Cue-Based Processing of Relative Clauses in L2 Japanese

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1. Introduction

The patterns of sentence processing that we observe in second language acquisition (SLA) have often been attributed to one of three sources: language universals, transfer from the first language (L1), or direct learning of the second language (L2). The current study focuses on the roles of these three forces in the interpretation of relative clauses in Japanese. In this area, the most prominent universalist account is the noun phrase accessibility hierarchy (NPAH) of Keenan and Comrie (1977). The NPAH argues on cross-linguistic grounds that the degree of difficulty in relativization on a particular noun phrase (NP) in human language is the following:

(1) Subject > Direct Object > Indirect Object > Oblique > Genitive > Object of Comparison

Studies of L1 speakers have consistently demonstrated that subject relatives are easier than object relatives (Frazier, 1987; Gibson, Desmet, Grodner, Watson, & Ko, 2005; Holmes & O'Regan, 1981; King & Just, 1991; MacWhinney & Pléh, 1988; but see Hsiao & Gibson, 2003). With L2 learners, studies of learners of European languages have indicated that subject relatives are typically easier than object relatives (Croteau, 1995; Eckman, Bell, & Nelson, 1988; Gass, 1979, 1982; Hawkins, 1989; Hyltenstam, 1984). However, recent results from East Asian languages appear to vary. One set of studies supported this prediction of the NPAH (Kanno, 2007; O'Grady, Lee, & Cho, 2003), whereas another set of studies provided contrasting results (Jeon & Kim, 2007; Ozeki & Shirai, 2007; Yip & Matthews, 2007). It is possible that some of these studies were not sufficiently sensitive to possible differences, be they online or offline differences.

The aim of the present study is to investigate how Japanese as L2 learners process Japanese relative clauses using both self-paced reading method and measures of overall comprehension. The question of interest is whether object relatives are more difficult than subject relatives and passive relatives. The study also investigated the impact of L1 attuned processing strategies of two participant groups with different L1s: English and Korean. The theoretical orientation for this work derives from the cue-based processing approach of the competition model (Bates & MacWhinney, 1982, 1989) and related work on the perspective shift hypothesis (MacWhinney, 1977, 1982; MacWhinney & Pléh, 1988), although we also consider the ways in which other approaches may account for the aspects of the obtained results.

2. Literature review

The syntactic construction examined in this study involves relative clauses with external heads. In English, the relative clause construction is typified by these three components: gaps, relative pronouns, and heads (Leech & Svartvik, 1994). Except in cases of extraposition, the relative clause follows the head noun. The relative clause itself begins with a relativizer (*that*, *which*, *who*, etc.) in clause-initial position and the original relativized NP is deleted, producing a gap. Subject relative clauses are those

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in which the head NP is the subject of the verb inside of the clause, as shown in (2). Object relative clauses are those in which the head NP is the object of the verb inside of the clause, as shown in (3). In object relative clauses, the relativizer may be optionally deleted. The gap positions are shown by *e* with co-reference of *i*.

(2) Subject relative
The woman$_i$ [that e_i hit the man] called the police.

(3) Object relative
The man$_i$ [that the woman hit e_i] called the police.

Japanese relative clauses have various characteristics that one does not observe in English. Because Japanese is a left-branching language, the position of the relative clauses is prenominal and there are no relativizers to demarcate the beginning or end of the relative clause (Kuno, 1973). These two characteristics make processing unique, because the parser may first treat the pre-head part of the construction as a main clause. It is only when the processor hits the head NP that it becomes clear that the initial material is a relative clause and not a main clause. The following are examples of subject relative (4) and object relative (5) in Japanese.[1]

(4) Subject relative
[e_i otokonohito-o tataita] onnanohito$_i$-ga keisatsu-o yonda.
man-ACC hit-PAST woman-NOM police-ACC call-PAST
'The woman that hit the man called the police.'

(5) Object relative
[onnanohito-ga e_i tataita] otokonohito$_i$-ga keisatsu-o yonda.
woman-NOM hit man-NOM police-ACC call-PAST
'The man who the woman hit called the police.'

In terms of accuracy order, studies of L2 learners of European languages have supported the predictions of the NPAH (Croteau, 1995; Eckman, Bell, & Nelson, 1988; Gass, 1979, 1982; Hawkins, 1989; Hyltenstam, 1984). One of the earliest L2 studies on the NPAH was by Gass (1979). She conducted grammaticality judgment tasks and sentence combination tasks on 17 adult ESL learners with nine different L1s. The predictions of the NPAH were borne out: subject relatives showed the greatest frequency and accuracy, followed by direct object relatives, and so forth. Subsequent studies provided further support for the NPAH, particularly as it applies to subject relatives and object relatives. The field by and large has reached consensus on this issue, and some introductory SLA textbooks introduce the NPAH as one of the universals in SLA (Ellis, 1994; Gass & Selinker, 2001; Mitchell & Myles, 2004). The success of the predictions of the NPAH leads naturally to questions about why this hierarchy exists. On this issue, Keenan and Comrie (1977) were noncommittal, leaving explanatory accounts to others.

One possible explanation of the NPAH is the linear distance hypothesis (LDH) of Tarallo and Myhill (1983), which links increases in sentence processing difficulty to increases in linear distance between gaps and fillers. The results from Tarallo and Myhill support this hypothesis. In English, object relatives are more difficult than subject relatives because the extraction site, shown by *e*, is further from the head NP, with a reference *i*, than is the case for subject relatives. Sentences (6) and (7) illustrate this effect. The number of intervening words is given in parentheses.

(6) Subject relative (1 word)
The woman$_i$ [that e_i hit the man] called the police.

[1] Abbreviations used in this paper: NOM, nominative case; ACC, accusative case; DAT, dative case; PAST, past tense; PASS, passive morphology.

(7) Object relative (3 words)
The man$_i$ [that the woman hit e_i] called the police.

Crucially, the LDH predicts that, in Japanese and in other languages with pronominal relative clauses, object relatives should be easier than subject relatives, as illustrated by (8) and (9). Thus, this account predicts that the NPAH would not actually be a language universal.

(8) Subject relative (2 words)
[e_i otokonohito-o tataita] onnanohito$_i$-ga keisatsu-o yonda.
man-ACC hit-PAST woman-NOM police-ACC call-PAST
'The woman that hit the man called the police.'

(9) Object relative (1 word)
[onnanohito-ga e_i tataita] otokonohito$_i$-ga keisatsu-o yonda.
woman-NOM hit man-NOM police-ACC call-PAST
'The man who the woman hit called the police.'

A second possible explanation for the NPAH is the structural depth hypothesis (SDH) proposed by O'Grady (1996, 1999). O'Grady maintains that the difficulty of relative clause processing is determined by the number of the syntactic nodes intervening between the head NP and the gap; in other words, how deeply the gap is embedded corresponds to the relativized NP. In English, subject relatives involve two nodes, whereas object relatives involve three nodes as shown in (10) and (11). The numbers and the types of nodes are provided in parentheses.

(10) Subject relative (2 nodes: CP and IP)
The woman$_i$ [$_{CP}$ that [$_{IP}$ e_i hit the man]] called the police.

(11) Object relative (3 nodes: CP, IP and VP)
The man$_i$ [$_{CP}$ that [$_{IP}$ the woman [$_{VP}$ hit e_i]]] called the police.

The SDH predicts that subject relatives are easier than object relatives in English, and also produces the same prediction for the left-branching language, like Japanese as in (12) and (13).

(12) Subject relative (2 nodes: CP and IP)
[$_{CP}$ e_i [$_{IP}$ otokonohito-o tataita]]onnanohito$_i$-ga keisatsu-o yonda.
man-ACC hit-PAST woman-NOM police-ACC call-PAST
'The woman that hit the man called the police.'

(13) Object relative (3 nodes: CP, IP, and VP)
[$_{CP}$ onnanohito-ga [$_{IP}$ e_i [$_{VP}$ tataita]]] otokonohito$_i$-ga keisatsu-o yonda.
woman-NOM hit man-NOM police-ACC call-PAST
'The man who the woman hit called the police.'

Unlike the LDH, the SDH predicts that the NPAH should hold universally. However, neither the LDH nor the SDH provides any clear account for the three additional levels of the NPAH below the levels of the subject and the object.

A third possible explanation of the NPAH is the perspective shift hypothesis (PSH) (MacWhinney, 1977; 1982, MacWhinney & Pléh, 1988). MacWhinney (1977) argues that both speakers and listeners prefer sentences in which the subject closely matches the unmarked human perspective and the perspective shifts interact with the integration and construction of sentence comprehension. According to this account, the more perspective shifts the sentence has, the more difficult comprehension becomes. Thereby, the difficulty of object relatives is due to the fact that they require more perspective shifts than do subject relatives. The PSH predicts that subject relatives are easier than object relatives

in English as in (14) and (15). The numbers and the sites of perspective shifts are given in the parentheses.

(14) Subject relative (1 shift: 'the woman' → 'the man')
The woman$_i$ [that e_i hit the man] called the police.

(15) Object relative (2 shifts: 'the man' → 'the woman' → 'the man')
The man$_i$ [that the woman hit e_i] called the police.

Like the SDH and LDH, the PSH attributes the processing difficulties described by the NPAH to increases in the number of cognitive operations required by the various relative clause patterns. However, the locus of these cognitive operations differs across the three hypotheses. The operations of the LDH are computed during processing of surface structure; the operations of the SDH are computed during formulation of syntactic structure; and the operations of the PSH are computed during mental model construction (MacWhinney, 2008). Because of this, the PSH can also potentially be extended to provide an account of the increasing markedness of oblique, genitive, and comparison heads, although the construction and examination of that extension lies outside the scope of the current study.

The specific cognitive operations proposed by the PSH can be further analyzed as involving these four actions: role assignment, perspective hold, perspective taking, and perspective shift. We will now discuss each of these operations in terms of the processing of Japanese relative clauses. If the initial NP is dative or accusative as in (16), then there is role assignment, but no initial perspective taking, since the NP is secondary.

(16) Subject relative
[e_i otokonohito-o tataita] onnanohito$_i$-ga keisatsu-o yonda.
man-ACC hit-PAST woman-NOM police-ACC call-PAST
'The woman that hit the man called the police.'
Hold: 'the man'
Taking: 'the woman'
Shift: none

Unlike speakers of English, speakers of Japanese are quite used to making this initial commitment to a non-perspectival role, based on the strong local cue of accusative case marking. However, if the initial noun is nominative, then it is taken as the full initial perspective. In (16), processing then continues smoothly to the verb and the following noun, leading to the assignment of perspective on the head *onnanohito* without any shift in perspective. The two operations involved are role assignment for the accusative and perspective taking for the nominative, which is then continued through perspective hold through the rest of the sentence. Thus, the Japanese subject relative, like the English subject relative requires no perspective shifting. However, unlike English, speakers of Japanese must hold the initial accusative NP in working memory until the agential perspective is encountered. But this hold in working memory is very slight, since the role of the initial accusative noun can be directly assigned on the basis of the strong and valid case-marking cue (MacWhinney, 2008). In (17), on the other hand, there is an initial perspective taking at the first NP. Once the second nominative NP is encountered, there must be a perspective shift, just as in the English object relative. It is this shift that then predicts greater difficulty for object relatives over subject relatives, according to the PSH. Note that, in this account, perspective taking involves the identification of an active Agent, and is initiated mostly by nominative NP (*-ga*) in Japanese.

(17) Object relative (1 word)
[onnanohito-ga e_i tataita] otokonohito$_i$-ga keisatsu-o yonda.
woman-NOM hit man-NOM police-ACC call-PAST
'The man who the woman hit called the police.'
Hold: none
Taking: 'the woman', 'the man'
Shift: the woman → the man

Apart from the three accounts we have examined in detail, there are several other explanations of the NPAH, each examined in greater detail in MacWhinney and Pléh (1988). However, for our present purposes, these three accounts serve to illustrate the core issues involved. Two of the accounts (SDH and PSH) predict that Japanese and other prenominal relative clause languages should behave like postnominal European languages in terms of the greater ease of subject relatives. Other accounts, such as LDH and related non-structural accounts, predict that prenominal languages should either show an advantage for object relatives or perhaps no difference between subject relatives and object relatives. This contrast in predictions leads to interesting empirical consequences regarding the applicability of the NPAH to both L1 and L2 processing. In regard to L1 processing, as we have noted, there is little disagreement regarding the universal application of the NPAH. The main issue in dispute relates to the application of NPAH to L2 processing. Here, if we find cases where the NPAH fails to apply to L2 learning, there are at least three possible explanations for this failure. First, it could be that, as a component of Universal Grammar, the NPAH has effects that diminish or evaporate after the passing of some critical period (Lenneberg, 1967). Second, it could be that L1 transfer or incomplete L2 learning serve to blur the effects of the NPAH on learners. In this case, we may simply need better methodology to detect the impacts of the NPAH on L2 learning. Third, it could be the case that there are systematic typological effects that interact with the basic effects of the NPAH. MacWhinney and Pléh (1988) found a pattern of this type for Hungarian in which NPAH effects interacted with a principle for topic-comment marking. These various possible accounts all point to the need for detailed data using multiple dependent measures on the processing of relative clauses of different types in learners of prenominal languages.

We already have good evidence that there are empirical complexities in this area. On the one hand, O'Grady et al. (2003) examined how L2 learners of Korean with L1 English process relative clauses using picture selection tasks. They found that participants performed more accurately on subject relatives than object relatives and interpreted the results so as to confirm the Structural Distance Hypothesis in Korean, a prenominal language. Corresponding results were obtained in Japanese (Kanno, 2007) and Turkish as L2 (Aydin, 2007). Contrastingly, Ozeki and Shirai (2007) and Jeon and Kim (2007) have shown that object relatives are not necessarily difficult in Japanese, thereby casting fundamental doubt on the application of the NPAH to L2 learning. Examining a corpus of L2 Japanese learners' ACTFL-OPI interviews, Ozeki and Shirai found that L2 Japanese learners were somewhat insensitive to the grammatical relations of the head NP, and relied more on the semantic cue of animacy. When asked to combine sentences to form relative clauses, learners erroneously produced subject relatives if the head NP was animate. Furthermore, less proficient learners were not able to produce subject relatives with an inanimate head NP. The authors argue that learners create a prototype for relative clauses, and relative clause types that fall outside of the prototypical criteria might be difficult, for example subject relatives with inanimate head NP (see also Jeon & Kim, 2007). These results can be viewed as indicating the competition of two parallel strategies from the competition model (MacWhinney, 2008). The strategy observed by Ozeki and Shirai focuses on the cue of animacy. If this cue is present, it plays a strong role in both L1 and L2 processing of Japanese. However, the sentences used in the studies like O'Grady et al. include two animate NPs. In this case, the animacy contrast is not available, and processing may fall back to other cues or strategies, such as the NPAH.[2]

[2] Alternatively, their results may be due to high correlation between animacy of head NP and subject relatives in interlanguage, which biases learners to interpret animate-head relatives as subject relatives, as suggested by Ozeki and Shirai (2007).

Because these studies have used off-line measures, it is possible that the absence of an NPAH effect might be due to insensitivity of the measures being used (see also Izumi, 2002, 2007). Recently a growing number of L2 research employs online methodologies, for example a self-paced reading technique (Juffs, 2005). The results obtained through such methods can not only inform us about the operations of the processing system moment by moment, but can also address crucial questions as to whether learners employ the same processing strategies as those found in monolinguals. Specifically, researchers are interested in knowing whether learners can obtain native-level processing efficiency (Dussias, 2003).

It is now generally accepted that sentence processing is incremental and the parser immediately draws upon all relevant sources of information as soon as they are available (MacDonald, Pearlmutter, & Seidenberg, 1994; Trueswell, Tanenhaus, & Kello, 1993). However, much of the analysis has centered on the ways in which English verbs anticipate their arguments. These types of expectations cannot apply directly to Japanese, since the verb is usually sentence final. Instead, incremental processing in Japanese relies on the ways in which case-markers provide information for role assignment (Kamide, Altmann, & Haywood, 2003; Miyamoto, 2002). Using eye-tracking methodology, Kamide et al. (2003) investigated how information from pre-head arguments is utilized for anticipating what classes of argument may follow. In the case of double-object construction, the claim, according to Kamide et al., is that sentences beginning with a sequence of NP-NOM and NP-DAT signal that the third NP will be marked in the accusative case as shown in (18).

(18) Weitoresu-ga kyaku-ni tanoshigeni hanbaagaa-o hakobu
waitless-NOM customer-DAT merrily hamburger-ACC bring.
'The waitress will merrily bring the hamburger to the customer.' (p. 147)

Consequently, the parser can anticipate an incoming verb that will denote an act of transference from the *Agent* to the *Goal*, in which subsequent *Theme* can be whatever is transferrable. The participants' eye-movement patterns show that Japanese speakers predict incoming structures prior to a verb.

The results from Kamide et al. (2003) are congruent with the fundamental cue-based processing assumptions of the competition model (MacWhinney & Bates, 1989; see MacDonald et al., 1994 for a similar argument). The cue-based processing approach argues that the parser is driven by surface cues such as word order, grammatical markings, prosodic cues, and information about grammatical class. In this view, parsing is the process of searching for candidates to fill the role slots. In English, these slots are generated by verbs. In Japanese, they are generated initially by case-marking postpositions, and if case marking is absent,[3] they are generated from word order cues and semantics first and then confirmed later by verbs. Since this process is probabilistic in nature, the cue-based processing approach assumes that the more stable cues are, the easier and the more efficient the parsing becomes. Cue strength is measured by placing cues into competition in orthogonal experimental designs and observing the patterns of main effects and interactions (Bates & MacWhinney, 1989). L2 learning is viewed as a process in which initial cue transfer gives way over to amount of time to learning the correct L2 cue validity. Bates and MacWhinney (1982) found that English native speakers give priority to the word order cue for comprehension, whereas native speakers of both Japanese and Korean predominately rely on case-markers (Ito, Tahara, & Park, 1993; Kilborn & Ito, 1989). Because Japanese and English differ in their predominant cues, English learners of Japanese demonstrated an interesting pattern of comprehension. Kilborn and Ito (1989) found that learners of Japanese with L1 English rely more on SOV word order than native speakers. Since SOV schema is the canonical word order of Japanese, but not of English, Kilborn and Ito argued that learners apply their L1 predominant cue, word order, as meta-strategy, rather than tracking surface constituent orders. Their results suggest that shifting cue reliance from L1 to L2 cannot be done rapidly and easily. Matessa and Anderson (2000) also argue that learners are likely to pick up frequent and available cues, such as SOV order in

[3] The rate of case marker drop in conversation is high in Japanese; ranging from 0% to 65% depending on different cases (Aida, 1993). However, the mechanism of how Japanese speakers generate these slots in the absence of case-markers is still not clear (see Rispoli, 1991 for discussion) since most experimental processing research uses sentences with case-makers (Kamide et al., 2003; Miyamoto, 2003).

Japanese. However, for classroom learners, it is textbooks and teachers that determine cue validity, rather than the broader language environment (Sasaki & MacWhinney, 2006). Because the dislocation or scrambling of constituents is infrequent in Japanese texts (Yamashita, 2002), inductively acquiring a strategy of keeping track of case-markers is a tall order for L2 learners, unless instructed.

How does cue-based processing work in the case of Japanese relative clauses? There are limited overt syntactic cues indicating relativization. The surface position of the syntactic gap does not denote thematic roles, because one cannot tell if a missing element is a gap, a constituent displaced by scrambling, or an ellipsis. Prior to the head NP, they could be interpreted both as a main clause with ellipsis like in (19) and (20) or the pre-head part of relative clauses.

(19) Mary-ga tataita…
Mary-NOM hit-PAST
'Mary hit (someone)'

(20) Mary-o tataita…
Mary-ACC hit-PAST
'(I/ someone) hit Mary'

Notice that subject relatives and object relatives are equally ambiguous in this regard. However, Japanese also provides another relative clause construction called passivized relative construction, in which role assignments are very clearly marked by morphological cues. The Japanese passive employs the word order of NP-NOM, NP-DAT, VP with passive morphology as in (21). In passives, an object in the active rises to a non-thematic position and receives a nominative case-marker, *-ga*, which functions as the Patient of the denoted action (Kuno, 1973). Under the relativization for the NP, both NP-DAT and verb with passive morphology appear prior to a head NP as in (22).

(21) Passive structure
onnanohito-ga otokonohito-ni tatakareta.
woman-NOM man-DAT was hit-PASS-PAST
'The woman was hit by the man.'

(22) Passive relative
otokonohito-ni tatakareta onnanohito-ga keisatsu-o yonda
man-DAT hit-PASS-PAST woman-NOM police-ACC call-PAST
'The woman who was hit by the man called the police.'

The passives are used to defocus the Agent and focus the Patient instead (Shibatani, 1990). The Japanese parser thereby should anticipate a Patient to follow the verb phrases, especially in an isolated sentence where the context does not suffice the interpretation. The logic here is that, because the Patient is focused, it is unnatural for the Patient to be dropped since the omission of focused argument contradicts its information status. At this point, the language does not allow scrambling, therefore this word order (NP-DAT, VP-PASS) signals the parser to draw a clause boundary for initiating a relative clause by anticipating that the focused argument is relativized.[4] It is therefore hypothesized that a combination of the dative case marker *-ni* and the passive verbal morphology *-reru* work as a cue to thinning out upcoming structures that fit into the construction. We hypothesize that this process ultimately facilitates processing.

[4] Another possibility is that a simplex passive sentence with null subject. However, such sentences are usually unnatural in an experimental situation where there are always overt subject, so participants will not probably expect such a sentence.

3. The present study

This study examines these two hypotheses: (a) object relatives are more difficult to process than subject relatives because more perspective shifts are required, and (b) passive relatives are easier to process than non-passives because they provide reliable cues for upcoming structures. Two different learner groups, with L1 Korean and L1 English, provide us with a fertile testing ground to explore whether L1 processing strategies affect L2 processing. In this case, we test whether the Korean learners make use of case-marking cues for both L1 and L2, whereas English learners need to adjust their dominant cue from the word order cue to the use of case-marking suffixes. It is of interest how the L1 cue-dominance affects the processing of relative clauses.

3.1. Methods

3.1.1. Participants

Participants of the study comprised three groups: L1 Korean learners of Japanese, L1 English learners of Japanese, and native speakers of Japanese (n = 16 each). L2 participants were undergraduate students at Carnegie Mellon University enrolled in either fourth or sixth semester Japanese courses at the time of the experiment. To assess their functional proficiencies in their L2, they were asked to complete a language background questionnaire on several aspects of language proficiency and use. Reading, writing, listening and speaking ability were self-rated on a 10-point scale where 1 indicated the lowest and 10 indicated the highest level of ability. Separate *t*-tests were performed on the scores from the each group on the four areas of Japanese in order to ensure that both groups of L2 learners are compatible. The information obtained from the questionnaire and the *t*-test results is shown in Table 1. These results demonstrated that two L2 groups are not statistically different in terms of their self-report proficiency in Japanese.

Table 1. *The Self-Rated Proficiency and Background*

	L1 background			
Measure	English	Korean	*t*	*p*
Age (years)	20.00 (1.26)	21.37 (2.44)	-	-
Time studied Japanese (years)	3.28 (3.27)	2.78 (1.25)	-	-
Immersion experience (years)	0.00 (0.00)	0.62 (1.74)	-	-
Listening ability	5.34 (2.27)	5.75 (1.98)	.414	.682
Speaking ability	4.93 (2.14)	4.87 (2.09)	.083	.932
Reading ability	5.31 (1.88)	5.18 (1.55)	.204	.84
Writing ability	5.00 (1.46)	4.75 (1.25)	.522	.605

Note. Standard deviations are given in parentheses.

3.1.2. Materials

For the self-paced reading experiment, twenty items were constructed for each relative clause type: subject relatives, object relatives, and passive relatives. A sample of each relative clause type is given in (23)-(25).

(23) Subject relative
apaato-de yasashii ruumumeito-o ketta kodomo-ga kouen-de hon-o yonda
apartment-LOC kind roommate-ACC kick-PAST child-NOM park-LOC book-ACC read-PAST
'The child that kicked the kind roommate in the apartment read the book in the park.'

(24) Object relative
apaato-de yasashii ruumumeito-ga ketta kodomo-ga kouen-de hon-o yonda
apartment-LOC kind roommate-NOM kick-PAST child-NOM park-LOC book-ACC read-PAST
'The child that the kind roommate kicked in the apartment read the book in the park.'

(25) Passive relative
apaato-de yasashii ruumumeito-ni kerareta kodomo-ga kouen-de hon-o yonda
apartment-LOC kind roommate-DAT kick-PASS-PAST child-NOM park-LOC book-ACC read-PAST
'The child that was kicked in the apartment by the kind roommate read the book in the park.'

In (23)-(25), the second NP (the fifth region), child-NOM, serves as the head of the relative clause in which readers are required to draw a clause boundary in order to link it to a matrix clause. The experimental items used in the current study are designed to compare the reading times on this region (hereafter the critical region) differ depending on relative clause type. In all conditions, the critical regions were followed by a locative postpositional phrase modifying a matrix verb, and the analysis collapses over for the analysis in order to take into account a spillover effect. The role of the relative clause within the matrix verb was fixed as the subject role. Verbs that denote transitive actions such as 'kick' and 'hit' were chosen. The types of the relationship between two NPs with feature [+ human] are carefully controlled so that it is impossible to construct scenes based solely on semantics or the world knowledge. All the vocabularies in the experimental stimuli were taken from the course packets used in the elementary Japanese courses at the university in order to minimize the likelihood of L2 participants' unfamiliarity with vocabulary and subsequent slowdown in reading. Also, all the stimuli were written in Hiragana and Katakana, Japanese phonetic alphabets, in order to eliminate the possibility of the Korean group having an advantage in word recognition.[5] A large number of fillers were included (53% of the stimuli).

A grammar task was designed to measure L2 learners' off-line grammatical knowledge on the structures of investigation. The test involved sentence combinations and fill-in-the-gap tasks on relative clauses and passive constructions as well as on the use of various types of case-markers (20 full points).

3.1.3. Procedures

Participants performed non-cumulative self-paced reading in a word-by-word moving window display (Just, Carpenter, & Woolley, 1982). A stimulus sentence initially appeared as a row of dashes, and participants were instructed to press a button to reveal each subsequent word of the sentence. When participants pressed a button, the first word appeared and replaced the corresponding dashes. But when participants pressed the button again, the first word reverted to dashes, and the second word appeared in place of the corresponding dashes. In this way, each subsequent button-press revealed a new word and removed the preceding word. The time between two button-presses was recorded as the reading time for each word. The experiment was conducted with the E-prime program running on a windows computer (Psychological Software Tools, 2000). The sentences were presented in a random order across participants determined by the program. Japanese fonts, MS Mincho 14 points, were used.

Each sentence was followed by two comprehension questions in order to avoid participants' pressing the button blindly. Questions were in a yes-no format and the participants were asked to identify the Agent of the relative clauses (Question 1) and of the matrix clauses (Question 2). For example, when participants read the sentence, "In the bank, the man who the woman hit used a cell phone at the movie theater," the first question would be, "Did the man hit the woman?" The second question would be, "Did the man use the phone?" No feedback was given.

[5] In Korea, the use of Chinese characters was once considered scholarly, and basic Chinese characters are still used although Hangul covers most of the literacy (Lee & Ramsey, 2000).

After the self-paced reading experiment, L2 participants were asked to complete the paper-pencil grammar test and the language learning background questionnaire. There was no time limit for this grammar test.

3.2. Results

Turning first to the results obtained from the grammar test, an independent samples *t*-test was conducted on the grammar test scores of the Korean group and the English group. There was no statistically significant difference in the scores of the Korean group (M = 18.00, SD = 2.09) and the English group (M = 17.38, SD = 2.70), $t(30) = -.730$, $p = .471$. This result indicates that the Korean group and the English group are comparable in their performance on the off-line measure.

3.2.1. Reading times

Next, we analyzed the self-paced reading time data. Only sentences for which participants correctly answered both of the two comprehension questions were analyzed. Reading times were discarded if they were three standard deviations away from the mean for each word position in each relative clause type. Residual reading times were obtained by subtracting expected reading times for the region of the same length from raw reading times. Such expected reading times were calculated from a linear regression equation of reading times for each region for each participant group in each relative clause type as a function of the number of characters in it (Ferreira & Clifton, 1986). Analyses were performed separately for each group.

For the native speaker group, within-subject analysis of variance (ANOVA) was performed on reading times as a function of relative clause types. In the critical region, there was a main effect of the relative clause types, $F(2, 28) = 6.816$, $p = .004$, partial $\eta^2 = .327$. In order to find a pattern of difference, post hoc pair-wise comparisons were performed with Bonferroni adjustment. Object relatives were read more slowly (M = 124.24, SEM = 108.28) than subject relatives (M = 274.18, SEM = 138.76) and passive relatives (M = 128.13, SEM = 102.32), $p = .012$ and $p = .048$, respectively. There was no statistically significant difference between subject relatives and passive relatives (p = .97).

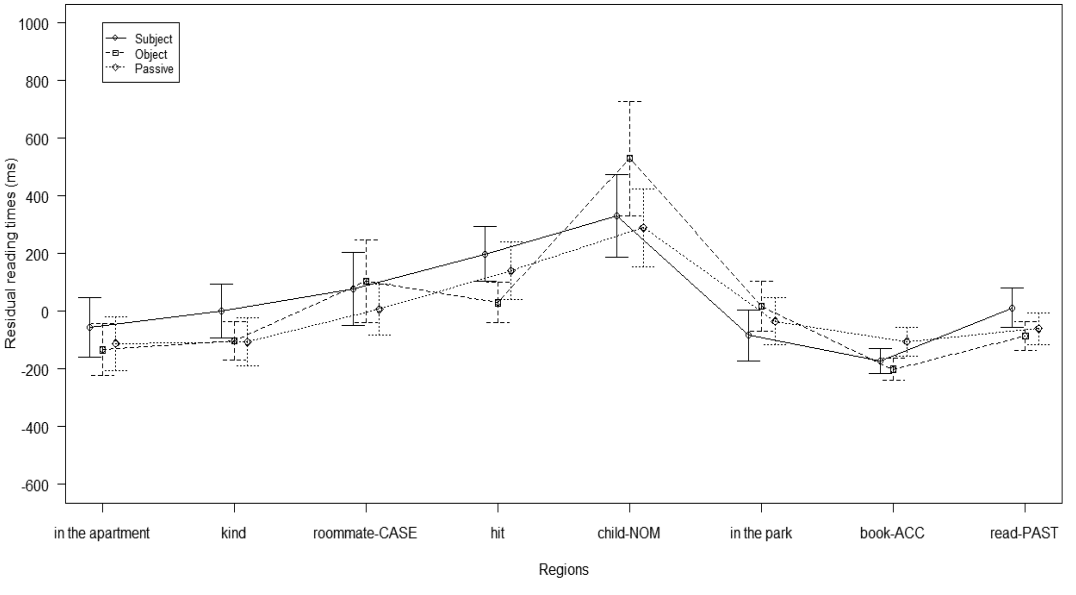

Figure 1. The processing performance of the native speaker group.

Second, there was a main effect of relative clause type for the Korean group in the critical region, $F(2, 30) = 8.876$, $p < .001$, partial $\eta^2 = .372$. Bonferroni post-hoc analyses revealed that object relatives were read more slowly ($M = 174.42$, $SEM = 157.83$) than subject ($M = -61.87$, $SEM = 157.83$) and passive relatives ($M = -125.39$, $SEM = 128.00$), $p = .021$ and $p = .014$, respectively. As with the native speakers, there was no statistically significant difference between subject relatives and passive relatives ($p = .788$).

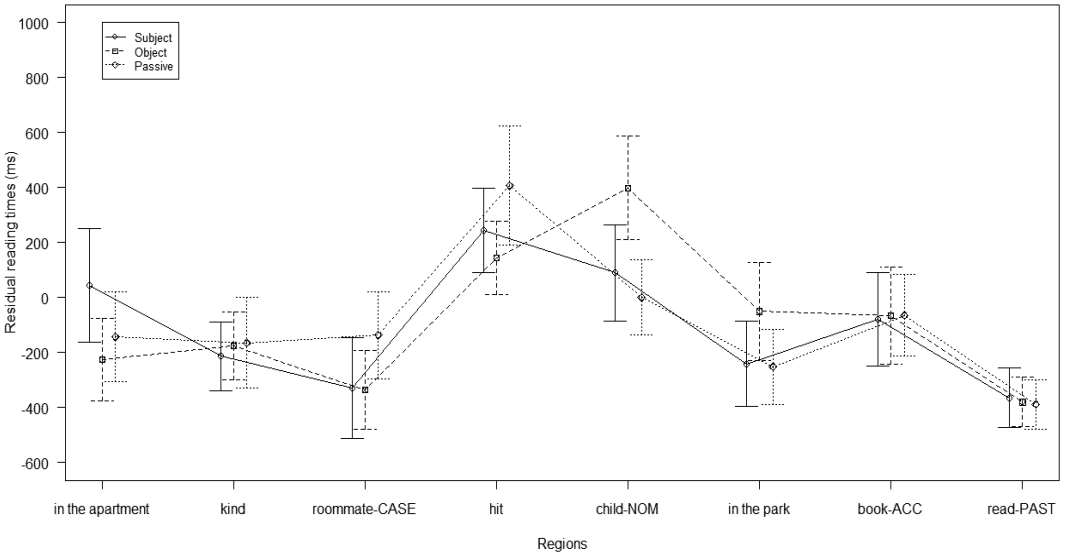

Figure 2. The processing performance of the Korean group.

For the English group on the other hand, there was no main effect of the relative clause types in the critical region, $F(2, 30) = .733$, $p = .489$, partial $\eta^2 = .047$. However, they did slow down in the passive condition at Region 4. This suggests that learners with L1 English might have had difficulty in processing of the passive verb morphology and it could ultimately affect their reading of the critical region. Although residual reading times control the word length, it is not relevant to compare reading times at the critical region with Region 4 collapsed over because of the different structural complexities among the conditions. Instead, we left the passive relative data out and conducted a paired samples *t*-test to compare subject relatives and that of object relatives alone at the critical region. There was no statistically significant difference in reading times for subject relatives ($M = 166.44$, $SD = 700.79$) and object relatives ($M = 70.18$, $SD = 535.14$), $t(15) = .856$, $p = .406$.

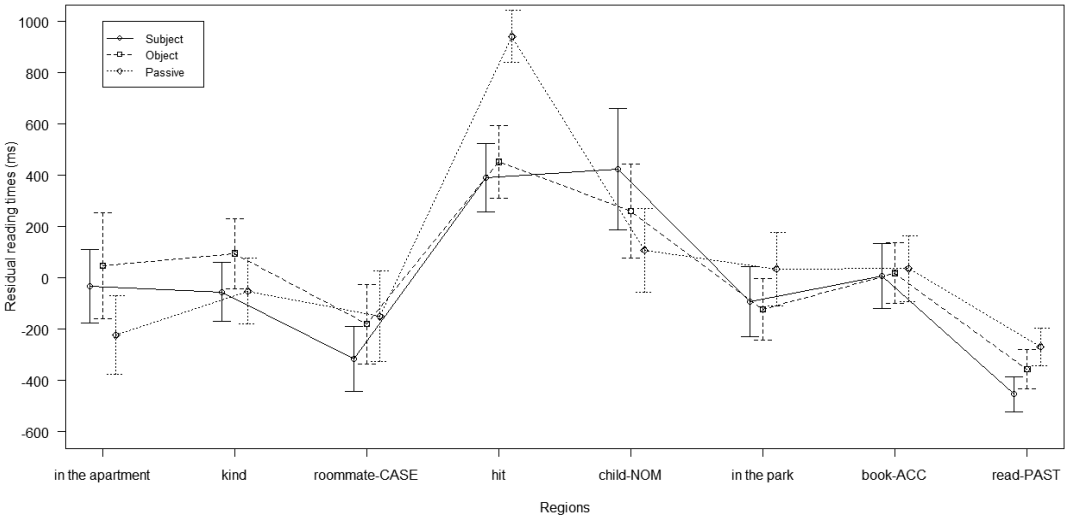

Figure 3. The processing performance of the English group.

The results from the self-paced reading experiment have shown that object relatives were more difficult to process than subject relatives and passive relatives for the native group and the Korean group. However, the English group did not show this same pattern. The different relative clause types did not affect L1 English group's reading times on the critical region.

3.2.2. Response accuracies

Let us now examine the response accuracies for the two types of comprehension questions. For the native speaker group, a two-way within-subject ANOVA was performed on the comprehension accuracy scores as a function of relative clause type (subject, object, and passive relatives) and question type (identifying main clause agent and relative clause agent). There was no interaction between relative clause types and the question types, $F(2, 28) = 1.061$, $p = .360$, partial $\eta^2 = .070$. There was no main effect of relative clause type, $F(2, 28) = 2.624$, $p = .090$, partial $\eta^2 = .158$, or question type, $F(1, 14) = .763$, $p = .397$, partial $\eta^2 = .052$.

For L2 groups, we first compared the overall response accuracies on the comprehension questions. An independent *t*-test was conducted to compare the L2 groups. There was a main effect of L1, $t(30) = -3.522$, $p < .001$, such that Korean group ($M = 89.25$, $SD = 11.77$) performed more accurately than the English group did ($M = 75.75$, $SD = 9.82$).

For the Korean group, a two-way within-subject ANOVA was performed as a function of relative clause type and question type. There was a main effect of question type, $F(1, 15) = 6.188$, $p = .025$, partial $\eta^2 = .292$, such that Question 2 (matrix clause agent; $M = 17.63$, $SEM = .284$) was easier than Question 1 (relative clause agent; $M = 15.88$, $SEM = .746$). However, there was no main effect of relative clause type and no interaction effect.

For the English group, there was a main effect of question type, $F(1, 15) = 33.684$, $p < .001$, partial $\eta^2 = .473$, such that Question 2 ($M = 17.37$, $SEM = .16$) was easier than Question 1 ($M = 14.70$, $SEM = .40$). There was also a main effect of relative clause type, $F(2, 30) = 6.729$, $p = .004$, partial $\eta^2 = .129$. A pair-wise comparison with Bonferroni adjustment demonstrated that for the English group, it was passive relatives ($M = 15.43$, $SEM = .306$) that yielded the lowest accuracy scores, and this effect was statistically significant against both subject relatives ($M = 16.00$, $SEM = .270$; $p = .025$) and object relatives ($M = 16.68$, $SEM = .288$, $p = .029$). There was no significant difference between subject relatives and object relatives.

The results from the comprehension questions indicate that for native speakers, question type and relative clause type did not affect comprehension accuracies but both L2 learner groups found it more difficult to identify the agent of the relative clauses than that of the matrix verbs. Interestingly, the

relative clause types did not affect the responses for the Korean group, but the English group had difficulties in processing passive relatives.

3.3. Discussion

Native speakers of Japanese found object relatives more difficult to process than subject relatives. We interpret these results as due to the effects of the NPAH, as explicated through the PSH. The results are compatible with the results of previous studies of L1 processing of relative clauses in Japanese (Miyamoto & Nakamura, 2002). Moreover, Japanese native speakers found it easier to process passive relatives than object relatives. We claim that, for native speakers, passive relatives are easier because of the presence of reliable local cues. For these sentences, native speakers of Japanese can rely on a combination of dative case-marker *-ni* and the passive verb morphology to focus processing early on in an efficient and incremental fashion.

The crucial question addressed in the present study is whether L2 learners display the same processing pattern as native speakers when reading Japanese relative clauses. In L2 processing arena, there is a dichotomy in the views of L2 parsing mechanism. Some researchers argue that L2 syntactic processing is fundamentally dissimilar to that of L1 (Marinis, Roberts, Felser, & Clahsen, 2005; Papadopoulou & Clahsen, 2003; for review, Clahsen & Felser, 2006). Others argue that L2 learners are able to acquire similar processing strategies employed by the native speakers of that language (Dussias, 2003; Dussias & Scaltz, 2008; Fender, 2001; Williams, 2006). Our results have provided supporting evidence for the latter view by demonstrating native-like performance by the Korean group. The reading time results for this group indicate that subject relatives and the passive relatives are easier to process than object relatives. From the results, we argue that they are able to rely on both transfer and successful L2 learning to achieve native-like processing for Japanese relative clauses. However, the reading patterns of the English group were less native-like, showing no subject-object asymmetry and no benefit from the local cues available in passive relatives.

In terms of the issue of similarity versus dissimilarity of L2 processing, the current data seem initially to provide support for both views. The Korean data provide support for the similarity view, whereas the English data provide support for the dissimilarity view. However, proponents of the similarity view can easily argue that the English learners have simply not yet had enough time to reconfigure their highly linear English processing system to deal successfully with the markedly different order of processing required by Japanese. Specifically, they have not yet learned to focus on local role assignment based on case-marking suffixes and verb morphology, and to rid themselves of reliance on linear processing and early perspectival commitment. The study by Aydin (2007) is informative in this regard. In his study on L2 acquisition of Turkish relative clauses, only the advanced learners demonstrated the subject-object asymmetry, while the beginning learners produced errors due to erroneously exert the word order strategies, interpreting the first NP in the relative clause as the Agent.

It is important to remember that the two L2 groups did not differ in their performance on the paper-pencil grammar test. However, the response accuracy of the English group fell below that of the Korean group, which may be a result of their reliance on non-native-like processing strategies. The gap between off-line and on-line performance in L2 has been often addressed (e.g., Juffs, 2007). However, there are two ways in which we could characterize the difference in performance between the English and Korean groups. One characterization focuses on the typological similarity between Korean and Japanese as both left-branching languages with SOV order and case marking. A rather different characterization focuses on the role of cue transfer independently of overall typology. According to this account, the Korean group performed in a native-like manner without much difficulty because both the Korean and the Japanese language rely on case-marking cues (Sasaki & MacWhinney, 2006), whereas the English group was required to adjust their predominant cue in L1 to L2 (MacWhinney & Bates, 1989). If the effect is located at the level of the individual cue, rather than the overall typological pattern, it is possible, for example, that German speakers could perform much like the Koreans because of the relatively clear marking of case in German and the occasional scrambling found in OVS word orders (Harald Clahsen, personal communication). Thus, it is not clear whether the successful performance of the Korean group should be characterized in terms of attention to specific

cue types, as opposed to more general typological features, such as branching direction, as reflected by the head-direction parameter.

To conclude, the results from the current study suggested that subject relatives and passive relatives were easier to process than object relatives for native speakers and L1 Korean learners of Japanese. However, the pattern of the on-line reading performance was not the same for L1 English learners such that the subject-object asymmetry was not observed, and stable local cues were not optimally used. A combination of the PSH and the cue-based processing account interpreted the results such that sentence processing is mediated by an identification of perspectives and that processing gets smoother if the language provides stable cues for immediate integration. In this case, the dative case-marker and passive verb morphology in passive relatives served as the reliable cues.

Our results have also illustrated that L2 processing is not fundamentally different from L1 processing, although there is a variation in terms of the rapidity with which linguistic information is utilized. There is also evidence here that delayed or inaccurate cue detection possibly leads to non-native like parsing, which ultimately results in erroneous comprehension.

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