Second Language Learners' Ability to Use Case Marking Information in Processing Japanese Relative Clause Sentences

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1. Introduction

In contrast with the abundance in research on second language (L2) learners' processing of syntax, studies on L2 learners' processing of morphosyntax only began to appear recently (see Juffs & Rodríguez, 2014, for recent review on syntactic processing). Their scarcity is, for instance, noted by Clahsen, et al. (2010) observing that "[m]uch less is known about L2 learners' processing of case morphology" (p. 34). This has resulted from much research having looked at L2 processing of English, a language with reduced case morphology. The present study examined L2 learners' processing of Japanese, a language with a robust case marking system, to advance our understanding of learners' ability to use case marking information in real time.

Existent research on L2 morphosyntactic processing produced mixed findings. Jackson and Bobb (2009), using a self−paced reading paradigm, found evidence of English learners' use of information from case marking in processing German *wh*−extractions. In reading *Wer hast du gedacht, vermisste den Lehrer in den Ferien?* (Who$_{NOM}$ have you thought, missed the$_{ACC}$ teacher during the vacation?) and *Wen hast du gedacht, vermisste der Lehrer in den Ferien?* (Who$_{ACC}$ have you thought, missed the$_{NOM}$ teacher during the vacation?), highly proficient English learners of German took longer to read the initial *wh*−element on the object−extraction compared to the subject−extraction. In reading the matrix subject, the asymmetry in their reading time reversed, with longer reading times on the subject−extraction than on the object−extraction. These findings indicate the learners' real−time use of case information in the *wh*−phrase. Importantly, their sensitivity to case

marking information failed to carry over to the complement clause across clause−boundaries, resulting in no reading time difference between both types of extraction (see Jackson & Dussias, 2009, for similar findings).

By contrast, Jiang (2004) found no evidence of L2 learners' sensitivity to number morpheme in self−paced reading experiments when Chinese learners of English read sentences involving subject−verb agreement in number: *The bridge/*The bridges to the island was about ten miles away*. This was the case even when they slowed down in reading sentences violating pronoun−*be* verb agreement as compared to those observing it: *I told you *she/I am a professor of psychology.*[1] Thus, Chinese learners were able to detect violations in subject−verb agreement when lexical items such as pronouns were involved, but were insensitive to ones involving morphosyntax like the plural marker −*s* (see also Jiang, 2007).

Although both studies examined L2 learners' processing of morphosyntax that was absent in their first language (L1), there was a critical difference in the nature of morphosyntax under investigation: Jackson and Bobb's (2009) study looked at case markers that provide information on grammatical roles assigned to case−marked noun phrases while Jiang's (2004) study examined the number morpheme −*s* that provides little information on grammatical roles assigned to number−marked noun phrases. The present article hypothesized that L2 learners can engage in real−time morphosyntactic processing when morphosyntactic elements provide information on grammatical roles assigned to morphosyntactically−marked noun phrases regardless of whether such elements exist in learners' L2. A self−paced reading study reported in this article tested the hypothesis by examining learners' processing of relative clause sentences in Japanese. As in German *wh*−extractions, it is necessary to use information from case markers in processing Japanese relative clause sentences. Learners' L1s included Korean with a robust case system and English without it.

2. The structure and the processing of Japanese, Korean and English Relative Clauses

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[1] Although recency effects (Gibson, 1998) are not entirely eliminable, Jiang (2004) reported that Chinese learners detected subcategorization violations that were non-adjacent as in *The teacher insisted the children to mail the letter to the president*.

Japanese and Korean are similar in their relative clause structure whereas English markedly differs from both. In Japanese and Korean, a relative clause precedes its head noun as both are a head－final language; in English, a relative clause follows its head noun as it is a head－initial language. Moreover, Japanese and Korean use a robust case system to mark the grammatical functions of noun phrases while English relies on word order. These differences are illustrated in (1) to (3):

(1) Japanese relative clause:
    [___$_i$ tantei-o   sinrai-site-iru] kisya-ga$_i$ paatii-o   nuke-deta.
        detective-ACC trust   reporter-NOM party-ACC left

(2) Korean relative clause:[2]
    [___$_i$ Hyengsa-lul   sinloyha-n] kica-ka$_i$ phati-lul   ttenassta.
        detective-ACC trust-ADN reporter-NOM party-ACC left

(3) English relative clause:
    The reporter$_i$ [who ___$_i$ trusted the detective] left the party.

Psycholinguistic research on the processing of Japanese, Korean, and English relative clause sentences found that subject－extracted relative clause sentences were easier to process than object－extracted ones: for Japanese, Miyamoto and Nakamura (2003), Ueno and Garnsey (2008); for Korean, Kwon, Gordon, Lee, Kluender, and Polinsky (2010); for English, King and Just (1991), Traxler, Morris, and Seely (2002). Several accounts have put forward a different source of the processing asymmetry between subject vs. object relative clauses. According to structural depth－based accounts (Frazier & Clifton, 1998; Hawkins, 1999; Sturt & Crocker, 1996), it is easier to associate the subject gap than the object gap with its filler because the subject gap is less embedded in structural representation and structurally closer to its filler than the object gap is (the filler is in the specifier of the

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[2] Both Korean and Japanese employ a pre-nominal relative clause without an overt complementizer. A Japanese relative clause has no morphological marking while a Korean relative clause bears the adnominal marker －(nu)n on its predicate (Kwon, Polinsky, & Kluender, 2006, p. 3).

complementizer). In contrast, Gibson (2000, pp. 101-105) offers a working memory resource−based account centering on locality (see also Gibson, 1998). By his account, subject relative clause sentences cause less disruption in the structural integration process than object relative clause sentences because there are fewer discourse referents intervening between the filler and the gap in subject relative clause than in object relative clause sentences. Although both accounts predict the subject−relative clause advantage in English, only the structural depth−based accounts predict the same advantage in Japanese and Korean: In Japanese and Korean, the subject−gap is structurally closer to its filler than the object−gap is, but the subject−gap is linearly more distant to its filler than the object−gap is. A similarity−based interference account maintains that the similarity of noun phrases in terms of their syntactic cues signaling a grammatical role assigned to the noun phrase is a significant determinant of difficulty in processing relative clause sentences (Lewis & Nakayama, 2002; Vasishth & Lewis, 2006). In Japanese and Korean, case markers serve as a syntactic cue whereas in English, word order relative to the verb provides a syntactic cue.[3]

The study reported in this article used four experimental conditions in (4a) to (4d) as modeled on Miyamoto and Nakamura (2003):

(4) a. Subject relative clause with nominative head noun
Kinoo\ __ obaasan-o\　　eki made\ mukae ni itta\ gakusee-ga\
Yesterday elderly lady-ACC station to went to meet student-NOM
syukudai-o\　　wasureta.
homework-ACC forgot
'The student who picked up the elderly lady at the station yesterday forgot the homework.'

b. Subject relative clause with accusative head noun
Kinoo\ __ obaasan-o\　　eki made\ mukae ni itta\ gakusee-o\
Yesterday elderly lady-ACC station to went to meet student-ACC
sensee-ga　　yonda.
professor-NOM summoned
'The professor summoned the student who picked up the elderly

[3] Constraint-based accounts hold that semantic constraints exert an immediate effect on syntactic processing of relative clauses. Animacy in the head noun and in the relative clause-internal noun has been adduced to influence difficulty in processing relative clauses (Gennari & Macdonald, 2008; Mak, Vonk, & Schriefers, 2002; Traxler, et al., 2002; Traxler, Williams, Blozis, & Morris, 2005). See Hara (2011) for discussion of semantic effects on the processing of relative clauses in Japanese.

lady at the station yesterday.'

c. Object relative clause with accusative head noun
Kinoo\   obaasan-ga\   eki made\ __ mukae ni itta\ gakusee-o\
Yesterday elderly lady-NOM station to went to meet student-ACC
sensee-ga   yonda.
professor-NOM summoned
'The professor summoned the student who the elderly lady picked
up at the station yesterday.'

d. Object relative clause with nominative head noun
Kinoo\   obaasan-ga\   eki made\ __ mukae ni itta\ gakusee-ga\
Yesterday elderly lady-NOM station to went to meet student-NOM
syukudai-o\   wasureta.
homework-ACC forgot
'The student who the elderly lady picked up at the station yesterday
Forgot the homework.'

All relative clauses in (4a) to (4d) have identical lexical items; their relative clause−internal noun phrase (*obasan* 'lady') is marked as either accusative or nominative depending on relativization type. Their head noun (*gakusee* 'student') is marked as either nominative or accusative within each type of relativization. The remainder of the main clause following the head noun differs depending on head noun's case marking but is counterbalanced between both types of relativization. Therefore, the experimental conditions are crossed in terms of relativization (subject vs. object) as well as case marking on the head noun (nominative vs. accusative).

If L2 learners can use information from case marking in processing Japanese relative clause sentences, their reading times would be longer on the head noun region, or on the subsequent one due to spill−over effects, in object−relative clause sentences as compare to subject−relative clause ones. By contrast, if even highly proficient learners remain susceptible to L1 effects, then English learners would fail to use case marking information online and show no reading time asymmetry between subject− and object−relative clause sentences. Alternatively, if English learners can use case marking information but with limited efficiency, they would be able to show a reading time asymmetry only when processing a simplex clause, the relative clause−internal segment in the above experimental sentences (cf. Jackson and Bobb (2009)).

3. The Present Study

Table 1: Learners' background information and JLPT scores

L1	Age (yrs)	JLPT (%)	Length of Study (yrs)	Visiting (mo)
Korean				
M	23.5	96.6	4.10	10.9
Range	19 – 33	89.3 – 100	2.0 – 7.0	3.5 – 29.0
SD	3.47	1.05	1.56	9.07
English				
M	24.3	94.4	4.68	24.7
Range	19 – 29	85.7 – 100	3.0 – 9.0	4.0 – 104.0
SD	2.89	1.50	1.50	25.60

The present study aimed at determining whether highly advanced L2 learners can use information from case morphology in processing relative clause sentences in Japanese. It considered L1 effects as a factor affecting their ability to make online use of case morphology.

3.1 Participants

There were three groups of participants in the study: 20 Korean−speaking and 18 English−speaking learners of Japanese along with 20 native speakers of Japanese. Table 1 presents background information on the learner participants' Japanese language−learning experiences. Korean and English learners' group average scores on the Japanese language proficiency test (JLPT) were not significantly different from one another ($F(1, 36) = 2.106$, $p = .155$). At the time of their participation in the study, all Korean learners had lived in Japan for at least three and a half months and many were taking undergraduate or graduate courses at Waseda University in Tokyo as degree−seeking students. Most English learners were students at the Inter−University Center for Japanese Language Studies in Yokohama, and had resided in Japan for at least eight and a half months at the time of participation. All English learners were advanced learners of Japanese and post−baccalaureates: some were graduate students studying a Japan−related field while others were preparing for a profession using Japanese (e.g., translation). All Japanese participants were university students in Tokyo. All participants were compensated for their participation in the study.

3.2 Materials

The present study used 24 quadruplets of sentences in four experimental conditions as given in (4a) to (4d).[4] Four lists were generated in a Latin Square design: each list was assigned six sentences of each of the four conditions, with no more than one condition from each of the 24 sets appearing in each list. Each list also contained 48 fillers. Half of the fillers were included for a separate experiment while the other half varied in structure and length. Thus there were a total of 72 sentences in each list. Each of the four lists was pseudo−randomized so that at least one filler sentence intervened between two experimental sentences. For each experimental and filler sentence, a comprehension question was created that targeted a various part of the sentence. Half of the experimental and filler sentences were assigned a comprehension question that was true with respect to the content of the sentence while the other half of the sentences received a comprehension question that was false.

3.3. Procedure

Prior to their arrival at an experimental session, learner participants completed a questionnaire on their Japanese language learning experience and biographical background. They also individually took the grammar section of the Japanese Language Proficiency Test (extracted from Levels 2 and 3) and were instructed to study a list of vocabulary items and *kanji* (Chinese characters adopted in Japanese) that appeared in the experimental material.

At the experimental session, the participant performed a self−paced reading experiment. The self−paced reading experiment employed a segment − by − segment, self − paced reading paradigm (see Just, Carpenter, & Woolley, 1982). Each sentence was presented region−by−region in the center of a display screen on a laptop computer as illustrated by the back slashes in (4a) to (4d). The participant pressed the button of a response button−box connected to the computer to bring up each region. After having read the final region of each sentence, the participant responded to a comprehension question on the sentence. Graphic feedback (a sad face) was provided when the response was incorrect: graphic feedback was explained to the participant in the instructions for the experiment. Upon completing the first half of the

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[4] A norming study, based on a seven − point scale rating of sentence naturalness, was conducted to ensure that there was no plausibility difference between two human − denoting nouns (*obaasan* 'elderly lady' and *gakusee* 'student') as either agent or patient of the verb (*mukae ni iku* 'go to meet') in the 24 sets used in the experiment.

experiment, there was a brief relaxation break. The participant then continued the experiment until finishing it. There was a practice session with eight trials prior to the first half of the experimental session; a two trial practice session preceded the second half of the session. The self−paced reading experiment took learner participants 40 to 50 minutes and native speaker participants approximately 30 minutes to complete. The reading time for each region of every sentence was recorded using E−Prime software (Schneider, Eschman, & Zuccolotto, 2002), as was the response to each comprehension question. The experimental session took place in the author's office.

3.4. Results
3.4.1. Comprehension question accuracy

Table 2 presents the three participant groups' accuracy rates on the comprehension questions on subject and object relative clause sentences ((4a-4b) vs. (4c-4d)). There was no significant difference between three participant groups in response accuracy on subject relative clause sentences ($F_1(2, 55) = 1.116$, $p = .335$; $F_2(2, 69) = .455$, $p = .637$) and on object relative clause sentences ($F_1(2, 55) = .878$, $p = .421$; $F_2(2, 69) = .304$, $p = .739$). The Japanese native speaker and the English learner groups responded similarly to comprehension questions on subject and object relative clause sentences: for the Japanese group, $F_1(1, 19) = .856$, $p = .367$; $F_2(1, 23) = .062$, $p = .805$, and for the English group, $F_1(1, 17) = .225$, $p = .641$; $F_2(1, 23) = .114$, $p = .738$. The Korean learner group was significantly more accurate on subject than on object relative clause sentences: $F_1(1, 19) = 8.435$, $p = .009$; $F_2(1, 23) = 5.435$, $p = .029$.

Table 2: Comprehension question accuracy rates (%)

Group	Condition	
	Subject relatives	Object relatives
Japanese NSs		
M	87.92	85.83
SD	7.39	5.48
Korean learners		
M	89.58	82.50
SD	8.92	7.10
English learners		
M	85.19	83.33
SD	10.91	11.43

3.4.2. The processing of subject and object relative clause sentences

Table 3: Residual reading times on the RC noun to main verb (ms)

Condition	Region					
	RC noun	Adv. Phr.	RC verb	Head noun	Post−HN	Main verb
Japanese NSs						
SubRC-nomHN						
M	12.28	59.85	77.57	105.15	-11.71	-24.35
SD	77.72	239.16	223.84	143.67	77.92	157.65
SubRC-accHN						
M	42.53	38.44	61.96	33.83	14.05	57.43
SD	115.41	119.26	139.18	91.56	120.72	135.11
ObjRC-accHN						
M	-22.44	12.58	24.67	83.21	16.80	74.58
SD	88.35	75.53	114.89	161.39	145.20	146.38
ObjRC-nomHN						
M	46.20	35.40	81.46	113.63	35.60	47.81
SD	149.73	75.55	163.19	204.44	137.07	108.15
Korean learners						
SubRC-nomHN						
M	67.83	120.59	139.41	-40.20	-35.60	-17.76
SD	212.02	159.07	291.14	244.64	153.49	187.38
SubRC-accHN						
M	101.38	113.76	91.28	154.18	56.81	-53.12
SD	261.49	169.46	156.58	290.40	224.96	168.33
ObjRC-accHN						
M	-42.95	23.08	61.28	109.47	281.65	39.12
SD	204.63	153.58	166.50	311.19	295.58	197.17
ObjRC-nomHN						
M	34.48	43.73	136.70	117.93	10.89	25.83
SD	150.99	172.76	305.52	273.35	169.25	237.51
English learners						
SubRC-nomHN						
M	119.14	178.81	215.92	53.81	80.61	199.04
SD	529.74	286.63	310.11	266.50	194.61	355.80
SubRC-accHN						
M	14.01	129.87	98.33	60.22	268.22	268.46
SD	339.76	317.66	165.91	334.07	411.65	456.00
ObjRC-accHN						
M	106.65	204.84	74.81	40.89	178.74	232.25
SD	255.14	324.33	122.17	279.41	379.09	553.00
ObjRC-nomHN						
M	-11.98	22.14	43.95	214.93	118.20	153.11
SD	215.39	203.42	175.11	547.68	202.38	455.50

Table 3 presents the three participant groups' residual reading times per mora on the relative clause–internal noun to main verb regions in each of the four conditions in (4a) to (4d) (see Ferreira & Clifton, 1986; Trueswell, Tanenhaus, & Garnsey, 1994, for discussion of residual reading times).[5] A repeated–measures ANOVA was conducted for each participant group: for the participants analysis, relative clause type (subject vs. object) was entered as a within–participants factor and for the items analysis, region (relative clause–internal noun to main verb) as a within–items factor.

The Japanese native speakers read the main verb region in subject relative clause sentences significantly faster than in object relative clause sentences: $F_1(1, 19) = 6.703$, $p = .018$; $F_2(1, 23) = 4.226$, $p = .051$; for all other regions, F_1s ≤ 1.028; F_2s ≤ 1.537. The Korean learners read the adverbial–phrase region, immediately following the relative clause–internal noun, in object relative clause sentences marginally significantly faster than in subject relative clause sentences: $F_1(1, 19) = 3.223$, $p = .089$; $F_2(1, 23) = 3.879$, $p = .061$. Moreover, they read the main–clause noun region, one immediately following the head noun, in subject relative clause sentences significantly faster than in object relative clause sentences: $F_1(1, 19) = 9.337$, $p = .007$; $F_2(1, 23) = 5.263$, $p = .031$; for all other regions, F_1s ≤ 2.961; F_2s ≤ 4.106.[6] The English learners read the relative clause–internal verb region in object relative clause sentences faster than in subject relative clause sentences, which falls just short of statistical significance: $F_1(1, 17) = 4.029$, $p = .061$; $F_2(1, 23) = 5.379$, $p = .030$; for all other regions, F_1s ≤ 1.164; F_2s $\leq .702$.

3.4.3. The processing of the four conditions of relative clause sentences

Additional analyses were conducted taking into account the differences in the head noun's case marking. The analyses generated similar results to those reported in the previous section. The Japanese native speakers read the main verb region in subject relative clause sentences marginally significantly faster than in object relative clause sentences when the head noun bore nominative case ((4a) vs. (4d)): $F_1(1, 19) = 4.059$, $p = .058$; $F_2(1, 21) = 3.503$, $p = .075$. The same

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[5] In Table 3, the RC and the HN stand for relative clause and head noun, respectively.
[6] The Korean learners read the main verb region in subject relative clause sentences faster than in object relative clause sentences. The difference was nearly significant in the items analysis ($F_2(1, 22) = 4.106$, p = .054) but not in the participants analysis ($F_1(1, 19) = 2.733$, p = .115).

asymmetry did not hold when the head noun bore accusative case ((4b) vs. (4c)): $F_1(1, 19) = .428$, $p = .521$; $F_2(1, 23) = .030$, $p = .865$).

The Korean learners read the head noun region faster with marginal significance in subject than in object relative clause sentences when the head noun bore nominative case ((4a) vs. (4d)): $F_1(1, 19) = 3.662$, $p = .071$; $F_2(1, 22) = 6.140$, $p = .021$. That asymmetry did not hold when the head noun bore accusative case ((4b) vs. (4c)): $F_1(1, 19) = .208$, $p = .653$; $F_2(1, 22) = .072$, $p = .790$. By contrast, they read the region immediately following the head noun faster in subject than in object relative clause sentences when the head noun bore accusative ((4b) vs. (4c)): $F_1(1, 19) = 5.939$, $p = .025$; $F_2(1, 22) = 6.350$, $p = .019$. That asymmetry did not hold when the head noun bore nominative ((4a) vs. (4d)): $F_1(1, 19) = 1.658$, $p = .213$; $F_2(1, 22) = 1.971$, $p = .174$. The reading asymmetry in the accusative−marked head noun conditions held on the main verb region with marginal significance ($F_1(1, 19) = 3.265$, $p = .087$; $F_2(1, 22) = 5.432$, $p = .029$) but not in the nominative−marked head noun conditions ($F_1(1, 19) = .486$, $p = .494$; $F_2(1, 22) = 1.529$, $p = .229$).

The English learners read the relative clause verb region faster in object than in subject relative clause sentences when the head noun bore nominative ((4a) vs. (4d)): $F_1(1, 17) = 5.655$, $p = .029$; $F_2(1, 22) = 6.438$, $p = .018$. They showed the same asymmetry in reading only numerically when the head noun bore accusative ((4b) vs. (4c)): $F_1(1, 17) = .186$, $p = .672$; $F_2(1, 22) < .0005$, $p = .984$.[7]

4. Discussion

The self-paced reading study reported above found evidence of L2 learners' use of information from case marking in processing relative clause sentences in Japanese. Korean learners read subject relative clause sentences faster than object relative clause ones on the head noun and post−head noun regions; by contrast, English learners read object relative clause sentences faster than subject relative clause ones on the relative clause−verb region.

Korean learners read the head noun region in subject relative clause sentences significantly faster than in object relative clause sentences when the head noun was in nominative case (4a vs. 4d); similarly, they read the post − head noun region, one immediately

[7] The absence of a significant difference when the head noun was marked accusative (4b vs. 4c) was likely to be due to a lack of statistical power because there was a significant difference on the relative clause verb in the analysis combining both versions of relative clause sentences (4a & 4b vs. 4c & 4d).

following the head noun, in subject relative clause sentences significantly faster than in object relative clause sentences when the head noun was in accusative case (4b vs. 4c). Because the subject and the object relative clause sentences were identical in terms of lexical items and linear order but only differed in case marking on the head noun and the relative clause‒internal noun, Korean learners' reading patterns suggest their ability to use case marking information in processing multi‒clause sentences.

Unlike Korean learners, English learners showed no significant difference in reading time between subject and object relative clause sentences while reading the head noun, post‒head noun, and main verb regions. Importantly, they read the relative clause verb in object relative clause sentences significantly faster than in subject relative clause sentences. Their reading time difference within the relative clause but not in the main clause indicates their ability to use case marking information in processing mono‒clause sentences but not multi‒clause ones.[8]

By providing the findings on Korean learners' ability to use case marking information in processing relative clause sentences in Japanese, the present study adds to evidence of highly proficient L2 learners' ability to make real‒time use of case morphology (cf. Jackson & Bobb, 2009; Jackson & Dussias, 2009). Moreover, it found persistent L1 effects in that domain. Highly advanced English learners were able to make real‒time use of case marking information only when processing mono‒clause sentences. As discussed in the Introduction, linguistic and cognitive factors were likely causes of their limited use of case marking information online. Linguistically, English differs from Japanese in critical ways: English lacks a robust case system unlike Japanese; a relative clause follows its head noun in English whereas it precedes its head noun in Japanese. Cognitive demand increased by their operating on linguistic cues markedly different from those of English would result in their reduced ability to use case marking information. Consequently, their use of case morphology failed to extend across clause‒boundaries.

This article hypothesized that L2 learners can make real‒time use of morphosyntax when its information is necessary to assign grammatical roles regardless of L1‒ L2 differences in that

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[8] English learners read object‒gap clauses significantly faster than subject‒gap ones on their verb region. Because a nominative‒ marked noun phrase was present in object‒ gap clauses and absent in subject‒ gap ones, their reading pattern points to subject preference as found in English learners of German (Jackson & Bobb, 2009).

morphosyntactic domain. The present study confirmed L2 learners' ability to use case marking information but failed to demonstrate surmountability of L1 effects. It is important to discern which typological differences between Japanese and English made it difficult for English learners to carry over their ability to use case morphology online across clause − boundaries. Examining Chinese learners' processing of relative clause sentences in Japanese will be informative because Chinese lacks a robust case system like English but places a relative clause in front of its head noun unlike English.

5. Conclusion

The present study found evidence of L2 learners' ability to make real−time use of case morphology as well as of persistent L1 effects limiting their use of it. Korean learners of Japanese read subject relative clause sentences faster than object relative clause ones on the head noun, indicating their ability to use case marking information online; English learners' ability to use case morphology was found only in their processing of the relative clause−internal, mono−clause segment of experimental sentences. Thus, L2 learners' sentence processing ability in the domain of case morphology is attainable, although L1 effects place constraints on their processing performance.

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