The Effect of Syntactically Different L2 Input on L2 Parsing Preference

Hyun Bae
University of Wisconsin-Madison

Abstract
This study investigates whether L2 input affects L2 parsing preference of ambiguous relative clauses that are structurally dissimilar to L1, looking at how 23 L1 Korean L2 English and 29 L1 Mandarin L2 English speakers resolve ambiguous relative clauses in L2 through a timed comprehension test. Mandarin has the same parsing preference of ambiguous relative clause as English and is a head-mixed language unlike English whereas Korean has the opposite parsing preference to English and is a head-final language contrary to English. All the participants are advanced L2 learners and have varying L2 immersion experiences. The results show that the parsing preference of L1 Korean L2 English speakers is influenced by intensive L2 input while that of L1 Mandarin L2 English speakers is not, implying considerable impact of crosslinguistic structural differences on the effect of L2 input on L2 parsing preference.

Key words
Parsing preference, ambiguous relative clause, crosslinguistic influence, input

1. Introduction

Central to the entries of discipline of second language (L2) acquisition are linguistic representation and language processing. Linguistic representation is "cognitive blueprints for the multiple different elements that make up a language: vocabulary, morphological and syntactic structure, semantic fields, pragmatic conventions and so on" (Rothman et al. 2019:23). Language processing is about how linguistic representation is cognitively computed when one produces or understands a language, and it is sensitive to various types of information such as memory and time (Poirer and Shapiro 2012).

Although recent trends in L2 acquisition and psycholinguistics have led to a proliferation of studies on representation and processing, there is no universal agreement on their role in the operation of crosslinguistic influence (Lewis and Phillips 2015, Rothman et al. 2019). In particular, Rothman et al. (2019) divided crosslinguistic influence into two concepts based on how representation and processing affect it. He argued that transfer happens when the interlanguage, an ongoing linguistic representation created and shaped by the dissimilarities between L1 and L2, is not stable, which include grammatical errors; on the contrary, crosslinguistic effect (CLE) takes place when representation is stable and there is a conflict in processing, which entails parsing preference. However, Westergaard (2019) states that such distinction cannot be made as representation and processing function inseparably with regards to crosslinguistic influence and reject to use transfer and CLE separately.

Accordingly, this study aims to explore whether representation and processing function in tandem or separately in relation to crosslinguistic influence by investigating whether representation, especially crosslinguistic structural differences, plays a role in modulating L2 parsing preference using ambiguous relative clause (RC) construction (Dussias 2003, Desmet et al. 2006, Dussias and Sagarras 2007).

The theoretical foundation of this study is the Linguistic Tuning Hypothesis, which states that "the parser simply chooses the structural analysis that has worked most reliably in the past" (Mitchell and Cuetos 1991:1). It means that input frequency determines how one processes and resolves ambiguous structures. Numerous corpus and/or experimental studies provided compelling evidence (Dussias 2003, Dussias and Sagarra 2007). Assuming that the frequency-based processing is a deterministic factor of L2 parsing preference, this study focuses on figuring out whether crosslinguistic structural dissimilarities modify the impact of input on L2 parsing preference rather than whether crosslinguistic structural differences directly affect or determine L2 parsing preference.

In this study, input is operationally defined as the number of years bilingual speakers have resided in the countries where their mother tongue or L2 is spoken, which is parallel to the definition of input used in Dussias and Sagarra's (2007) study. This study adopts an experimental design, and the target L2 learners are L1 Mandarin L2 English and L1 Korean L2 English speakers. English, Korean, and Mandarin have different ambiguous RC structures, which is further discussed later.

In Section 2, I discuss studies on L2 ambiguous RC attachment and the Linguistic Tuning Hypothesis (Cuetos and Mitchell 1988, Dussias and Sagarra 2007). Section 3 introduces the research question and the hypothesis of the current study based on the crosslinguistic differences of ambiguous RC constructions in English, Mandarin, and Korean. Section 4 is about the research design, which includes the participants, experimental design, materials, analysis, etc. Section 5 explores the results and section 6 reveals the primary findings. Finally, the conclusion sums up the research and discusses future work.

2. Literature review

2.1 The resolution of relative clause attachment ambiguities in L2 sentence processing

The structural uniqueness of ambiguous RCs has been widely recognized as a useful source to research how one parses ambiguous structures. The following is an example.

(1) Someone shot [the servant of the actress] who was on the balcony.
(Cuetos and Mitchell 1988:89)

The RC "who was on the balcony" can modify either "the servant" or "the actress" depending on one's parsing preference as the sentence is syntactically correct either way. If one prefers the first noun "the servant," it is called high attachment (HA), and if one favors the second noun "the actress," low attachment (LA).

Not only individuals, but languages also have parsing preferences when it comes to resolving ambiguous RCs. For example, it has been found that some languages (e.g. Spanish, Korean) display a preference for HA and others (e.g. English, Mandarin) LA (Jun 2003, Shen 2006). Varying cross-linguistically but being free from grammaticality, ambiguous RC has been investigated intensively in the field of L2 acquisition and processing. In the meantime, a number of hypotheses and theories have been suggested to identify what determines L2 learners' parsing preference, which include Shallow Structure Hypothesis (SSH), structure-based approaches, Construal Theory, and others (Clahsen and Felser 2006, Frazier and Clifton 1996). Among the several approaches, this study uses the linguistic tuning hypothesis (Mitchell and Cuetos 1991).

2.2 Linguistic tuning hypothesis

According to the linguistic tuning hypothesis, when one reads or hears an ambiguous structure, his or her past successful resolutions of the same type of ambiguities will determine the resolution of the current one (Mitchell and Cuetos 1991). Applying it to L2 acquisition, if one's L1 prefers LA, his or her L2 parsing preference should be LA under the influence of past L1 experiences. It also means that if that person is exposed to a HA-preferring L2 input intensively, the person's parsing preference can be switched to HA.

Several studies were conducted to examine the linguistic tuning hypothesis (Cuetos et al. 1996, Jegerski et al. 2016). Among the numerous studies, Dussias (2003) and Dussias and Sagarra's (2007) study provide great insight into the current study.

To begin with, Dussias (2003) performed two experiments to investigate whether advanced L2 learners' parsing strategy is the same as native speakers' when reading an ambiguous RC. In the first experiment, 31 L1 Spanish L2 English and 32 L1 English and L2 Spanish speakers along with native speakers of the two languages were recruited. The L1 Spanish L2 English speakers had lived in the United States for 7.5 years on average at the time of the experiment whereas L1 English L2 Spanish speakers had lived in a Spanish-speaking country for 2 years on average. They took a test composed of 16 target sentences with ambiguous RCs, 24 distractors, and fillers in both languages. (2) is an example of the target sentences. Each sentence was followed by a question indirectly asking which noun should be attached to the RC as in (3).

Peter fell in love with the daughter of the psychologist who studied in California.

Who studied in California?

a. The daughter studied in California.
b. The psychologist studied in California. (Dussias 2003)

The second experiment was a self-paced reading task with similar items, but this time, the target items were disambiguated with gender cues and the experiment was conducted only in Spanish. 28 L1 Spanish L2 English speakers and 28 L1 English L2 Spanish speakers out of those who participated in the first experiment took the test. 32 Spanish monolingual speakers also took the task as a control group. The following is one of the target sentences in the experiment.

(4) El perro mordió al cuñado de la maestra / que vivió en Chile / con su esposo.

(5) The dog bit the brother-in-law of the teacher (FEM) who lived in Chile with his/her husband. (Dussias 2003)

The findings showed a strong LA tendency for the English monolingual speakers and the opposite tendency for the Spanish monolinguals in both the experiments. Concerning L2 speakers, both the L2 groups preferred LA in both the experiments. That is, only L1 English L2 Spanish speakers adopted L1 parsing preference. Moreover, L1 Spanish L2 English speakers favored L2 parsing preference in both L1 and L2. Dussias (2003) identified the amount of L2 input as the cause of the difference as the L1 Spanish L2 English group lived in the US for 7.5 years while the L1 English L2 Spanish group resided in a Spanish-speaking country for only 2 years on average.

To further investigate the impact of input on parsing preference, Dussias and Sagarra (2007) studied whether L2 input influences not only L2 but also L1 parsing preference by comparing L1 Spanish L2 English speakers with intensive L2 and those without intensive L2 input. It was predicted that those with intensive L2 input would prefer LA and the others would not. The experiment was conducted only in Spanish. The principle of the experiment was the same as that of Dussias' (2003) study except that they used eye-tracking this time. The ambiguous RCs in the target sentences were disambiguated by gender cues. The results revealed that those with limited L2 input along with the control group, L1 Spanish speakers, prefer HA while those with intensive L2 input have a LA preference.

Thus, Dussias (2003) and Dussias and Sagarra (2007) both provided convincing evidence that input is a deterministic factor in L2 parsing preference.

Nevertheless, it is questionable whether such linguistic tuning takes place only when the two languages' ambiguous RCs are structurally identical like Spanish and English; both English and Spanish are post-nominal and head-initial linguistic. Thus, one can raise a question of whether a corresponding linguistic tuning would occur even when L1 and L2 are structurally incompatible as in L1 Korean L2 English or L1 Mandarin L2 English (See Table 2).

Accordingly, this study investigates whether L2 input modifies L2 parsing preferences in accordance with the linguistic tuning even when L1 and L2 are structurally dissimilar by looking at L2 resolution of ambiguous RCs by L1 Mandarin L2 English and L1 Korean L2 English speakers with intensive L2 input in comparison to those without such intensive L2 input. As stated above, input is operationally defined as the number of years the L2 speakers have lived in the countries where their L1 or L2 is spoken. The following is the research question.

RQ: *Does L2 input affect L2 parsing preference of ambiguous RC resolution regardless of crosslinguistic structural differences?*

3. Current study

3.1 RC attachment preference of English, Korean, and Mandarin

According to previous studies, both English and Mandarin prefer LA, and Korean alone favors HA. (Bai 2019, Cuetos and Mitchell 1988, Jun 2003, Kwon et al. 2019, Shen 2006). Thus, English and Mandarin are considered to encourage LA and Korean HA in this study.

Table 1. Attachment preference of the three languages

	Mandarin	English	Korean
Attachment preference	LA	LA	HA

3.2 Crosslinguistic analysis of ambiguous RC structures in English, Mandarin, and Korean

English, Korean, and Mandarin ambiguous RC constructions are different from each other primarily in head directionality, case-marking, and complex genitive nouns. Table 2 summarizes the differences, followed by an example of ambiguous RC in the three languages.

Table 2. Crosslinguistic differences of ambiguous RC structures between the three languages

	Korean	English	Mandarin
Head directionality	Final	Initial	Initial + Final (with RC)
Case-marking vs constituent order	Case-marking	Constituent order	Constituent order
Complex genitive noun	Modifying word first	Modified word first	Modifying word first

(6) English
the student of the teacher **who/that** buys the car

(7) Mandarin
Mai na liang che **de** laoshi de xuesheng (RC – **DE** – NP – DE – NP)
buy that CL car **DE** teacher DE student
'the student of the teacher **who/that** buys the car'
(CL = classifier, **DE** = Mandarin RC marker, DE = Mandarin possessive marker)

(8) Korean
Ku cha-rul sa-**nun** sunsaengnim-uy haksaeng (RC-**REL.PRES** - NP-GEN - NP)
the car-ACC buy-**REL.PRES** teacher-GEN student
'the student of the teacher **who/that** buys the car'
(ACC = accusative marker, **REL** = relative marker, **PRES** = present tense, GEN = genitive)

3.3 Hypotheses

Following Dussias (2003) and Dussias and Sagarra's (2007) study, it is predicted L1 Korean L2 English participants start preferring LA at a certain point as L2 input increases. Meanwhile, L1 Mandarin L2 English participants are expected to prefer LA with or without intensive L2 input as

English and Mandarin have the same preference.

Table 3. Hypothesis

Group	Parsing preference of ambiguous RCs
L1 Mandarin L2 English with limited or intensive L2 input	*Mandarin (LA) + limited or intensive English (LA) = LA -> LA*
L1 Korean L2 English with limited L2 input	*Korean (HA) + limited English (LA) = HA –> HA*
L1 Korean L2 English with intensive L2 input	*Korean (HA) + intensive English (LA) = HA -> LA*

4. Methodology

4.1 Participants

Three groups of participants were recruited: monolingual English speakers as the control group, L1 Mandarin L2 English speakers, and L1 Korean L2 English speakers with advanced L2 proficiency and varying amounts of L2 input as the target groups. The L2 proficiency of the L2 speakers were measured based on the results of the L2 proficiency tests and the amount of L2 input was recorded via the language background questionnaire.

Table 4. Background information of the participants

	Age at testing (AAT)		English proficiency (Max = 35)		Length of L2 exposure (year)	
	Mean(*SD*)	Range	Mean(*SD*)	Range	Mean(*SD*)	Range
Native English speakers (*n*=23)	21.4 (2.4)	19-27	34.9 (0.3)	34-35	n/a	n/a
L1 Korean L2 English speakers (*n*=23)	28.3 (4.1)	23-42	33.6 (1.6)	30-35	7.5(8.7)	0-31
L1 Mandarin L2 English speakers (*n*=29)	26.8 (4.4)	19-42	32.9 (1.8)	27-35	5.5(5.4)	0-18

4.2 Materials and procedure

I created a timed comprehension test using Qualtrics, an online survey tool where one can build and distribute surveys. There are 20 target sentences, 20 distractors, and 40 fillers. Each target item contains an ambiguous RC with no disambiguating cue. To prevent confounding effects, only animate nouns are used in complex nouns, the RCs and the main clauses in the target items contain less than five words excluding the complex nouns, only one complementizer *that* was used, and only subject RCs were used in the subject position of the sentences.

A timed comprehension question followed every sentence, which indirectly asked what their parsing preference is. The participants had 3 seconds to answer each question. Only two choices were available: (a) and (b). Half of HA responses were assigned to (a) and the other half to (b) to balance out the choices. I also quasi-randomized the distractors and fillers with the target items to hide the purpose of the study and prevent the priming effect. Table 5 shows example targets.

Table 5. Sample target items

Target sentence	Question
The father of the man who bought a pet looked very handsome.	Who bought a pet? (a) the father (b) the man
The nanny of the child who slept until noon needed my help.	Who slept until noon? (a) the child (b) the nanny

Aside from the main experiment, a cloze test was used to check the L2 speakers' English proficiency. The sample cloze test created by Park (1998) was adapted. Lastly, a brief language background questionnaire was used to know the participants' mother tongue, L2 proficiency, etc.

The experiment was run online via Qualtrics. The link to the experiment was sent to the participants. The link first led them to the instruction screen, which informed them of how to complete each task. Then, the participants finished the tasks one by one.

4.3. Analysis

For descriptive analysis, I obtained the sum and the average of the participants' LA responses by group. For inferential analysis of the effect of L2 input on L2 parsing preference, I used a generalized logistic mixed-effects regression model. The model had L2 parsing preference as response variable, L2 proficiency as fixed effects, and participant and item as random effects.

5. Results

5.1 Parsing preference of native English speakers and L1 Mandarin L2 English speakers and L1 Korean L2 English speakers

The average preference towards LA from each group shows that English native speakers prefer LA with 63%, L1 Korean group favors HA with 40% and L1 Mandarin speakers have no preference with 47%.

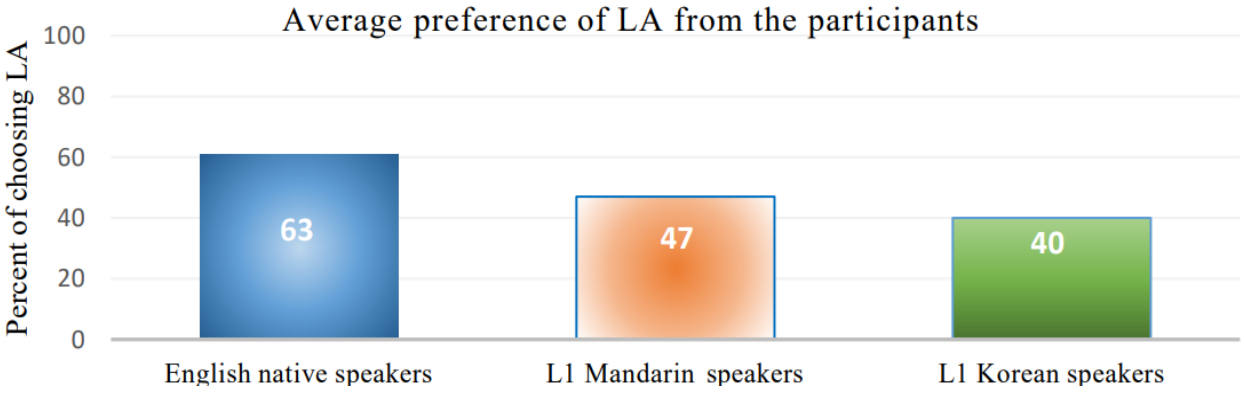


Figure 1: Average preference of LA from each group

5.2 L1 Korean L2 English speakers' parsing preference by L2 input

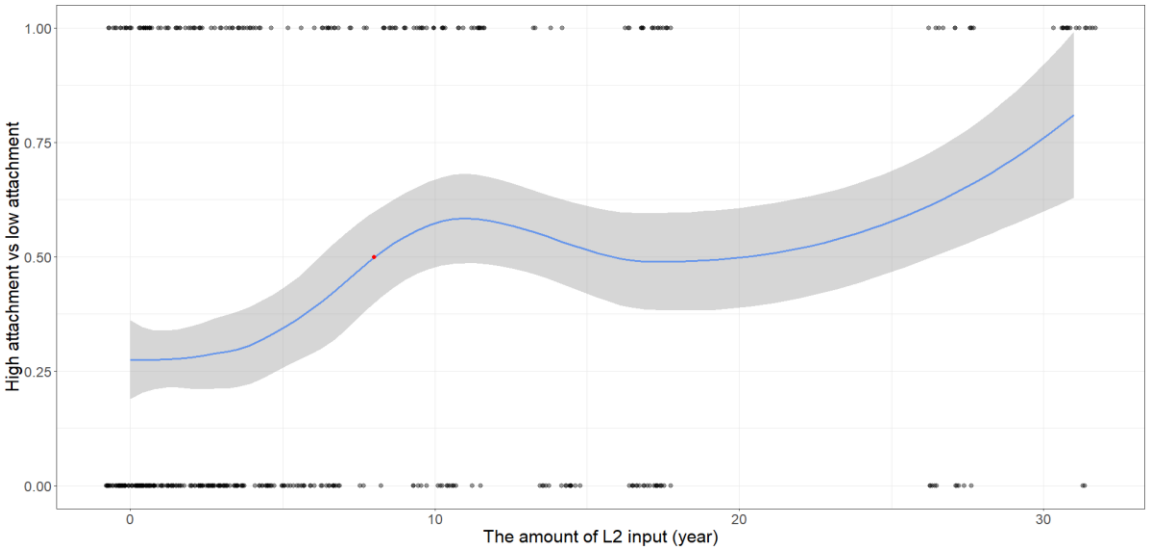
According to the generalized logistic mixed-effects regression analysis, L1 Korean L2 English

speakers experience the expected linguistic tuning as the amount of L2 input increases, and the effect of L2 input is significant (β = .0953, *SE* = .0395, *z* = 2.411, *p* = .0159). This means that L2 input plays a deterministic role in L2 parsing preference despite the aforementioned crosslinguistic structural differences between the two languages. Without L2 input, they prefer HA as predicted (β = -1.372, *SE* = .484, *z* = -2.834, *p* = .004). Table 6 and Figure 2 present and visualize the result of the analysis.

Table 6. Fixed effects estimates and standard errors (SE) of generalized logistic mixed-effects regression analysis (L1 Korean L2 English speakers' L2 input)

	Estimate (β)	***SE***	***z***	***p***
(intercept)	- 1.372	.484	-2.834	.004
L2 proficiency	.0953	.0395	2.411	.0159*

*** $p < .0001$, ** $p < .001$, * $p < .05$



Notes The black dots represent the participants' answers; 1 is LA and 0 is HA in relation to L2 input (year).

Figure 2: The effects of L2 input on preference towards LA (L1 Korean L2 English speakers)

5.3 L1 Mandarin L2 English speakers' parsing preference by L2 input

Contrary to the L1 Korean L2 English speakers, L1 Mandarin L2 English speakers are not influenced by L2 input concerning their parsing preference. The effect of L2 input is minimal and insignificant (β = -.015, *SE* = .0587, *z* = - .256, *p* = .798). Not only that, they do not show any particular preference for either LA or HA even though their L1 and L2 have the same parsing preference, LA (See Figure 3).

Table 7. Fixed effects estimates and standard errors (SE) of generalized logistic mixed-effects regression analysis (L1 Mandarin L2 English speakers' L2 input)

	Estimate (*β*)	***SE***	***z***	***p***
(intercept)	- .0714	.4661	- .153	.878
L2 proficiency	- .015	.0587	- .256	.798

*** $p < .0001$, ** $p < .001$, * $p < .05$

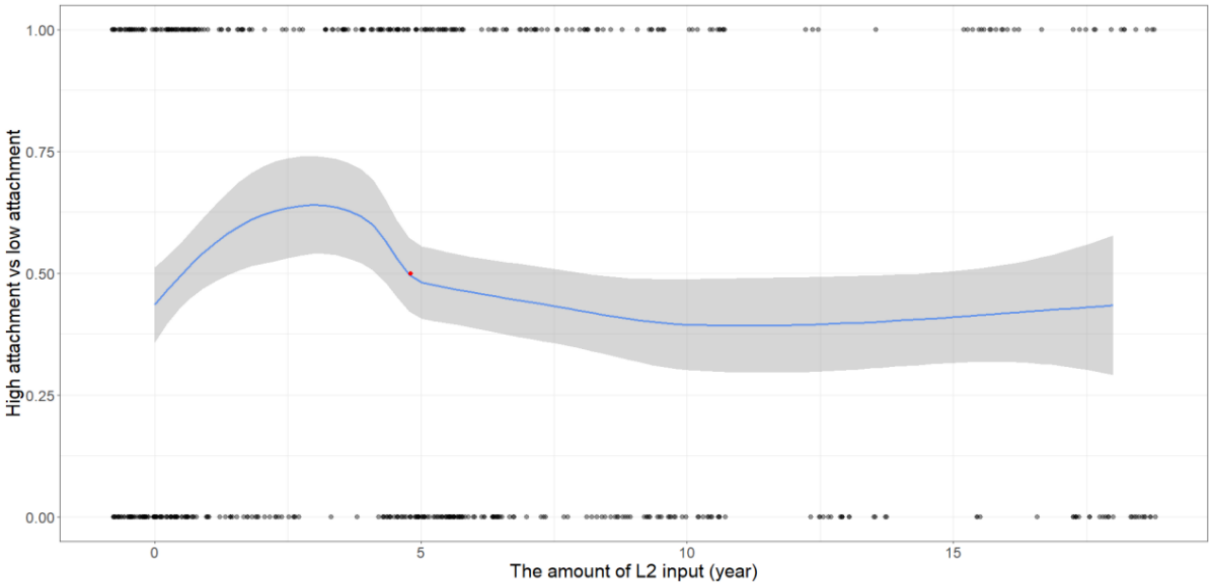


Figure 3: The effects of L2 input on preference towards LA (L1 Mandarin L2 English speakers)

6. Discussion

First, the result of the English monolingual speakers' data shows that English prefers LA (63%). This is consistent with previous studies of ambiguous RC attachment preference for English monolinguals (Cuetos and Mitchell 1988, Dussias 2003, Dussias and Sagarra 2007). Meanwhile, the effects of L2 input reached significance with L1 Korean speakers, but not with Mandarin speakers. That is, the linguistic tuning occurred despite the crosslinguistic structural differences between Korean and English, but not with those between Mandarin and English. The former case complies with Dussias (2003) and Dussias and Sagarra (2007), and the latter does not.

There are several possible explanations for this result. First, it might be because of the difference between Korean and Mandarin's parsing preference; Korean prefers HA unlike English while Mandarin favors LA like English. As Dussias (2003) and Dussias and Sagarra's (2007) studies used English and Spanish whose parsing preferences are different, it is possible that the linguistic tuning in L2 can be applied only when the parsing preferences of the involved languages are not the same. Another possible explanation has to do with the difference between Korean and Mandarin ambiguous RC constructions. Although both Korean and Mandarin are post-nominal with RCs, Mandarin is prenominal with the verbal domain as it has a mixed head-directionality. It is possible that the Mandarin's mixed head-directionality made the L1 Mandarin L2 English speakers not comfortable with choosing either LA or HA in their L2 contrary to the L1 Korean L2 English speakers. Lastly, it could be due to the crosslinguistic differences in both parsing

preference and structure. Still, with the lack of supporting evidence, these results need to be interpreted cautiously.

Previous studies in the field provide theoretical support for the second and third interpretations. According to Bai (2019), prenominal relative clauses and post-nominal relative clauses are parsed in different ways, especially when HA is preferred. To be specific, as the first noun of the complex genitive, LA, is read or heard before the following noun with post-nominal ambiguous RCs, it is after the second noun, HA, appears that ambiguity emerges, so the initial interpretation, LA, should be reanalyzed for HA to be selected. The examples can be found in (9) and (10). On the other hand, prenominal ambiguous RCs do not require such reanalysis for HA as the entire complex genitive precedes the relative clause.

Taking everything into account, this study contends that L1 Mandarin L2 English speakers' absence of the linguistic tuning resulted from the crosslinguistic structural differences, and it supports the ideas that representation and processing cannot function distinctively with crosslinguistic influence and that transfer and crosslinguistic effect cannot be defined distinctively. (Westergaard 2019). Still, further study is needed for an accurate interpretation.

7. Conclusion

The present study was designed to determine the effect of crosslinguistic structural differences on the linguistic tuning. The major finding is that the linguistic tuning can takes place even with crosslinguistic structural differences. However, when the parsing preferences of the languages are the same and their structures are different, the linguistic tuning could not occur. Taken together, these results suggest that crosslinguistic structural differences play a role in L2 parsing preference. For future studies, it would be interesting to explore the logic behind how head-directionality affects the linguistic tuning.

References

Bai, Chunhua. (2019) Influence of L1 and L2 on L3 Sentence Processing: Evidence from Ambiguity Resolution in First, Second, and Third Language Processing. *The CGCS Journal of Language Research and Education* 3, 1-13.

Clahsen, Harald and Claudia Felser. (2006) Grammatical Processing in Language Learners. *Applied Psycholinguistics* 27.1, 3-42.

Cuetos, Fernando and Don C. Mitchell. (1988) Cross-linguistic Differences in Parsing: Restrictions on the Use of the Late Closure Strategy in Spanish. *Cognition* 30.1, 73-105.

Cuetos, Fernando, Don. C Mitchell and Corley Martin. (1996) Parsing in Different Languages. In Manuel Carreiras, Jos E. Garcı´a-Albea and N£ria Sebastia´n-Galle´s (eds.), *Language Processing in Spanish.* 145-187. Mahwah, NJ: Erlbaum.

Desmet, Timothy, Constantijn De Baecke, Denis Drieghe, Marc Brysbaert and Wietske Vonk. (2006) Relative Clause Attachment in Dutch: On-line Comprehension Corresponds to Corpus Frequencies When Lexical Variables are Taken Into Account. *Language and Cognitive Processes* 21.4, 453-485.

Dussias, Paola E. (2003) Syntactic Ambiguity Resolution in L2 Learners. *Studies in Second Language Acquisition* 25.4, 529-557.

Dussias, Paola E. and Nuria Sagarra. (2007) The Effect of Exposure on Syntactic Parsing in

Spanish–English Bilinguals. *Bilingualism: Language and Cognition* 10.01, 101-116.

Frazier, Lyn and Charles Clifton Jr. (1996) *Construal*. Cambridge, MA: MIT Press.

Jegerski, Jill, Bill VanPatten and Gregory D. Keating. (2016) Relative Clause Attachment Preferences in Early and Late Bilinguals. In Diego Pascual y Cabo (ed.), *Advances in Spanish as a Heritage Language.* 81-98. Amsterdam: John Benjamins.

Jun, Sun-Ah. (2003) Prosodic Phrasing and Attachment Preferences. *Journal of Psycholinguistic Research* 32, 219-249.

Kwon, Nayoung, Deborah Ong, Hongyue Chen and Aili Zhang. (2019) The Role of Animacy and Structural Information in Relative Clause Attachment: Evidence From Chinese. *Frontiers in Psychology* 10, 1576.

Lewis, Shevaun and Colin Phillips. (2015) Aligning Grammatical Theories and Language Processing Models. *Journal of Psycholinguistic Research* 44.1, 27-46.

Mitchell, Don. C. and Fernando Cuetos. (1991) The Origins of Parsing Strategies. In Carlota S Smith (ed), *Current Issues in Natural Language Processing.* 1–12. Centre for Cognitive Science, University of Texas, Austin.

Park, Jongsook. (1998) *The C-test: Usefulness for Measuring Written Language Ability of Non-native Speakers of English in High School*. Retrospective Theses and Dissertations. 16143. Iowa State University.

Poirier, Josée and Lewis P. Shapiro. (2012) Linguistic and Psycholinguistic Foundations. In Richard K Peach and Lewis P Shapiro (eds.), *Cognition and Acquired Language Disorders: An Information Processing Approach*. 121-146. Mosby: Elsevier Publishing.

Rothman, Jason, Jorge González Alonso and Eloi Puig-Mayenco. (2019) *Third Language Acquisition and Linguistic Transfer* (Cambridge Studies in Linguistics). Cambridge, UK: Cambridge University Press.

Shen, Xingjia. (2006) *Late Assignment of Syntax Theory: Evidence From Chinese and English*. Doctoral dissertation, University of Exeter.

Westergaard, Marit. (2019) Microvariation in Multilingual Situations: The Importance of Property-by-Property Acquisition. *Second Language Research* 37.3, 379-407.

hbae29@wisc.edu