speakers of English from various ethnic groups. The target structure was dative constructions, double object dative and

prepositional dative alternation. They found a robust priming effect on the prepositional dative, but a weak effect was shown on the double object dative. Concerning the weak priming effect on double object dative structures, the author suggested that the English L2 speakers may have incomplete linguistic knowledge of dative alternation. Also, their double dative alternations may be associated with limited usage of the dative, such as 'specific lexical items or specific discourse contexts' (McDonough, 2006, p.197). A question about the participants' L1 linguistic influence was discussed in Park(2008a). Bernolet, Hartsuiker, & Pickering (2007) also conducted syntactic priming research with 32 university students who speak Dutch as L1 and English as L2. In this research, scripted interaction task was implemented. The results showed priming effects in word order with relative clauses.

In picture description tasks which were implemented for syntactic priming effects, the lexical words were provided in the picture (Kim & McDonough, 2008; McDonough, 2006; Hartsuiker, Pickering, and Veltkamp, 2004). Desmet & Declercq(2006) pointed out the close lexical representations. In the language production model, the combinatorial information can be represented in the lemma stratum and its activation is totally dependent on the lexical entries (for detail language production model, please refer to Park, 2009)

However, Desmet & Declercq(2006) insist that syntactic priming studies using the relative clause attachment are more closely tied to syntactic representation than being tied to specific lexical items. Desmet & Declercq(2006) state that syntactic representation in the processing of two alternative attachments to relative clauses is not limited to lexical and specific lexical items in terms of the following reasons. First, the same relative pronoun is used whether the construction of the relative clause is HA or LA, so the possibility that the lexical priming of function words have influence on the priming effect is very low. Secondly, different from the target structures such as dative structures or transitive structures, relative clauses play a role of modifiers. Modifiers are not represented in the argument structures according to the standard linguistic theories. In other words, in the dative structures, the lexical entry of a ditransitive verb like "give" expects to be followed by two complements to be grammatical sentence, such as two noun phrases in the double-object construction and one noun phrase and one prepositional phrase

in the prepositional dative construction. However, the relative clause as a modifier does not have the restriction such as argument structure.

Admitting those advantages as stated above, a few studies including Scheepers(2003) and Desmet & Declercq(2006) investigated the priming effect in the relative clause completion with two possible noun phrases attachment sites. In the priming paradigm, the relative clause attachment was manipulated towards HA or LA by manipulating the gender of relative pronouns in Dutch(Desmet & Declercq, 2006) and in German(Scheepers, 2003). In the cross linguistic study between Dutch and English of Desmet & Declercq(2006) manipulated the number agreement between antecedent and the verb in the relative clause. Scheepers(2003) found that participants tend to increase HA preference followed by high-attachment inducing priming in German. Desmet & Declercq(2006) investigated the cross-linguistic priming effect through three experiments: 1) Dutch L1 speakers with the gender agreement marked on Dutch relative pronoun 2) cross-linguistic priming from Dutch to English for Dutch L1 and English L2 speakers, and 3) replication of experiment 2 in order to exclude the explanation related to discourse-level priming. The participants completed the target sentence beginnings followed by three types of prime sentence beginnings: high-attachment inducing prime, low-sentence the relative clause, and baseline prime. As a result, overall priming effects were observed. In other words, the participants have a higher tendency to HA followed by the HA priming and have higher tendency to LA followed by the LA priming. These results in RC attachment priming imply that priming effect may have influenced on the participants' implicit sentence processing strategy.

3. The Current Study

The present study admits the advantages of RC attachment as a good tool to assume participants' syntactic information representation and implicit sentence processing strategy. In addition, this research focuses on EFL learners who have limited experience of syntactic information compared to the native speakers of the language. It aims to investigate the following two research questions:

Research question 1.

Do EFL learners show the same NP attachment preference as native speakers of English have shown? The present study hypothesizes that if the limited syntactic information and L1 influence play a role, RC attachment would be different from the results of the previous studies. This question will be investigated in Experiment 1.

Research question 2.

Do EFL learners show syntactic priming effect in RC attachment preference? The present study hypothesizes that if participants uses the previous syntactic information as a sentence processing implicitly, priming effects will be observed in Experiment 2.

4. Experiment 1

4.1 Participants

43 volunteers participated in this study and they consist of 33 female and 10 male students. Their mean age is 24.44 years old (SD=3.692) ranging from 22 to 40 years old. They are all native speakers of Korean who have studied English as a foreign language. They are taking English composition class in a university located in Daegu city, which is offered as a major course in the English department. Their language proficiency is high intermediate level (average TOEIC score = 818.16). They are unaware of the purpose of the study.

4.2 Material

The sentences for this study were adopted and modified from a part of sentence items of Desmet & Deslercq's(2006) second experiment which were implemented in cross-linguistic priming between Dutch and English. The main task is a sentence completion task. Participants are provided with sentence beginning fragment in the questionnaire and they complete ambiguous relative clauses with two possible NP attachment sites. The experiment items consist of

15 target sentence fragments and 15 filler fragments. The target sentence fragment contains two NP phrases combined with preposition 'of', in which the number of NPs was manipulated. For example, if NP1 is singular, then NP2 is plural, and if NP2 is singular, then NP2 is vice versa. The order of singular NP and plural NP was represented randomly through the whole items. Participants were guided to use the present tense of the verb in order to be read off easily which NP is attached by a relative clause. Of course the researcher's intention was concealed to the participants. The target fragments used in Experiment 1 can be found in Appendix I.

4.3 Analysis

Participants' sentence completion was analyzed based on the number agreement between the host noun and the verb in relative clause. The data were coded into 'high attachment (HA, or NP1)', 'low attachment (LA, or NP2)', or 'Other(OT)'. When the number of verb in RC agrees with NP1, the sentence completion is analyzed into HA. In addition, when the number or verbs in RC agrees with NP2, the sentence completion is analyzed into LA. When participants use the past tense of a verb or auxiliary(e.g. can, may, will, etc) so the NP attachment is not clear, the sentence completion is analyzed as 'Other'.

4.4 Results and Discussion

With regard to the host NP that relative clause attached to, most of the sentence completions of relative clauses (90.54%) could be read off by the number agreement between the host NP and the verb in RC except 9.46% of RC completions. The results are shown in Table 1 and Figure 1.

Table 1. Relative Clause Attachment Preference of EFL Learners

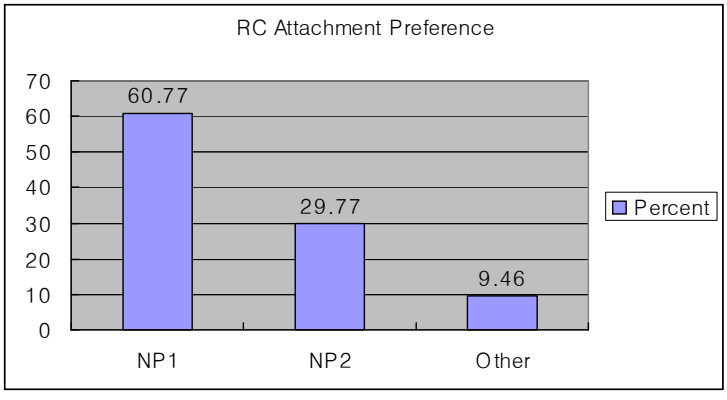
	HA	LA	OT	Total
Frequency	392	192	61	645
Percentage	60.77	29.77	9.46	100.

HA, high attachment; LA, low attachment' OT, other.

As shown in Table 1 above, the results show that participants completed

ambiguous relative clauses with high attachment by 60.77%, compared to low attachment with 29.77%. These results are not consistent with the previous report of Cuetos and Mitchell(1988) They found native speakers of English showed a higher preference of LA in English. Figure 1 shows the difference more clearly.

Figure 1. Relative Clause(RC) Attachment Preference



The contrary results with Korean EFL learners may be attributed from the influence of L1 sentence processing. Since head-final languages such as Korean and Japanese have shown LA preference in the previous studies such as Jun (2003) and Lee & Kweon (2004), the results in the present study can be interpreted as L1 influence. As mentioned earlier, EFL learners have limited language usage of the target language. The sentence processing strategy from their L1 may have been transferred into their L2 sentence processing.

5. Experiment 2

5.1 Participants

190 university students participated in this study. The participants consisted of 138 female and 52 male university students. Their age ranged from 18 to 29 years old and the mean is 22.97 years old(SD=2.073). They are all native

speakers of Korean and have studied English as a foreign language. They are all undergraduate students who have been taught English at least 6 years in middle and high schools, and they were taking several English related courses, such as English Comprehension I, II, and English Grammar, during semester when data were collected. Their language proficiency is at an intermediate level from the report of their TOEIC score (mean = 647.57). The test type that participants took was provided in random order. The purpose of the study is not known to participants.

5.2 Materials

The material implemented in experiment 2 was adopted and modified from a part of English sentence items in Desmet and Declercq's (2006) study. The experimental items consisted of 12 priming sentence beginnings and 12 target sentence beginnings. In addition, 20 filler fragments were used. Each of the 12 target sentence beginnings was immediately preceded by one of two prime sentences: a high-attachment inducing prime or a low-attachment inducing prime. The examples of prime, fragment, and filler fragments are shown in (1) below.

(1) a. The director congratulates the instructor of the schoolboys who are _____. (Prime fragment)
b. The concert manager waits for the musicians of the pop star that _____. (Target fragment)
c. The expert calls the help desk of the companies when _____. (Filler fragment)

The test material was composed of four types(A, B, C, and D). The number(singular vs. plural) and the order of two noun phrases in the priming fragment were counterbalanced in the four types of tests as shown in the example of (2). The participants test type was chosen randomly by participants. The full sentence items in test A are provided in Appendix II.

(2) A: The doctor recognised the nurse of the pupils who was _____.

B: The doctor recognised the nurse of the pupils who were _____.
C: The doctor recognised the pupils of the nurse who were ____.
D: The doctor recognised the pupils of the nurse who was ____.

There is no semantic or conceptual relation between the prime sentences and the target sentences. In the high-attachment primes, the verb in the relative clause agreed in number only with the first noun phrase and thus could not refer to the second noun phrase. In the low-attachment primes, the verb in the relative clause agreed in number only with the second noun phrase. The ambiguity of the noun phrases in the target sentences was checked to make sure whether the attachment preference in the target sentences is not influenced by the potential stronger tendency in the Desmet and Declercq's study.

5.3 Analysis

First the priming fragment completions were coded into whether they completed the sentence or not. The target sentence completions were coded into NP1 attachment (NP1), NP2 attachment(NP2), and other(OT). It was obvious that the relative clause attachment is NP1 or NP2 in case that the verbs used in the relative clause are one of BE verbs('is/was' for singular and 'are/were' for plural), HAVE verb('has' for singular and 'have' for plural), and 3rd person singular marked -s for common verbs. However, in the case either the preceding priming sentence fragments were incomplete, or the place of attachment is not clear such as "We were amused about the articles of the newspaper that had interesting stories," the target sentence completion was coded as 'Other'.

5.4 Results and Discussion

The paired samples t-test was executed for the statistical analysis. The target completions between HA priming condition and LA priming condition were compared. The results of mean and the mean difference are presented in Table 2.

Table 2. Priming effect in RC attachment preference

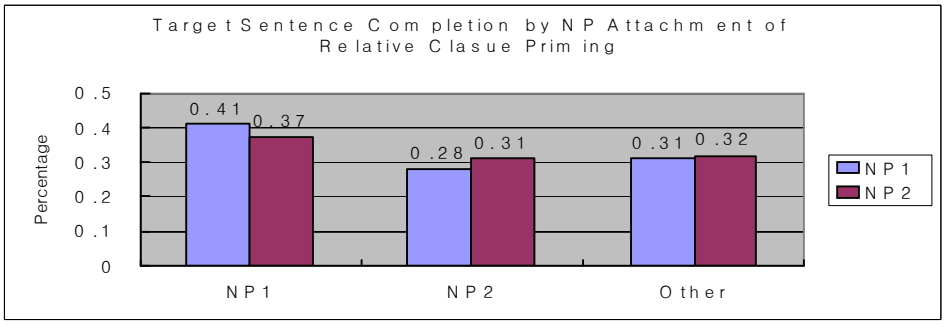
	RC attachment preference		
Priming Type	HA(NP1)	LA(NP2)	Other
HA(NP1)	41.17%	27.88%	30.95%
LA(NP2)	36.56%	31.4%	31.45%
Priming Effect	*4.61	3.52	

* $p < 0.05$

As the results of experiment 1 showed high attachment(NP1) was preferred overall consistent with the results in Experiment 1. In the priming condition in experiment 2, in NP1 attachment(HA) inducing primes, participants tend to complete the target sentence fragments using more NP1 attachment(41.17%) rather than NP2 attachment(30.95%). The mean difference is 4.61% and the paired-samples t-test shows a significant effect ($t(1, 167) = 2.133$, $p < 0.05$).

In addition, when the priming is NP2, LA inducing, participants tend to complete the target sentences using NP2 LA (31.4%), a slightly higher than HA (27.88%). The mean difference is 3.52 and the paired-samples t-test shows a marginal effect ($t(1, 167) = 1.694$, $p=0.092$).

Figure 2. Priming effect in RC attachment



To sum up, as seen in the graphs of Figure 2, Korean EFL learners were more likely to produce a relative clause that attached to NP1 which is the higher noun phrase in the syntactic tree configuration when they had been induced to complete relative clauses with a NP1 attachment(HA) of relative clause in the previous item compared to when they had been induced to

complete relative clauses with a NP2 attachment(LA) of relative clause in the previous item. Hence, target sentence completion with NP1 attachment(HA) stimulated by NP1 attachment priming showed stronger priming effects than that with NP2 attachment stimulated NP2 attachment(LA) priming.

With regard to an overall tendency in preference of RC attachment is consistent with that in Experiment 1. However, priming stimuli might have played as a role of previous experiences related to the language structures and enhanced their sentence processing strategy. As stated in section 2, language user's preceded experiences related to the language forms facilitate the processing of the phonological or syntactic structures(Ellis & Ellis, 1998; Kirsner, 1998).

As for the stronger priming effects in HA than LA, their L1 linguistic experience for sentence processing might have influenced as discussed in Experiment 1. However, this aspect leaves leeway for further study.

7. Conclusion

The goals of this study were to investigate whether EFL learners showed similar NP attachment preference in relative clause completion task to the native speakers of English and whether priming effects would be observed in the NP attachment of RC stimuli. NP1 attachment preference was observed contrary to findings with native speakers of English. Regarding priming effects in RC completion with two possible NPs attachment, the RC completions with NP1 attachment increased in NP1 attachment-induced priming condition and also NP2 attachment preference also increased in NP2 attachment-induced priming condition.

The findings in the present study show that the sentence processing of Korean EFL learners' is different from that of English native speakers'. This may result from the influence of L1 sentence processing or from less experience to the language forms than native speakers of English.

However, as shown in priming effects, when the priming condition is provided as previous linguistic experience for the syntactic representation, the Korean EFL learners seemed to make use of the priming stimuli for their

syntactic representation or a sentence processing strategy in resolving the ambiguity of relative clause.

From the point of view of second language acquisition, the findings in this study shed lights on implicit learning and ambiguity resolution strategy through priming effects.

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Appendix I

Target Items for Relative Clause Attachment Preference

1. The farmer feeds the calves of the cow that _____.
2. The concert manager waits for the musicians of the pop star who _____ .
3. The tutor advises the students of the schoolmistress who _____ .
4. Klara visits the students of the piano teacher who _____ .
5. The pastor talks to the leader of the scouts who _____ .
6. John meets the boss of the employees that _____.
7. The pensioner complains about the content of the fliers that _____ .
8. The maid looks at the children of the principal who _____.
9. The civilian service worker greets the nurse of the seniors that ____.
10. The tourist guide mentioned the bells of the church that _____ .
11. Kurt checks the payment slips of the company that _____ .
12. We are amused about the articles of the newspaper that _____ .
13. The chauffeur met the representative of the state guests who ____ .
14. The scholar investigated the language of the countries that _____ .
15. The sport news praised the defense formation of the soccer teams that _____ .

Appendix II

Priming and Target Items for Priming Effect in RC Attachment

1. The doctor recognised the nurse of the pupils who was _____.
2. The farmer feeds the calves of the cow that _____.
3. The director congratulated the instructor of the schoolboys who are __.
4. The concert manager waits for the musicians of the pop star that ___.
5. The young girl favoured the players with the driver who were _____.
6. The tutor advised the students of the schoolmistress that _____
7. The journalist criticised the runners with the coach who was _____.
8. Klara visited the students of the piano teacher that _____.
9. The cleaning lady noticed the chief of the players who was _____.
10. The pastor talked to the leader of the scouts that _____.
11. The woman knew the photographer of the singers who were _____.
12. John met the boss of the employees that _____.
13. The student photographed the actress with the fans who was _____.
14. The pensioner complained about the content of the fliers that _____.
15. The doctor contacted the lawyer with the nurses who were _____.
16. The civilian service worker greeted the nurse of the seniors who ___.
17. The photographer liked the models of the artist who were _____.
18. Kurt checked the payment slips of the company that _____.
19. The nurse trusted the doctors of the teacher who was _____.
20. We were amused about the articles of the newspaper that _____.
21. The journalist hated the colonel with the soldiers who was _____.
22. Dieter smiled at the children of the secretary that _____.
23. The little girl envied the princess with the maids who were _____.
24. Franceska corrected the manuscripts of the publisher that _____

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