LEARN Journal: Language Education and Acquisition Research Network
(ISSN: 2630-0672 (Print) | ISSN: 2672-9431 (Online)
Volume: 15, No: 2, July – December 2022
Language Institute, Thammasat University
https://so04.tci-thaijo.org/index.php/LEARN/index

High Attachment in Thai Learners' Processing of English Relative Clauses

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APA Citation:
Wang, J. & Singhapreecha, P. (2022). High attachement in Thai learners' processing of English relative clauses. *LEARN Journal: Language Education and Acquisition Research Network*, *15*(2), 263-299.

Received
09/01/2022

Received in revised form
02/04/2022

Accepted
09/04/2022

Keywords
Complex NP *of*, Complex NP *with*, High Attachment, Low Attachment, Thai Learners, Relative Clause Processing

Abstract

Resolution to ambiguity imposed by English relative clauses (RC) was examined with Thai EFL students in this study. Offline experimental items included two-site context NPs, i.e., NP1 *of* NP2 (Complex NP *of*) and NP1 *with* NP2 (Complex NP *with*) modified by RCs. As NP1 and NP2 occupy higher and lower positions in the hierarchical structure of a complex NP, RC attachment to NP1 and NP2 are termed High Attachment (HA) and Low Attachment (LA). It was hypothesized that the RC would be attached to NP1 in the Complex NP *of*, and NP2 in the Complex NP *with*, based on the Thai L1 strategy and the universal properties of thematic prepositions, respectively. Three proficiency levels, i.e., beginning, intermediate, and upper-intermediate, were established for the participants. The results confirmed both predictions. In addition, there were a rise and decline across the three proficiency levels in the employment of HA for the Complex NP *of* and a continuous and significant increase in the employment of LA for the Complex NP *with*. Overall, this study suggests the influence of an L1 strategy and the development of an L2 strategy in the absence of a

	corresponding L2 structure, in association with L2 employment of thematic information.

Introduction

Processing of relative clauses has been widely investigated in L1 and L2 studies. Relative clauses (RC) are a useful tool to reveal strategies because the matrix clause can accommodate a complex NP, e.g., NP1-*of*-NP2 (also termed Complex NP *of*) as (1), an experimental trial in this study, illustrates.

(1) The man shouted at the tutor of the friend who was wearing a white skirt.

Ambiguity in meaning often arises in such a *two-site complex* NP (an NP comprising dual NPs), as the RC *who was wearing a white skirt* may be interpreted as a clause modifying NP1 *the tutor* or NP2 *the friend.* Based on the generalized phrase structure in generative grammar, NP1 is higher in the hierarchical structure than NP2 and attachments to NP1 and NP2 are termed High Attachment (HA) and Low Attachment (LA), respectively. HA and LA strategies were found to be employed by learners of different L1 backgrounds. As our study focused on baseline RC processing, especially on RC attachment to the higher or lower position in the hierarchy, we restrict the discussion of the theoretical part to the approaches that are the basis for our hypotheses, the section to which we turn next.

Theoretical Background

One approach, addressed commonly in relation to English, is Late Closure. Late Closure (Frazier & Fodor, 1978) holds that the parser attaches the new constituent to the phrase being currently processed. With respect to relative clauses, the parser attaches the RC to NP2, the closest phrase that is currently or most recently processed. This type of processing is attributed to humans' limited memory retention. As restrictions on short-term memory are involved in the processing of a new constituent, LA is considered a universal strategy. Late Closure has received support from studies looking at participants with different L1 backgrounds, e.g., English (Frazier & Foder, 1978), Swedish and Norwegian

(Ehrlich et al., 1999), Brazilian Portuguese (Miyamoto, 1998), and Arabic (Abdelghany & Fodor, 1999).

Recency Preference (Gibson et al., 1996), which allows interaction with some principles, is a variant of Late Closure. Similar to Late Closure, in Recency Preference, the parser attaches a relative clause to the more recent NP. Recency Preference applies to any potential site, and a principle such as Predicate Proximity can be combined with it to yield an attachment preference. Predicate Proximity (Gibson et al., 1996) requires that a constituent is attached as close as possible to the head of a predicate, which as Gibson et al. (1996) claim, is the core of a sentence. In addition, the average distance between a predicate head and an argument (subject or object) determines the strength of predicate proximity in a given language. The longer the distance, the more strongly the predicate is to be activated to enable long-distance attachments. In languages with rigid word order such as English, a verb immediately precedes its complement (a property of a configurational language); thus, the distance is relatively short, and the predicate is weakly activated; consequently, Recency (NP2) preference becomes a priority. In languages such as Spanish, a verb can be non-adjacent to its complement (a property of a non-configurational language)[1]. Compared to English, the average distance between a predicate and its object is longer and the predicate has to be strongly activated, resulting in High Attachment (NP1) preference, as it is the site closest to the predicate. Gibson et al. (1996) remark that Predicate Proximity could be involved in Spanish speakers' preference of HA in Cuetos and Mitchell's (1988) findings, in addition to support from their study.

Another approach, Construal theory (Frazier & Clifton, 1996) attempts to explain attachment by means of a primary or nonprimary relation in a given sentence. A relation between a verb and an argument (e.g., subject and object) is considered primary, while a relation between a modifier and its head is nonprimary. Constituents involved in primary relations are processed by universal principles such as Late Closure, while those involved in nonprimary relations such as relative clauses are processed in association with current thematic domains. In *the tutor of the friend*, the entire complex NP is the current thematic domain; *the friend* is part of PP *of the friend*. Given that this NP includes the high NP *the tutor* (the head) and the low NP *the friend*, the parser opts for discourse principles such as Referentiality to decide which NP to attach the RC to. As

Gilboy et al. (1995) formulate, the head of a phrase is *referential* as it introduces entities into a discourse or corresponds to a pre-existing discourse entity; the referentiality property of a head may enable the parser to attach the RC to the high NP *the tutor*. If *of* is replaced by *with*, which is the last theta role assigner, the parser attaches the RC to *the friend,* the new thematic domain obtained by *with.*

While Referentiality predicts RC attachment to the high NP (HA) for *Complex NP of* instances in English, this prediction is inconsistent with the fact that LA is actually preferred. The English LA strategy can be explained by the Grician Maxim principle (of avoiding ambiguity).[2] There are two genitive forms in English, i.e., the Saxon genitive (*the friend's tutor*) and the Norman genitive (*the tutor of the friend*). When the Saxon genitive form, e.g., *the friend's tutor*, is used, the relative clause is unanimously attached to *the tutor*, the one being possessed. When the Norman genitive form, e.g., *the tutor of the friend*, is used, ambiguity often arises; the parser attaches a relative clause to *the friend* due largely to memory restrictions, or Late Closure. Since the Saxon genitive is available for English speakers to express a complex NP and its modifying clause in an unambiguous manner, the use of the Norman genitive (Complex NP *of*) implies a degree of ambiguity, enabling the attachment of the RC to the low NP. Construal Theory of Referentiality, particularly the claim on *with* (or a corresponding preposition in a given language) is supported by L1 Spanish data in Gilboy et al. (1995) and data from Greek and German speakers of English (Felser et al., 2003).

If one views languages that have been intensively studied, such as English and Spanish, from Recency/Predicate Proximity and Referentiality in Construal, one finds they may be held equally accountable as the same preference results. On the one hand, the English and Spanish preferred strategies of LA and HA can be developed from configurational and non-configurational properties in the Recency principle of Predicate Proximity. On the other, the availability of Saxon and Norman genitive forms along with Referentiality in Construal can explain differences between English and Spanish. These notwithstanding, when Thai is brought into view, a question immediately arises as to which approach would better explain the Thai attachment preference. Thai is a configurational language with only the Norman genitive form. Evidently, our survey with Thai informants and that of Siriwittayakorn et al. (2014), to be discussed prior to our hypotheses, reveal a HA bias. Theoretically, there is a conflict in predictions

with regard to Thai, i.e., Recency/Predicate Proximity would predict LA, while Construal would predict HA. Thus, our study is crucial as it will reveal insights into the parser's strategy in configurational languages without Saxon genitives such as Thai, with our findings to lend support to one of these contending approaches. Next, as our main investigation involved Thai L2 strategy, we present studies that examined the attachment preferences of L2 learners and bilinguals and address methodological issues to the effect that offline tasks, the mode employed in this study, remain significant to this area of research.

HA, LA and Neither

In L2 and bilingual literature on attachment preferences, various studies were conducted online and offline (with and without real time assessments). The findings show three respects in terms of strategies employed by L2 learners. Firstly, L2 learners transfer their L1 strategy of High Attachment when they process the L2. Supporting evidence comes from data obtained from participants of a variety of L1 backgrounds, e.g., Spanish, German and Russian learners of Greek (Papadopoulou & Clahsen, 2003), early Spanish-English bilinguals (Dussias, 2001), Chinese learners of English (Lee & Wang, 2010), Korean learners of Japanese (Miyao & Omaki, 2005), offline, Turkish learners of English (Uludağ, 2020), eye-tracking, and (low-proficient) Persian learners of English (Karimi et al., 2021). Secondly, L2 learners employ the L2 strategy of Low Attachment. Participants involved in these studies included late Spanish-English bilinguals (Dussias, 2001), Persian learners with high working memory capacity (Marefat & Farzizadeh, 2018), and (high-proficient) Persian learners of English (Karimi et al., 2021). Thirdly, neither of the strategies is preferred, evident in Korean learners of Japanese (Miyao & Omaki, 2005), online, advanced German learners of English (Felser et al., 2003), Turkish learners of English (Uludağ, 2020), offline, Persian learners of English with low working memory capacity, and Spanish and English bilinguals (Fernández, 2002). Given the above results, L1 strategy (particularly of HA) seems to be the predominant strategy, but L2 (LA) is sometimes employed, while learners may also apply neither strategy, suggesting the issue of whether or not L2 learners employ L1 or L2 strategy remains unsettled.

Modulating Factors

Apart from studies that focus on RC attachment strategies, recent studies have largely been concerned with whether or not attachment preferences can be affected by factors such as contexts, animacy, and definite marking elements. In an offline experiment by Pan et al. (2015), context information affected ambiguity resolutions of native English speakers and Chinese and German learners of English; in their online task, the context effects applied to the L2 learners, not the L1 speakers. Kwon et al. (2019) found that animate NPs were preferred as attachment sites in their offline production study with native Chinese speakers. Shabani (2018) found that the enclitic marker *–i* played a role in L1 Persian's RC attachment preferences in offline interpretation tasks; NP2 attracted more RC attachments when they carried a definite marker. With a variety of experimental techniques, these studies provide further evidence suggesting that RC attachment preferences can be modulated by various factors.

Methodological Issues and Current Study

With regard to the methodology employed in research on attachment strategies, online and offline tasks were conducted in single or different studies and, in some cases, complemented each other (e.g., Karimi et al., 2021; Papadopoulou & Clahsen, 2003). Notably, online and offline techniques seemed to fare equally well in assessing the strategies employed by L1 and L2 speakers. For instance, online experiments in Dussias (2001) with early Spanish-English bilinguals, Papadopoulou and Clahsen (2003), Uludağ (2020), and Karimi et al. (2021) reveal L1 transfer of HA, as do offline experiments in Lee and Wang (2010) and Miyao and Omaki (2005). Similarly, online experiments in Dussias (2001) with late Spanish-English bilinguals, and Karimi et al. (2021) reveal LA; this strategy is also found in offline experiments in Marefat & Farzizadeh (2018). In light of all these findings, online and offline techniques are deemed equally important in yielding insights into processing strategies.

In terms of L2 participants, proficiency has been found to play a role. In Karimi et al. (2021), high-proficient Persian learners of English preferred LA. In addition, there are probably stages of development. In Miyao and Omaki (2005), Korean learners of Japanese had L1 transfer (HA) offline, but in the online task they showed NP2 preference, a strategy unavailable in their L1 and L2. Miyao and Omaki suggest that there may be

three different stages of L2 processing development, i.e., L1 transfer, intermediate (with many substages), and a target-like phase.

This study employed offline interpretation tasks with L1 Thai speakers and Thai EFL learners. Since there is scant literature investigating Thai EFL learners, as a preliminary study into this area, we employed offline tasks, which remain important in assessing L2 strategies. Inspired by Miyao and Omaki's (2005) claim for developmental stages in L2 processing, we took into account levels of proficiency and recruited participants representing different stages of L2 development. In terms of L1 Thai, as noted previously, Thai configurational property with only Norman genitives poses a challenge to contending theories. Therefore, the results from this study will crucially substantiate one of the approaches and enable a better understanding of the system underlying L2 processing.

The remaining part of this paper is organized as follows. The next section, Formulation of Hypotheses, presents the background on Thai relative clauses, our survey with Thai informants, Siriwittayakorn et al.'s (2014) study, and two hypotheses. The Tasks section demonstrates the creation of an offline interpretation (OLI) task, with a data norming test as a prerequisite. A series of three experiments conducted with three groups of participants follows. The paper is concluded with the General Discussion, Recommendations, Pedagogical Implications, and the Conclusion.

Formulation of Hypotheses

Ambiguous RCs in Thai: A Comparison with English

Like English, Thai is an SVO language. It mainly differs from English in the absence of tense, (number) agreement morphology, and determiners. As shown in (1a), there is a marker PROG indicating the progressive aspect, which in this non-contextualized context is associated with the present tense. Thai makes no use of definite and indefinite articles. The bare NP *nǎŋsŭɯ* can be interpreted as an indefinite or definite element; without a context (e.g., a relative clause), the indefinite reading is the default, as shown in the translation in (1a). It is possible to express *nǎŋsŭɯ* as a specific noun, e.g., by adding a (proper) classifier and a (distal) demonstrative, as in (1b). Sentences (1b) and (1c) illustrate the Thai language's configurational property. In Thai, like English, the object

nǎngsʉ̌ɯ is adjacent to its matrix verb *ʔàan*, as shown in (1b); when it is intervened by an adverb *tɔɔnníi,* as shown in (1c), the sentence becomes ungrammatical.

(1) a. khǎw kamlaŋ ʔàan nǎŋsʉ̌ɯ tɔɔnníi
He PROG read book now
"He is reading a book now."
b. khǎw kamlaŋ ʔàan nǎŋsʉ̌ɯ lêm nán tɔɔnníi
He PROG read book class dem now
"He is reading that book now."
c. *khǎw kamlaŋ ʔàan tɔɔnníi nǎŋsʉ̌ɯ

Thai relative clauses are introduced by complementizers. Conventionally, two different complementizers are used, i.e., *thîi* for restrictive relative clauses and *sʉ̂ŋ* for non-restrictive relative clauses (Iwasaki & Ingkaphirom, 2005). Sentence (2a) below, simplified from a trial in our survey, contains a relative clause introduced by *thîi*, which essentially modifies the head noun *khon khàprót,* a typical property of restrictive relative clauses. If *sʉ̂ŋ* appears instead of *thîi*, according to native speakers' intuition, the reading has a formal or literal sense and the modifying clause may be interpreted as additional or extra information. Sentence (2b) is the English counterpart of (2a).

(2) a. dèk.phûjĭŋ chʉ̂ɯnchɔ̂ɔp khon khàprót [$_{CP}$ thîi *e* phûutkhuj kàp jĭŋ.chara]
child female admire person.drive Comp talk with female.old
"The young girl admired the driver who talked to an old woman."
b. The young girl admired the driver [$_{CP}$ who *e* talked to an old woman]

Following a standard assumption in generative grammar, a (restrictive) relative clause is adjoined to the head noun. In both (2a) and (2b), the head noun *khon.khàprót/driver* precedes the adjoined CP relative clause, and a gap, i.e., the trace of the moved *wh*-phrase marked by *e*, is assumed in the subject position of the relative clause. Given (2a) and (2b), Thai and English relative clauses are similar in that they follow the head nouns and are introduced by an RC marking element, i.e., the complementizer *thîi* in Thai and a *wh*-phrase in English.

It is noteworthy that while it is customarily held that *thîi* is associated with restrictive relative clauses, in semi-formal and colloquial Thai *thîi* is used in non-restrictive relative clauses as well. In sentence (2c), featuring the proper name *Daeng* in the matrix clause object position, the non-restrictive RC can be introduced by *thîi* or *sɯ̂ŋ*, and *thîi* is used predominantly.

(2) c. dèk.phûjĭŋ chɯ̂nchɔ̂ɔp Daeng [$_{CP}$ thîi/sɯ̂ŋ *e* phûutkhuj kàp
child female admire Daeng Comp talk with
jĭŋ.chara]
female.old
"The young girl admired Daeng, who talked to an old woman."

If the Daeng that is identified by the RC, i.e., the restrictive relative clause reading, is involved, Thai uses *khon thîi*, a compound of the classifier for persons and the complementizer *thîi,* as shown in (2d). The complementizer compound *khon thîi* explicitly marks restrictive relative clauses.

(2) d. dèk.phûjĭŋ chɯ̂nchɔ̂ɔp Daeng [$_{CP}$ khon thîi *e* phûutkhuj kàp
child female admire Daeng class Comp talk with
jĭŋ.chara]
female.old
"The young girl admired the Daeng who talked to an old woman."

With regard to RCs in relation to complex NPs, Thai has ambiguous RCs, as (3), an item in our survey and a counterpart of (2) in Felser et al., illustrates. Thai speakers may interpret the RC, i.e. *thîi phûutkhuj kàp jĭŋ chara* as a clause modifying NP1 or NP2.

(3) dèk.phûjĭŋ chɯ̂nchɔ̂ɔp [$_{NP1}$khonkhàprót] khɔ̌ɔŋ [$_{NP2}$ náksadɛɛŋ] thîi
child female admire driver of actor Comp
phûutkhuj kàp jĭŋ.chara
talk with female.old
"The young girl admired the driver of the actor who was talking to an old woman."

In terms of definiteness that is expressed by *the* in the matrix clause subject, NP1 of NP2 in the translation of (3), in Thai, as previously

noted, bare NPs can be interpreted as definite or indefinite. The sense of definiteness in (3), a decontextualized sentence, can be derived by the speaker's supposition that these persons are known by the hearer. In Gilboy et al.'s (1995) sense, NPs in English can be referential when they are introduced by the overtly expressed article *the*. Since Thai does not use overt definite markers, we extend Gilboy et al.'s sense to Thai bare NPs. In this respect, the referentiality of Thai bare NPs is enabled by the speaker's supposition.

With respect to *with*, Thai does not use the preposition *kàp,* which corresponds to *with* in a complex NP. Prepositional phrases headed by *kàp* are largely VP modifiers, as (4) illustrates.

(4) cɛɛn paj duu nǎŋ kàp phûɯan
Jane go see movie with friend
"Jane went to the movies with her friend."

In (4), *kàp phûɯan* is a VP modifier. The PP *kàp phɯûan* can also follow *cɛɛn*. With the PP following the subject, the meaning of *kàp* changes to "*and,*" and as a result the meaning becomes "Jane and her friend went to see the movies."

When a Complex NP *with* such as *the professor with the secretary* in a trial in Felser et al.'s study was compared with its Thai counterpart in (5), it could be seen that Thai does not use a preposition but rather an RC, and there is no ambiguity.

(5) khanábɔɔdii chôɔp acaan [$_{RC}$ (khon) thîi leekhăa khɔ̌ɔŋ khăw
dean like teacher (class) Comp secretary of he
kamlaŋ ʔàan còtmăaj]
PROG read letter
"The dean liked the professor whose secretary was reading a letter."

Thus, a Norman genitive in Thai is potentially ambiguous, and Thai does not use *kàp* in complex NPs, unlike English.

Surveys with Native Thai and English Speakers

As there had not been studies on Thai speakers' RC attachment preferences at the beginning of this study, we conducted an offline survey

with a group of Thai informants to obtain information as a basis for formulating the hypotheses. In this survey, we employed a questionnaire including ten experimental sentences, which were selected from Felser et al. (2003) and translated into Thai. One hundred and seventy-one students and seven teachers from a missionary school in Rayong Province responded to the questions. Seventy-five percent of the students were 14 years old (8th graders); the remaining ones ranged in age between 16-17 (10th and 11th graders). The results indicated that 70% of the respondents favored NP1, while 30% preferred NP2.

In addition, we carried out another survey, testing the English original versions of the Thai experimental sentences above with eight native English speakers residing in the U.S. and Japan. We invited them to complete an English questionnaire by email. This group consisted mainly of graduate students and faculty members. We found that they chose NP1 17.5% and NP2 82.5% of the time.

Siriwittayakorn et al.'s (2014) Study

After we completed our surveys, a study by Siriwittayakorn et al. (2014) confirmed our findings. Their goal was to determine Thai speakers' attachment strategy and if context information would affect Thai speakers' preferences, employing genitive complex NPs followed by relative clauses in Thai. The data were obtained from six writing genres of the Thai National Corpus (Aroonmanakun et al., 2009) and self-paced reading experiments with 52 native Thai speakers. Siriwittayakorn et al. (2014) found that overall NP1 attachments were more frequent than NP2 attachments and that preferences were influenced by context information. When the disambiguating appeared before the complex NP, the RC was more frequently attached to NP1; when the context appeared after the complex NP, the RC was more frequently attached to NP2. It is noteworthy that we and Siriwittayakorn et al. (2014) similarly found that NP1 or HA was the preferred strategy for Thai speakers. This is inconsistent with the Recency with Predicate Proximity hypothesis, an issue to be revisited in the General Discussion section.

Based on the above, Thai is interesting in that the Thai RC is the head initial, and ambiguity is possible. However, unlike English, NP1 is preferred, according to the results from the survey and Siriwittayakorn et al. (2014). In addition, the Complex NP *with* structure is unavailable in Thai;

therefore, it is worth exploring further how Thai learners resolve such ambiguity. These issues serve as the basis for our hypotheses.

Hypothesis 1

Based on the findings from our survey with the Thai informants and Siriwittayakorn et al.'s (2014) study, we hypothesize that Thai learners of English will attach the RC to NP1 in an English sentence containing *NP1 of NP2*-RC. This prediction is consistent with the Construal approach of Referentiality (Gilboy et al., 1995; Frazier and Clifton, 1996). As only the Norman genitive is present in Thai, the entire complex NP is the current thematic domain, and consequently the complex NP head attracts the RC due to its ability to introduce entities into a discourse or associate with the existing discourse entities.

Hypothesis 2

Since the Complex NP *with* is not available in Thai, we hypothesize that Thai learners of English will use the Low Attachment strategy in resolving RC ambiguities. Given that *with* is the last theta role assigner, which creates a new thematic domain to which the RC is attached, in Frazier and Clifton's (1996) relevant formulation, Thai learners might attach the RC to NP2.

Tasks

The section below describes the norming test that was conducted before the offline interpretation task. The norming test was used to ensure the validity of the experimental task and the reliability of the findings.

Plausibility Norming Test

We conducted a norming test to ensure that NP1 and NP2, which formed part of a Complex NP in English, were equally plausible, i.e., there was no semantic bias toward NP1 or NP2, before integrating them into the

actual experimental sentences. The sentences in (6) illustrate a pair of norming sentences. We checked whether the order *<NP1 of NP2>* in (6a) and its reverse order *<NP2 of NP1>* in (6b) were plausible.

(6) a. The chauffeur of the manager is dreaming of holidays.
b. The manager of the chauffeur is dreaming of holidays.

There were 17 complex NP *of* pairs and 16 complex NP *with* pairs. The plausibility of each sentence was rated on a scale of 1 to 5, where 1 represented least plausible and 5 most plausible. Before administering the norming test, both the *of* and the *with* sets were checked by a native English speaking linguist for grammaticality and plausibility.

We recruited ten Thai 11th graders from a bilingual school in Rayong Province, Thailand. Based on our interviews with their teachers, their English proficiency was intermediate and above, a level quite compatible with that of our intermediate and upper-Intermediate EFL participants. They responded to the questionnaire containing the (randomized) norming sentences. The plausibility of the NP1 compared to NP2 was calculated by means of a Wilcoxon signed-rank test; in a descending manner, the top ten items with the highest value of 1.0 were selected from the *of* and *with* sets. These NPs were integrated into the target items in the offline interpretation task.

It is noteworthy that this norming test was carried out in the interests of the experiment with the Thai EFL participants, who were involved in our main investigation. We did not norm the experimental sentences that were used with controlled native English and native Thai participants, as these tasks would be relevant to L1 research, which is beyond the scope of this study.

Offline Interpretation Task (OLI), Task Presentation, and Scoring

In response to the hypothesis tests, an offline interpretation (OLI) task was created to investigate the RC attachment preferences of the three groups of participants: native English speakers (in the upcoming Experiment 1), native Thai speakers (Experiment 2), and Thai EFL learners (Experiment 3).

For the native English speaking and Thai EFL groups, the OLI task consisted of a total of 50 English items, i.e., 20 target experimental

sentences and 30 fillers. All the experimental sentences were ambiguous; the fillers were not. Three sentence types constituted the fillers, i.e., RC modifying the Object, RC modifying the Subject, and Non-RC. These fillers were employed to distract participants from being aware of the point under investigation.

The sentences obtained from the norming test were integrated into the structure of NP–V–[NP1–of/with–NP2]–RC. Ten items featured the Complex NP *of;* the other ten displayed the Complex NP *with*. Sentences (7) and (8) illustrate the two sentence types. In addition to the test sentences, there were questions and choices to test the subjects' RC attachment strategies. (See Appendix A for the Complex NP *of* experimental items, and Appendix B for the Complex NP *with* experimental items.) Two different batteries (Forms A and B) were created and distributed equally in the EFL group in order to reduce effects from the ordering of items. Both the target items and fillers were checked by a native English speaking editor to ensure ambiguity and non-ambiguity, respectively.

(7) The sponsor trusted *the painter of the model* who was smiling all the time.
Q: Who was smiling all the time?
A. the painter B. the model

(8) The writer admired *the professor with the assistant* who was giving training sessions.
Q: Who was giving the training sessions?
A. the professor B. the assistant

The degrees of difficulty in the vocabulary in the task items were stabilized by using commonly known words. The EFL participants were allowed to clarify any vocabulary items which they were unsure about before the OLI task began. Test booklets with five items per page were used. The participants were instructed to read one sentence, e.g., (7) or (8), at a time and answer a *wh*-question, which followed subsequently. This question required them to choose either NP1 (*the painter* or *the professor*), or NP2 (*the model* or *the assistant*). They were instructed to choose the answer on a first-come-to-mind basis. The participants were not allowed to skip items or return to change the answer they had chosen.

With regard to the native Thai speaking group, the test stimuli consisted of ten Thai versions of the English target Complex NP *of* sentences and 23 fillers. The translation was conducted by a Thai graduate student and checked by a Thai linguist to ensure consistency in form and meaning. As the English Complex NP *with* does not have a Thai counterpart, this structure was not tested with these Thai informants.

Sentence (9) below is an example of the experimental sentences, which is the Thai sentence corresponding to the English sentence (7) above, with the relevant question and answer choices. (See Appendix C for the entire set of the Thai sentence stimuli.)

(9) สปอนเซอร์เชื่อมั่นในช่างภาพของนางแบบที่ยิ้มแย้มตลอดเวลา
The sponsor trusted the painter of the model who was smiling all the time.
ใครที่ยิ้มแย้มตลอดเวลา
Who was smiling all the time?
ก. ช่างภาพ ข. นางแบบ
A. the painter B. the model

In the demographic section, the native Thai speakers also answered questions about gender, age, the highest level of education, and occupation.

In terms of the scoring of the experimental items, since there were two choices for each target item, a score was given to Choice A or Choice B. When a participant indicated that the answer to a question such as (7) was A, *the painter*, we granted one point and entered 1 in the NP1 cell, and zero in the NP2 cell. When a different participant indicated that the answer to the same question was B, NP2, we granted one point and entered 1 in the NP2 cell and zero in the NP1 cell.

After the completion of scoring, we determined participants' preferred strategies by means of Repeated Measures ANOVAs. One-way ANOVAs and Repeated Measures ANOVAs were also performed to determine if the mean scores of the preferred NPs were different among the three groups.

The three experiments conducted with the different groups of participants are presented next.

Experiment 1

Objective

This experiment was undertaken to examine whether or not native English speakers, who served as the English speaking controls, would prefer options that were different from our L2 Thai learners of English. It also furnished evidence as to whether or not their strategies were similar to those found in previous studies.

Participants

Twelve native English speakers who had not participated in any other experiments participated. They were invited by email or in-person. All were full-time faculty members teaching English to Thai undergraduate students at a public university in Bangkok, Thailand. Five of them (four males and one female) were American English speakers; the remaining seven (six males and one female) were British English speakers. Their ages ranged between late 20s to 50s, and they had resided in Thailand from two to 20 years.

Task Administration

As presented in the offline interpretation task section, there were 50 items in total; essentially, the Complex NP *of* and the Complex NP *with* followed by the RCs were assessed. The offline interpretation task was administered with this group.

Test booklets were distributed to the participants in person or via their office mailboxes. Although there were no time restrictions for returning the completed papers for the participants who did the task by themselves, they were instructed to spend no more than 12 seconds per item. We received their responses at different times but within a month after the distribution of the booklets.

Results

We compared the two strategies using Repeated Measures ANOVAs by subject and item. The means of NP1 and NP2 preferences in the Complex NP *of* were 0.5 (0.67) and 9.5 (0.67) by subject and 0.7 (1.34) and 11.4 (1.26) by item, respectively. (Standard deviation values appear in the

parentheses.) The difference between the two strategies was reliably significant (*F1* (1,11) = 534.600, $p < .001$; *F2* (1,9) = 171.449, $p < .001$).

With respect to the Complex NP *with*, the means of NP1 and NP2 preferences were 0.67 (1.16) and 9.42 (1.17) by subject and 0.8 (0.79) and 11.30 (0.67) by item, respectively. The difference between the two strategies was also significant (*F1* (1,11) = 173.498, $p < .001$; *F2* (1,9) = 536.351, $p < .001$).

Discussion

The results from both structures suggested that the native English speaking participants clearly employed LA across the two types of complex NPs. The result from the Complex NP *of* is consistent with those from the native English speaking group in our survey and previous studies (Frazier & Fodor, 1978; Gibson et al., 1996). The Complex NP *with* result can be interpreted as supporting either Predicate Proximity's Recency (Gibson et al., 1996) or Construal's Referentiality (Gilboy et al., 1995).

Notably, although the by-subject and by-item results revealed a clear NP2 bias, the variability was smaller in the Complex NP *of* than in the Complex NP *with* by subject, while it was greater in the Complex NP *of* than in the Complex NP *with* by item. This could be attributed to the fact that while NP2 was chosen predominantly in both structures, quite a few NP1 instances were concentrated in only one trial in the Complex NP *of*, whereas they were evenly distributed among a number of trials in the Complex NP *with.* The fact that the RC attaches to NP2 more uniformly in the Complex NP *of* than it does in the Complex NP *with* is intriguing. This could be attributed to different thematic domains, obtained by *of* and *with*. Further investigations can shed light on these issues.

Experiment 2

Objective

This experiment was conducted to investigate the RC attachment preferences of native Thai speakers, who served as the Thai speaking

controls. It would also confirm the Thai attachment strategy found in Siriwittayakorn et al. (2014) and our survey with the native Thai informants presented in the Formulation of Hypotheses section.

Participants

Fifteen Thai informants who had not been involved in the prior experiments participated. All of them worked for a Chinese language educational firm based in Nakon Pathom Province. Eight of them held bachelor's degrees and seven were interns. They ranged in age from 18 to late 30s.

Task Administration

As presented in the offline presentation task section, ten Thai target stimuli which were counterparts of the English Complex NP *of* set were checked in this experiment. The English Complex NP *with*, which does not have a Thai counterpart, was not tested with these Thai informants. The booklets were distributed to the participants in the office in person. Like in Experiment 1, the participants were instructed to spend no more than 12 seconds per item. They were not allowed to discuss or return to change the answers which they had chosen. It took them approximately 15 minutes to finish the task.

Results

Repeated Measures ANOVAs were performed across the Thai Complex NP *of* data, by subject and item, to make a comparison between the two strategies. The means of NP1 and NP2 preferences were 6.8 (1.97) and 3.2 (1.97) by subject and 10.20 (3.12) and 4.80 (3.12) by item, respectively. The difference between the two strategies was reliably significant ($F1$ (1,14) = 12.507, $p < .004$; $F2$ (1,9) = 7.490, $p < .03$).

Thus, the HA preference among this Thai control group was confirmed by subject and item; this finding was similar to the result (70%) in our survey with the Thai informants.

In terms of the individual items, the results, as shown in Table 1, indicated that the preference for NP2 ranged between 67% to 47% in items 7, 1, and 2; the remaining ones were rated between 33-0%.

Compared to the native English controls, although the degree of NP2 preference in the native Thai data was noticeable, the overall data suggested NP1 preference (HA), a different strategy from that of the English controls.

Table 1

Mean Scores of RC Attachments to NP2 in Thai Complex NP of Structures on an Individual Item Basis: Native Thai Speakers

Item	Thai NP1 of NP2	Raw Scores	Mean %	SD (from raw scores)
7	ช่างภาพของนางแบบ "the photographer of the model"	10	66.7	*.488*
1	ติวเตอร์ของเพื่อน "the tutor of the friend"	9	60	*.507*
2	แฟนสาวของเพื่อน "the girlfriend of the friend"	7	46.7	*.516*
10	เพื่อนของสามี "the friend of the husband"	5	33.3	*.488*
5	หัวหน้าของตากล้อง "the boss of the cameraman"	5	33.3	*.488*
6	อาจารย์ของนักเรียน "the teacher of the student"	4	26.7	*.458*
4	เลขาของผู้จัดการ "the secretary of the manager"	3	20	*.414*
3	นักเรียนของเพื่อน "the student of the friend"	3	20	*.414*
8	ลูกชายของเพื่อนร่วมงาน "the son of the colleague"	2	13.3	*.352*
9	คนขับรถของผู้จัดการ "the chauffeur of the manager"	0	0	*0*

Discussion

The preference for HA largely supports the Construal approach (Frazier and Clifton, 1996). The moderate rate of NP1 preference (the mean of 6.8) could partly be attributed to the moderate scores of items 7, 1, 2. As this list of Thai Complex NP *of* tokens was used with controlled participants and was not normed, there could be some degree of bias. This methodological issue should be taken into account in future L1 research.

Theoretically, the finding is inconsistent with Gibson et al.'s (1996) Recency strategy, which predicts NP2 (LA) for Thai, a configurational language, but it lends support to the Construal approach (Frazier & Clifton, 1996). Particularly, the referentiality property of the head (NP1) attracts the RCs as a means to express a new discourse entity or relate to a pre-existing entity.

Experiment 3

Objective

This experiment was conducted to investigate how Thai EFL learners resolve the RC attachment ambiguity with regard to the Complex NP *of* and the Complex NP *with*, as presented in both hypotheses.

Participants

We recruited 85 Thai EFL learners, who did not participate in any other experiments, from an all-boy missionary school in Bangkok, Thailand. Like the group of students in Rayong Province, all the subjects were 11th graders. A slight difference between the two groups is that the student subjects in Bangkok were able to communicate with native English speaking instructors more frequently than the students in Rayong Province.

Before conducting the OLI task, we assessed the 85 students' English proficiency by means of the Michigan Test and placed them into three different levels (beginning, intermediate, and upper-intermediate). The Michigan Test consisted of 20 listening and 30 grammar items. The participants were allowed 30 minutes to finish the test. We conducted the test with the 11th graders in two rooms. The participants started the test at the same time.

The cut-off ranges of the Michigan Test were as follows. Those who scored from 10-27, 28-36, and 37-46 were categorized into the beginning, intermediate and upper-intermediate levels, respectively. With these criteria, there were 29 beginning, 29 intermediate, and 27 upper-intermediate participants. We determined the cut-off ranges on the basis of the average scores, standard deviations, frequencies, and ranges.

With respect to the instruction on English relative clauses, all the student participants had taken English relative clause lessons. Their comprehensibility of English relative clauses was assumed on the basis of the lessons they had attended and our interviews with the teachers in charge of the English instruction at the school.

Task Administration

The materials used in Experiment 3 were booklets containing the 50 experimental items, as discussed in the offline interpretation task section. We conducted two different batteries (i.e., Forms A and B).

Subjects took the Michigan Test before the OLI task during the home room session on the same day. It took approximately ten and 20 minutes, respectively, for them to finish the listening part and the grammar part of the Michigan Test. They spent another 30 minutes on the OLI task. There was a ten-minute break between the Michigan Test and the OLI task.

Results

Mean percentages of NP1 and NP2 preferences were calculated on the three groups' data. Repeated Measures ANOVAs were performed by subject and item, with NP1 and NP2 scores as within-subject factors and proficiency levels as the between-subject factor, to determine the differences in strategies. In addition, One-way ANOVAs were performed on the preferred options to see if there were group differences by subject, followed by Repeated Measures ANOVAs, employed to investigate the same query, by item.

Prior to the results from the ANOVAs, we report the mean percentages and standard deviations of the student participants' preferences for RC attachments in both the Complex NP *of* and the Complex NP *with* in Table 2.

Table 2

Mean Percentages and Standard Deviations of RC Attachments in Complex NPs: Experimental Groups

NP Preference/Group	NP of NP-RC		NP with NP-RC	
	NP1	SD	NP2	SD
Beginning	66	26	67	28
Intermediate	87	18	69	33
Upper-Intermediate	72	31	86	22
Overall Percentages	75	27	74	29

Note: The standard deviations here were computed based on the mean percentages, not the raw scores.

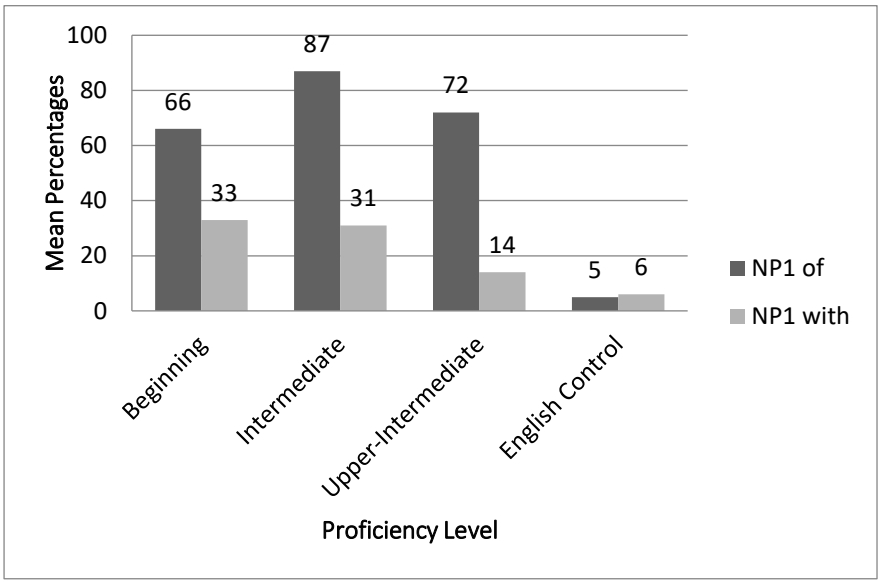
The overall percentages suggest NP1 preference for the Complex NP *of* (75%) and NP2 preference for the Complex NP *with* (74%). Given the individual groups' percentages, a progression in NP2 and a rising-falling pattern in NP1 appeared with regard to the Complex NP *with* and the Complex NP *of*, respectively.

Figure 1 displays the mean percentages of RC attachments to NP1 in both Complex NP structures by the Thai EFL learners and the native English speaking controls, whose data are also presented in percentages.

As shown in the bar graph in Figure 1, the percent responses for NP1 in the Complex NP *of* by three levels were greater than their NP1 counterparts in the Complex NP *with*, while in the English speaking controls, NP1 was commonly minimally chosen (5-6%). Figure 2 below presents the same results but from the NP2 perspective.

Figure 1

Thai EFL Participants' NP1 Preference in Complex NP of and Complex NP with Structures

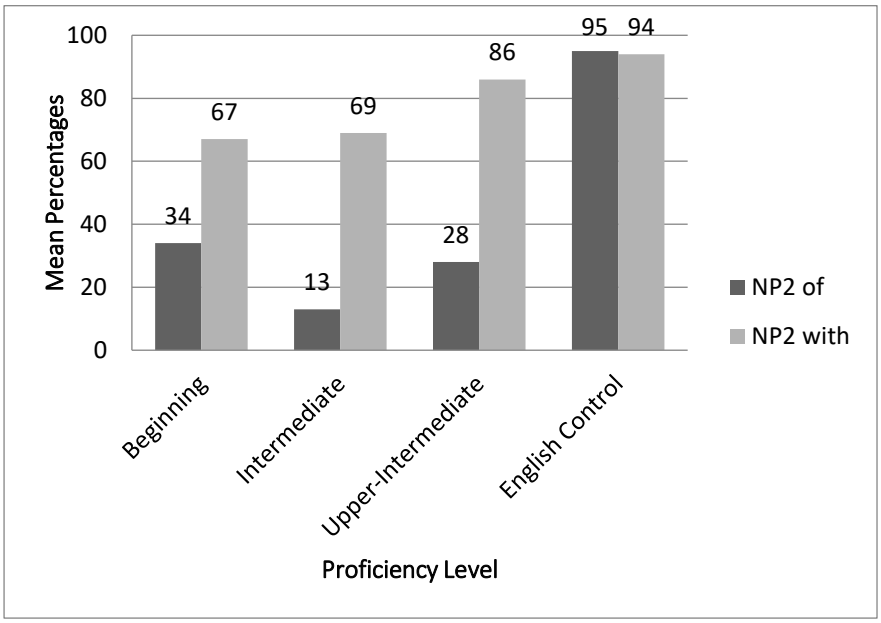


As shown in Figure 2, the percent responses for NP2 in the Complex NP *of* structure by the three Thai EFL groups were smaller than their NP2 counterparts in the Complex NP *with* (34%, 13%, 28% vs. 67%, 69%, 86%). As reported earlier, native English speakers chose NP2 at very high percentages (95%, 94%) across the two structures. Interestingly, the upper-intermediate group chose NP2 at a rate similar to the native English controls when they processed the Complex NP *with* structures.

In terms of the statistical results for the Complex NP *of*, Repeated Measures ANOVAs (by subject) revealed a reliable difference ($F1$ (1, 82) = 80.961, $p < .001$) and a slight interaction effect between proficiency and the two strategies ($F1$ (2, 82) = 5.007, $p < .01$). By item, Repeated Measures ANOVAs performed overall and level-by-level of proficiency confirmed NP1 preference ($F2$ (1, 9) = 100.098, $p < .001$; $F2$ (1, 9) = 13.327, $p < .006$, for beginner; $F2$ (1, 9) = 146.769, $p < .001$, for intermediate; $F2$ (1, 9) = 41.274, $p < .001$, for upper-intermediate). Thus, the first hypothesis, i.e., High Attachment was Thai EFL learners' preference in the Complex NP *of*, was confirmed by these subject and item analyses.

Figure 2

Thai EFL Participants' NP2 Preference in Complex NP of and Complex NP with Structures



A One-way ANOVA comparing RC attachments to NP1 between groups indicated a significant difference (*F1* (2, 82), 5.007, $p < .01$) by subject. Tukey and Bonferroni's post-hoc tests revealed a reliable difference between the beginning and the intermediate learners ($p < .009$). By item, a Repeated Measures ANOVA comparing RC attachments to NP1 among the three groups also indicated a significant difference (*F2* (2, 18) = 13.018, $p < .001$). The pairwise comparisons revealed a significant difference between the beginning and the intermediate learners ($p < .002$) and another significant difference between the intermediate and the upper-intermediate learners ($p < .001$).

This suggests that the HA strategy increases during initial stages and slightly drops at a later stage.

As for the Complex NP *with*, the results from the Repeated Measures ANOVAs (by subject) revealed a reliable difference (*F1* (1, 82) = 63.239, $p < .001$) and a slight interaction effect between proficiency and the two strategies (*F1* (2, 82) = 4.120, $p < .03$). By item, the Repeated Measures ANOVAs performed overall and level-by-level of proficiency

confirmed NP2 preference (*F2* (1, 9) = 68.045, *p* < .001; *F2* (1, 9) = 31.371, *p* < .001, for beginner; *F2* (1, 9) = 19.912, *p* < .003, for intermediate; *F2* (1, 9) = 287.163, *p* < .001, for upper-intermediate). These subject and item analyses confirmed the second hypothesis, i.e., Thai EFL learners prefer Low Attachment in the Complex NP *with*.

A One-way ANOVA comparing RC attachments to NP2 between groups indicated a significant difference (*F1* (2, 82), 4.072, *p* < .03) by subject. Tukey and Bonferroni's post-hoc tests indicated a significant difference between the beginning and the upper-intermediate learners (*p* < .03) and another significant difference between the intermediate and the upper-intermediate learners (*p* < .07). By item, a Repeated Measures ANOVA comparing RC attachments to NP2 among the three groups also indicated a significant difference (*F2* (2, 18) = 15.007, *p* < .001). Similar to the post-hoc tests, the pairwise comparisons revealed a significant difference between the beginning and the upper-intermediate learners (*p* < .001) and another significant difference between the intermediate and the upper-intermediate learners (*p* < .005).

This suggests that the LA strategy develops with proficiency; it rises steadily during initial stages and remarkably increases at a later stage.

As the two patterns seem to show opposite directions, a Repeated Measures ANOVA was conducted to compare the RC attachment to NP1 in the Complex NP *of* and the RC attachment to NP2 in the Complex NP *with*, in order to determine if there would be interaction effects. The result, as expected, indicated interaction effects (*F* (2,82) = 4.540, *p* < .02). The relatively unsteady pattern of HA across proficiency levels in the Complex NP *of* and the development of LA with higher proficiency in the Complex NP *with* were likely to contribute to this interaction.

Discussion

High and Low Attachment were found to be the Thai EFL learners' strategies for the Complex NP *of* and the Complex NP *with* data, respectively. Theoretically, these L2 learners employed the L1 strategy of HA, in line with the discourse principle of Referentiality, where the entire complex NP constitutes a thematic domain and the RC is attached to NP1, the complex NP head. This finding is consistent with the strategy of L2 learners in previous studies (e.g., Spanish, German, and Russian learners of Greek in Papadopoulou & Clahsen, 2003; Spanish-English bilinguals in

Dussias, 2001; Chinese learners of English in Lee and Wang, 2010; and Turkish learners in Uludağ, 2020). With respect to the Complex NP *with*, the Thai EFL learners employed LA, a strategy associated with the new thematic domain assigned by the preposition *with*. This part of the findings is in accordance with those found in Greek speakers of English and German in Felser et al. (2003). Given that the referentiality property of the head and thematic domains for RC attachments are the Construal theoretical notions, the L2 data in this study, therefore, support the Construal theory.

In terms of proficiency, an adverse effect is evident in the increase of HA during the earlier stages. A slight drop in HA at the later stage could reveal the potential for minimized L1 transfer, pending further studies. Interestingly, the data on the Complex NP *with*, a structure unavailable in L1 Thai, suggest a continuous and marked progression in the LA preference at the earlier and later stages. These data are in line with Miyao and Omaki's (2005) claim for developmental stages in L2 processing and the findings of Karimi, Samadi and Babaii (2021).

General Discussion

The findings in this study can be discussed in the following respects. Firstly, HA is preferred in L1 Thai speakers (Siriwittayakorn et al., 2014 and our survey) and Thai EFL learners, in contrast to English speakers' strategy. This suggests the role of L1 in L2 processing, in line with previous research (e.g., Dussias, 2001; Papadopoulou & Clahsen, 2003; Lee & Wang, 2010; Uludağ, 2020). Theoretically, although L1 strategies were not the primary focus of our investigation, it is evident in this study that the Construal theory (Frazier & Clifton, 1996) is a more likely approach for Thai than Recency/Predicate Proximity. The principle of Referentiality receives support from a new language such as Thai, which is configurational without Saxon genitives. In terms of L2 processing, Thai EFL learners may apply Referentiality in Construal theory instead of Late Closure. In the absence of Saxon genitives, Thai EFL learners on average may not be able to use this L2 strategy to avoid ambiguity. When both NP1 and NP2 are available to be modified by an RC, they interpret the head of the complex NP (NP1) as the referent of the RC, as it is able to introduce a new discourse entity or associate with a pre-existing one.

Secondly, higher proficiency is potentially correlated with native-like strategies, as shown in an increase in the Low Attachment preference

in the Complex NP *with* and a tentative drop in High Attachment preference in the Complex NP *of*. An increasing awareness of the L2 strategy is in line with developmental stages of L2 processing (Karimi et al., 2021; Miyao & Omaki, 2005).

Finally, our findings that Thai learners prefer NP2 when NP2 is introduced by a lexical thematic preposition *with* support those of previous studies. The Thai EFL learners in this study employed Low Attachment, like L2 learners with German, French, Greek and Spanish backgrounds (cf. Felser et al., 2002; Papadopoulou & Clahsen, 2003). This can be viewed as evidence for Gilboy et al.'s (1995) claim, i.e., the preposition *with* creates a local thematic domain and is the last theta-assigner, so NP2 is more attractive to the RC.

Recommendations and Pedagogical Implications

Recommendations

As noted in Experiment 2, although it was found that NP1 was preferred by the Thai-speaking controls, the rate of 6.8 (or 68%) was relatively moderate and there could be a degree of bias in the NPs constituting the Complex NPs. To reveal data that truly reflect the effects of the strategies, it is recommended that plausibility norming of these Thai complex NPs be conducted.

It is desirable that a fully conventional psycholinguistic design, counterbalanced by experimental trials and the application of the 1:3 ratio of the numbers of targets and fillers, be employed in the methodology. Particularly, online tasks such as self-paced reading and eye-tracking are desirable, as these will crucially provide detailed and behavioral data, complementing the offline findings and contributing to L2 processing strategies.

Pedagogical Implications

In our study, we found that NP2 preference rose markedly between the beginning or intermediate and the upper-intermediate levels. This suggests that proficiency in the L2 enhances a target-like option. Limited amounts and lengths of exposure to the L2 could partially explain

why L2 learners are unable to fully acquire the target language processing strategy. Therefore, in order to become more proficient, L2 learners should be intensively exposed to their L2 and have more practice on grammatical structures that are relevant to their purposes.

In addition, the Thai students in the main experiment acquired NP2 strategy in the Complex NP *with* structure more easily than they did the Complex NP *of* structure. The availability of the Norman genitive form in both L2 English and L1 Thai may adversely affect their learning of this type of complex NPs. In this respect, teachers may pay more attention to the Complex NP *of* in their teaching. More instruction and practice on this structure, in addition to the Saxon genitive form, should be given to learners.

Conclusion

This study investigated how Thai learners of English resolved ambiguity imposed by English relative clauses (RC) in two-site context NPs. It was hypothesized, based on their L1, that they would attach the RC to NP1 in the Complex NP *of* structure, and would attach the RC to NP2 in the Complex NP *with* structure, based on the thematic domain assigned by *with* (Gilboy et al., 1995).

Offline interpretation tasks were conducted with native English speaking controls, native Thai speaking controls, and Thai EFL learners. To compare the two strategies, Repeated Measures ANOVAs were performed by subject and item. The results indicated that the native English speaking group chose NP2 as the head of the RC in the Complex NP *of* and the Complex NP *with*, similar to the results from our prior survey with English controls and previous studies. The native Thai speaking group preferred NP1, confirming the results from our prior survey and the findings in Siriwittayakorn et al. (2014). As for the Thai EFL participants, NP1 and NP2 were their preferences for the Complex NP *of* and the Complex NP *with*, respectively, confirming both hypotheses. One-way and Repeated Measures ANOVAs assessing the proficiency effects on the two strategies revealed the positive role of proficiency on the LA preference and the negative role at earlier stages of development of the HA preference.

We conclude that Thai learners' processing of English relative clauses is influenced by their L1. This HA strategy is associated with the discourse principle of Referentiality in the Construal theory (Frazier &

Clifton, 1996). Thai learners, when encountering ambiguity in an L2 structure, will rely on their L1 (HA) strategy. When they process an L2 structure unavailable in their L1, they utilize semantic information associated with thematic elements, such as the preposition *with*. This suggests that the usage of semantic information rendered by a theta-assigner may be a universal strategy for L2 learners.

Acknowledgements

We would like to thank Yuki Hirose for her considerable assistance in the experimental design, Thom Huebner and Neil Griffiths for checking the English norming and target sentences, and Naparat Meechanyankul for the Thai translation of the target and filler items. We are grateful to the English speaking informants, the international faculty, the two groups of Thai students in Rayong, the Thai students in Bangkok, and the Thai informants in Nakhon Pathom. We appreciate Lapassanan Juntarote's arrangements with the students and facilities in Bangkok. A preliminary version of this paper was presented at the 14th Annual Conference of the Japan Second Language Association (J-SLA 2014), Kwansei Gakuin University, Nishinomiya Uegahara Campus, Osaka, Japan on May 31, 2014. We thank the Language Institute of Thammasat University for a thesis writing grant to the first author, a travel grant to J-SLA, and the audience's comments. Finally, we are thankful to the two anonymous reviewers for their helpful comments and suggestions, Mark Zentz for his careful check on the language presentation, and the LEARN editor Supakorn Phoocharoensil for his kind assistance with our submission.

Endnotes

[1] According to Hale (1983), non-configurationality is a typological term used to classify some languages that are considered to exhibit free word order, null pronominals, and discontinuous syntactic elements. In sentences (i), (ii), and (ii) in Warlpiri, an Aboriginal language of Central Australia, reproduced from Hale's (1)-(3), the subject, the object, and the verb may appear in any order, but the auxiliary *ka* must be in the second position. All have the same meaning. Note that ERG refers to Ergative (transitive).

(i) Ngarrka-ngku ka wawirri panti-rni
man ERG Aux kangaroo spear NONPAST
"The man is spearing the kangaroo."
(ii) Wawirri ka panti-rni ngarrka-ngku
(iii) Panti-rni ka ngarrka-ngku wawirri

Spanish has more restrictions on word order than Warlpiri, but it is possible for the logical object of a verb to appear at the beginning of a sentence. In (iv), reproduced from (8c) in Gilboy et al. (1995), the logical object *la mesa que es de madera* occupies the sentence initial position, followed by the pronoun *la* and the verb *compramos* (inflected for the first person plural pronoun). As the verb is not adjacent to its logical object, this suggests that Spanish has a degree of the non-configurational property.

(iv) La mesa que es de madera la compramos el verano pasado
the table which is of wood it (we) bought the summer past
"The table which is of wood we bought it last summer."

[2] The Grician Maxim principle (of avoiding ambiguity) may account for the preference for the English LA strategy, particularly in offline experiments; thanks to a reviewer for pointing out this issue.

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Appendix A

Experimental Sentences Before Randomization (Complex NP *of*)

1. The man shouted at the tutor of the friend who was wearing a white skirt.
Who was wearing the white skirt?
a. The tutor b. The friend

2. The man killed the girlfriend of the colleague who was writing a letter.
Who was writing the letter?
a. The girlfriend b. The colleague

3. The professor supported the student of the friend who was staying in a dorm.
Who was staying in the dorm?
a. The student b. The friend

4. The thief hurt the secretary of the manager who was preparing to go home.
Who was preparing to go home?
a. The secretary b. The manager

5. The actor adored the director of the cameraman who was wearing cowboy boots.
Who was wearing the cowboy boots?
a. The director b. The cameraman

6. The man questioned the teacher of the student who was reading a book.
Who was reading the book?
a. The teacher b. The student

7. The sponsor trusted the painter of the model who was smiling all the time.

Who was smiling all the time?
a. The painter b. The model

8. The father worried about the son of the colleague who was looking serious.
Who was looking serious?
a. The son b. The colleague

9. The secretary saw the chauffeur of the manager who was dreaming of holidays.
Who was dreaming of holidays?
a. The chauffeur b. The manager

10. The wife followed the friend of the husband who was holding an umbrella.
Who was holding the umbrella?
a. The friend b. The husband

Appendix B

Experimental Sentences Before Randomization (Complex NP *with*)

1. The man remembered the secretary with the manager who always joined political activities.
Q: Who always joined political activities?
a. The secretary b. The manager

2. The young man noticed the singers with the guitarists who were reading music magazines.
Q: Who were reading the music magazines?
a. The singers b. The guitarists

3. The coach encouraged the football players with the fans who were looking very happy.
Q: Who were looking very happy?
a. The football players b. The fans

4. The young girl favored the actor with the chauffeur who was speaking to an old man.
Q: Who was speaking to the old man?
a. The actor b. The chauffeur

5. The doctor envied the lawyer with the nurse who was talking on the phone.
Q: Who was talking on the phone?
a. The lawyer b. The nurse

6. The woman recognized the singer with the photographer who was leaving early.
Q: Who was leaving early?
a. The singer b. The photographer

7. The writer admired the professor with the assistant who was giving training sessions.
Q: Who was giving the training sessions?
a. The professor b. The assistant

8. The fans liked the singer with the bodyguard who was wearing a black hat.
Q: Who was wearing the black hat?
a. The singer b. The bodyguard

9. The man thought about the actress with the director who was celebrating a birthday.
Q: Who was celebrating the birthday?
a. The actress b. The director

10. The waiter knew the painter with the model who was crazy about antiques.
Q: Who was crazy about antiques?
a. The painter b. The model

Appendix C

Thai Experimental Sentences Before Randomization (Complex NP *of*)
(The English counterparts appear in Appendix A)

1. ผู้ชายตะโกนใส่ติวเตอร์ของเพื่อนที่ใส่กระโปรงสีขาว

คำถาม ใครใส่กระโปรงสีขาว

ก. ติวเตอร์ ข. เพื่อน

2. ผู้ชายฆ่าแฟนสาวของเพื่อนที่กำลังเขียนจดหมาย

คำถาม ใครกำลังเขียนจดหมาย

ก. แฟนสาว ข. เพื่อน

3. อาจารย์ให้การสนับสนุนนักเรียนของเพื่อนที่อาศัยอยู่ที่หอพัก

คำถาม ใครอาศัยอยู่ที่หอพัก

ก. เพื่อน ข. นักเรียน

4. ขโมยทำร้ายเลขาของผู้จัดการที่กำลังเตรียมตัวกลับบ้าน

คำถาม ใครกำลังเตรียมตัวกลับบ้าน

ก. เลขา ข. ผู้จัดการ

5.นักแสดงชื่นชอบหัวหน้าของตากล้องที่ใส่รองเท้าบูทแบบคาวบอย

คำถาม ใครใส่รองเท้าบูทแบบคาวบอย

ก. ตากล้อง ข. หัวหน้า

6. ผู้ชายถามอาจารย์ของนักเรียนที่กำลังอ่านหนังสือ

คำถาม ใครกำลังอ่านหนังสือ

ก. อาจารย์ ข. นักเรียน

7.สปอนเซอร์เชื่อมั่นในช่างภาพของนางแบบที่ยิ้มแย้มตลอดเวลา

คำถาม ใครที่ยิ้มแย้มตลอดเวลา

ก. ช่างภาพ ข . นางแบบ

8. พ่อเป็นห่วงลูกชายของเพื่อนร่วมงานที่กำลังดูเครียด

คำถาม ใครที่กำลังดูเครียด

ก. เพื่อนร่วมงาน ข. ลูกชาย

9. เลขาเห็นคนขับรถของผู้จัดการที่กำลังฝันถึงวันหยุด

คำถาม ใครกำลังฝันถึงวันหยุด

ก. คนขับรถ ข. ผู้จัดการ

10. ภรรยาเดินตามเพื่อนของสามีที่กำลังถือร่ม

คำถาม ใครกำลังถือร่ม

ก. สามี ข. เพื่อน