

English Speakers' Comprehension of Embedded Relative Clauses in L2 Japanese

Shinichi Shoji

Organization for the Development of Higher Education and Regional Human Resources, Mie University, Tsu, Japan

Abstract—This study investigated native English speakers' comprehension of Japanese sentences in which relative clauses are embedded. Specifically, this study contrasted between (a) short-before-long sentences with center-embedded relative clauses and (b) long-before-short sentences with non-center-embedded relative clauses. Sentence-type (a) indicates a sentence that includes a short phrase before a long phrase and includes a relative clause that is embedded in the middle of the sentence, e.g., *Onna-ga Ken-ga kiratteiru giin-o hometa* 'The woman praised the senator who Ken hated'. Sentence-type (b) indicates a sentence with a long phrase before a short phrase and includes a relative clause that is embedded peripherally, e.g., *Ken-ga kiratteiru onna-ga giin-o hometa* 'The woman who Ken hated praised the senator'. Experiment 1 revealed that native English speakers, who are learners of Japanese, comprehended the type (b) sentences with long-before-short phrases and with non-center-embedded relative clauses more accurately than the type (a) sentences with short-before-long phrases with center-embedded relative clauses. The results indicate that the preference for the non-center-embedded clauses to center-embedded clauses is universal across languages, while the preference for short-before-long phrases is language-specific. However, Experiment 2 indicated that the different accuracy rates in comprehensions of (a) and (b) disappeared when the matrix subjects are marked by the topic-morpheme *wa*. The outcome indicated that the topic phrases are immediately interpreted as a part of main clauses.

Index Terms—embedded clause, 'short before long', topic, Japanese

I. INTRODUCTION

This study investigated native English speakers' comprehension of Japanese sentences that include embedded relative clauses. Specifically, the present study focused on the position of embedded relative clauses, namely center-embedded relative clauses and non-center-embedded relative clauses. In general, sentences whose argument noun phrases (NPs) are separated by center-embedded constituents are processed slower than sentences whose arguments are close to each other (McElree, Foraker & Dryer, 2003). This is because, according to working-memory-based accounts (Gibson, 2000), processing of sentences with separated arguments requires readers to store the earlier argument and retrieve it after processing the embedded constituents, which is costly for working memory. On the other hand, this store-retrieval task is not required for processing sentences with arguments that are not separated. Compare the sentences below that include embedded relative clauses.

- (1) a. Center-embedded clause: The woman [who Ken hated] praised the senator.
- b. Non-center-embedded clause: The woman praised the senator [who Ken hated].

In (1a), the matrix sentence 'The woman praised the senator' is separated by the center-embedded relative clause 'who Ken hated'. When processing this sentence, readers process the matrix subject 'The woman' and proceed to the following relative clause. During the processing of the relative clause, readers store the matrix subject in their working memory. When they encounter the matrix predicate 'praised the senator', they attach it to the stored matrix subject 'The woman' to construct the matrix sentence structure. In short, readers are tasked to store and retrieve the earlier argument when processing this type of sentence that includes center-embedded relative clauses. On the other hand, when processing (1b), the store-retrieval task is not necessary because readers process the whole matrix sentence first, and then they process the non-center embedded relative clause. Thus, sentences with non-center-embedded clauses such as (1b), which requires the store-retrieval task, is processed faster, and possibly comprehended more accurately, than sentences with center-embedded clauses such as (1a), which does not require the task. This article calls this the 'non-center over center' preference.

It is also widely known that English speakers prefer processing short phrases before long phrases (Hawkins, 1994; Arnold, Wasow, Losongco & Grinstrom, 2000). Compare the example sentences shown below.

- (2) a. Bill sang [a song] [with friends].
- b. # Bill sang [with friends] [a song].
- c. # Bill sang [a song that was written by a famous guitar player from Texas] [with friends].
- d. Bill sang [with friends] [a song that was written by a famous guitar player from Texas].

(Yamashita & Chang, 2001, p. 46, with modification)

Compared with (2a), the sentence (2b), which includes the prepositional phrase 'with friends' before the grammatical object 'a song', sounds problematic to native English speakers. However, this order of a prepositional phrase before a

grammatical object is preferred to the other order when a short prepositional phrase precedes a long direct object phrase, as shown in (2c) and (2d). This article calls this preference the ‘short before long’ preference, following Yamashita and Chang (2001).

This ‘short before long’ preference is compatible with the ‘non-center over center’ preference in English. Compare the below sentences.

(3) a. Center-embedded clause: [The woman who Ken hated] praised [the senator]. (=1a)

b. Non-center-embedded clause: [The woman] praised [the senator who Ken hated]. (=1b)

In the sentence (3a), the long subject NP precedes the short object NP: ‘[The woman who Ken hated] praised [the senator]’, whereas the sentence (3b) includes the short subject NP before the long object NP: ‘[The woman] praised [the senator who Ken hated]’. Thus, both accounts, the ‘non-center over center’ preference and the ‘short before long’ preference, predict the preference for (1b, 3b) to (1a, 3a).

However, unlike head-initial languages including English, head-final languages such as Japanese exhibit a discrepancy between the ‘non-center over center’ preference and the ‘short before long’ preference. This is because a head-final language such as Japanese places a relative clause before the head noun, while a head-initial language such as English places a relative clause after the head noun. Thus, a center-embedded relative clause in English becomes non-center-embedded in Japanese, and vice versa. The equivalent Japanese sentences to (1a, 3a) and (1b, 3b) are shown below.

(4) a. Non-center-embedded clause

健が	嫌っている	女が	議員を	褒めた。
[[Ken-ga	kiratteiru]	onna-ga]	giin-o	hometa.
Ken-NOM	hate	woman-NOM	senator-ACC	praised

‘[The woman [who Ken hated]] praised [the senator].’ (=1a, 3a)

b. Center-embedded clause

女が	健が	嫌っている	議員を	褒めた。
Onna-ga	[[Ken-ga	kiratteiru]	giin-o]	hometa.
woman-NOM	Ken-NOM	hate	senator-ACC	praised

‘[The woman] praised [the senator [who Ken hated]].’ (=1b, 3b)

The sentences in (4a) and (4b) include non-center-embedded and center-embedded relative clauses (Ken-ga kiratteiru ‘who Ken hated’), respectively. Therefore, according to the ‘non-center over center’ preference, (4a) should be preferred to (4b). However, (4a) includes a long subject NP (Ken-ga kiratteiru onna ‘The woman who Ken hated’) before a short object NP (giin ‘the senator’), while (4b) includes a short subject NP (onna ‘The woman’) before a long object NP (Ken-ga kiratteiru giin ‘the senator who Ken hated’). According to the ‘short before long’ preference, (4b) should be preferred to (4a).

Yamashita and Chang (2001) found that native Japanese speakers exhibit the ‘long before short’ preference as opposed to English speakers. This ‘long before short’ preference is compatible with the ‘non-center over center’ preference in Japanese. Both preferences predict that native Japanese speakers prefer (4a) to (4b) because (4a) includes non-center-embedded clause and a long subject NP before a short object NP. However, one question is whether native English speakers, who exhibit the ‘short before long’ preference in their native language, would still prefer (4a) to (4b) in Japanese sentence when it is their second language (L2). As mentioned, the ‘non-center over center’ preference predicts English speakers’ preference for (4a) to (4b), but if their ‘short before long’ preference in English is still active when processing L2 Japanese sentences, then English speakers might prefer (4b) to (4a). Thus, the research question of this study is to determine whether native English-speaking learners of Japanese are affected more strongly by the ‘non-center over center’ preference than by the ‘short before long’ preference, or vice versa, when comprehending sentences with relative clauses in L2 Japanese. The present study reports experiments that examined this issue.

II. EXPERIMENT 1

A. Participants

15 native English speakers who were learners of L2 Japanese participated in Experiment 1. They were undergraduate students in the U.S., who completed at least four semesters of Japanese classes. Also, 12 native Japanese speakers participated in the experiment as the control group.

B. Items and Method

The experimental items were long-before-short sentences with non-center-embedded relative clauses and short-before-long sentences with center-embedded relative clauses in Japanese, similar to (4a) and (4b), respectively. For native English-speaking learners of L2 Japanese, a simple translation task was assigned, i.e., they were tasked to translate five sentences like (4a) and the other five sentences like (4b). These items were typed in Japanese characters on a sheet and given to the participants. Ten distractor sentences were also included in the same testing sheet to disguise the purpose of this experiment. The order of the experimental and distractor sentences listed in the testing sheet was randomized by the investigator. To ensure that participants understood all Japanese words in the given sentences, a vocabulary list with English translations was also provided to each participant. A single testing session lasted

approximately 15 minutes.

For the native Japanese-speaking control group, the investigator used a different testing method than that of the native English-speaking learners because the translation task would be too easy for native Japanese speakers. Instead of translations, for native speakers, a self-paced reading task was assigned, using E-Prime. They read test sentences word-by-word in the moving window paradigm. Ten long-before-short sentences with non-center-embedded clauses (e.g., 4a) and ten short-before-long sentences with center-embedded clauses (e.g., 4b) were presented, and they were mixed among 60 distractor sentences. The order of the items presented to the participants was randomized by E-Prime. After native Japanese-speaking participants read each test sentence, they answered a comprehension question for that sentence that they just read. For instance, after they read a sentence like (4a) 'The woman who Ken hated praised the senator', the comprehension question asked, 'Which is true? 1. The woman praised the senator; 2. Ken praised the senator'. Participants hit the number key 1 or 2 to answer the questions. A single testing session lasted approximately 15 minutes.

The accuracy in the translations for native English speakers and the accuracy in the comprehension questions for native Japanese speakers were the indication of the participants' preferences for either sentence types. For example, if they accurately translated/answered the questions for long-before-short sentences with non-center-embedded clauses more frequently than for short-before-long sentences with center-embedded clauses, the outcome would indicate that the 'non-center over center' preference would be more influential than the 'short before long' preference. If their accuracy rates appear in the other way, it would indicate that the 'short before long' preference is more influential than the 'non-center over center' preference.

C. Results

The results of native English and Japanese speakers' comprehension accuracy rates for given relative clause sentences are shown below.

TABLE 1
COMPREHENSION ACCURACY OF NATIVE ENGLISH AND JAPANESE SPEAKERS

Items	Accuracy (%)	
	Japanese Speakers	English Speakers
Long before short, Non-center-embedded	89.23 (SD = .31119; SE = .02729)	89.33 (SD = .31077; SE = .03588)
Short before long, Center-embedded	83.08 (SD = .37641; SE = .03301)	56.00 (SD = .49973; SE = .05770)

Regarding native Japanese-speaking control group, as predicted, the results showed numerically higher accuracy rate for long-before-short sentences with non-center-embedded clauses than for short-before-long sentences with center-embedded clauses. However, one-way ANOVA analysis did not elicit a statistically significant difference in the accuracy rates between the conditions [$F = 2.064$, $p = .152$]. This result might indicate that the given experimental sentences could have been too short or too easy to elicit the effects from the 'long-before-short' preference and the 'non-center over center' preference.

In contrast, native English speakers' results showed a significant difference between the conditions. They comprehended long-before-short sentences with non-center-embedded clauses significantly more accurately than short-before-long sentences with center-embedded clauses [$F = 24.063$, $p < .001$]. This outcome indicates that, in native English speakers' comprehension, the 'non-center over center' preference is significantly more influential than the 'short before long' preference.

III. DISCUSSION

The results clearly showed that native English-speaking learners of Japanese are strongly affected by the positions of embedded clauses. The accurate comprehension was significantly lower for sentences whose subject NP and object NP are intervened by center-embedded relative clauses compared with sentences whose subject NP and object NP are close to each other, without the intervention by embedded clauses. The 'short-before-long' preference did not appear in the results, which may indicate that the 'short-before-long' preference is confined in comprehending their native language, English (and possibly other head-initial languages), whereas the 'non-center over center' preference is a more universal phenomenon across different languages. This account can be examined by a similar experiment with native Japanese speakers using English sentences such as (1a, 3a) and (1b, 3b), which are a long-before-short sentence with a center-embedded clause and a short-before-long sentence with a non-center-embedded clause, respectively. As mentioned, native Japanese speakers hold the 'long-before-short' preference. If they accurately comprehend (1b, 3b) more frequently than (1a, 3a), the outcome indicates that the 'non-center over center' preference is more influential than the 'long before short' preference. Accordingly, the results support the account that the 'non-center over center' preference is universal across the speakers of different languages, while the 'long before short' preference is language-specific.

One thing that should be noted about Experiment 1 is that the experimental items in the center-embedded condition included two nominative morphemes, *ga*, consecutively, e.g., (4b) *Onna-GA Ken-GA kiratteiru giin-o hometa* 'The woman praised the senator who Ken hated'. A number of studies indicate that sentences with two consecutive *ga* are

known to be difficult to process and comprehend (Uehara, 1997; Sawasaki, 2009; Shoji, 2014). The argument based on the similarity-based interference may account for the difficulty of processing and comprehending the two consecutive NP-ga. In general, a similarity of two constituents makes it difficult for readers to distinguish the two constituents' roles (Lewis & Nakayama, 2002; Gordon, Hendrick, Johnson & Yoonhyoung, 2006). For example, when reading a sentence with a center-embedded relative clause such as (1a) 'The woman who Ken hated praised the senator', readers first find two NPs, 'The woman' and 'Ken', which play similar grammatical roles, i.e., matrix subject and subordinate subject. When the matrix verb 'praised' appears, readers must retrieve the correct subject NP for the matrix clause ('The woman'), which is interfered by the competing subject NP ('Ken'). Consecutive NP-ga in Japanese could be the same case. When readers find two subject NPs both marked by ga, it can be difficult to figure out which subject-ga is the matrix subject or the subordinate subject. However, Uehara's (1997) study found that replacement of ga for matrix subjects with the topic morpheme, wa, makes comprehension easier. Compare the following sentences.

- (5) a. 佐藤さんが 高橋さんが 山田さんを 告訴した と 言った。
 Sato-san-ga [Takahashi-san-ga Yamane-san-o kokuso-shita] to itta.
 Mr. Sato-NOM Mr. Takahashi-NOM Mr. Yamane-ACC sued COMP said
 'Mr. Sato said that Mr. Takahashi sued Mr. Yamane.'
- b. 佐藤さんは 高橋さんが 山田さんを 告訴した と 言った。
 Sato-san-wa [Takahashi-san-ga Yamane-san-o kokuso-shita] to itta.
 Mr. Sato-TOP Mr. Takahashi-NOM Mr. Yamane-ACC sued COMP said
 'Mr. Sato said that Mr. Takahashi sued Mr. Yamane.'
- (Sawasaki, 2009, p. 7, with modification)

The meanings of above two sentences are the same, and both include a center-embedded that-clause in the same position. The only difference is that the matrix subject ('Mr. Sato') is appended with ga in (5a) and wa in (5b). Uehara's study was questionnaire-based, which asked native Japanese speakers to judge the difficulty-levels of given sentences such as (5a) and (5b), on a 6-point scale. The Japanese-speaking participants' responses indicated that sentences such as (5b) with the matrix subject-wa was easier to comprehend than (5a) with the matrix subject-ga. The relative easiness of (5b) compared with (5a) can be attributed to the different usages between wa and ga. That is, a topic NP with wa typically appears in matrix clauses, but is not allowed to appear in certain subordinate clauses, including relative clauses (Heycock, 2008). When readers encountered an NP-wa and an NP-ga consecutively, they might immediately interpret the NP-wa as a constituent of a matrix clause and the following NP-ga as a subordinate subject. Therefore, when readers retrieve the matrix subject, they choose the NP-wa with little interference from the NP-ga. This account could be applicable to native English-speaking learners of Japanese as Shoji's (2017) sentence-completion experiment found that native English-speaking Japanese learners realize that NP-wa should be a part of matrix clauses. Here, the investigator conducted Experiment 2 to examine the second research question: whether the comprehension difficulty for native English speakers on L2 Japanese sentences with center-embedded relative clauses would be decreased by marking the matrix subject with wa, not ga.

IV. EXPERIMENT 2

A. Participants

14 native English-speaking Japanese learners and 12 native Japanese speakers participated in Experiment 2. None of them participated in Experiment 1. Similar to Experiment 1, the participating English speakers were those who completed at least four semesters of Japanese classes in an undergraduate program at a U.S. college.

B. Items and Method

The experimental items and methods were similar to Experiment 1. Native English speakers were tasked to translate test sentences with non-center-embedded relative clauses and those with center-embedded relative clauses. Native Japanese speakers read test sentences with non-center-embedded relative clauses and those with center-embedded relative clauses in a self-paced reading fashion, and they answered comprehension questions about the sentences that they read. The difference from Experiment 1 was that the matrix subjects in the given items were marked by the topic-morpheme wa, whereas the subordinate subjects were marked by the nominative morpheme ga. Example items are shown below.

- (6) a. Non-center-embedded clause
 健が 嫌っている 女は 議員を 褒めた。
 [Ken-ga kiratteiru] onna-WA giin-o hometa.
 Ken-NOM hate woman-TOP senator-ACC praised
 'The woman [who Ken hated] praised the senator.'
- b. Center-embedded clause
 女は 健が 嫌っている 議員を 褒めた。
 Onna-WA [Ken-ga kiratteiru] giin-o hometa.
 woman-TOP Ken-NOM hate senator-ACC praised

The woman praised the senator [who Ken hated].

All other aspects of items and methods were the same as in Experiments 1

C. Results

The results of native English speakers' and native Japanese speakers' comprehension accuracy rates are summarized below.

TABLE 2
COMPREHENSION ACCURACY OF NATIVE ENGLISH AND JAPANESE SPEAKERS

Items	Accuracy (%)	
	Japanese Speakers	English Speakers
Non-center-embedded	92.31 (SD = .26750; SE = .02346)	91.67 (SD = .27872; SE = .03598)
Center-embedded	87.18 (SD = .33576; SE = .03104)	85.56 (SD = .35351; SE = .03726)

As for the results from the native Japanese control group, similar to Experiment 1, they did not show significant difference in accurate comprehension for the non-center-embedded and center-embedded conditions, although their accuracy rates were numerically higher for the non-center-embedded condition [$F = 1.779$, $p = .184$].

Regarding native English speakers, their accurate comprehension for sentences with center-embedded clauses increased compared with Experiment 1 (56% 85.56%), as predicted. Unlike Experiment 1, there was no significant difference in accuracy rates for sentences with non-center-embedded clauses and those with center-embedded clauses [$F = 1.267$, $p = .262$]. In other words, when matrix subjects are marked by *wa* (not *ga*), sentences with center-embedded clauses are comprehended indifferently from sentences with non-center-embedded clauses.

V. DISCUSSION

Experiment 2 elicited predicted results. When the matrix subjects were marked by *wa*, English speakers comprehended L2 Japanese sentences with center-embedded relative clauses as accurately as sentences with non-center-embedded relative clauses. The results reflect that participants successfully interpreted the NP-*wa* as a part of matrix subject and the NP-*ga* as the subordinate subject. In other words, *wa* functioned to indicate the boundary between matrix and subordinate clauses. Therefore, the different accuracy rates in comprehension between non-center and center-embedded conditions, which was detected in Experiment 1, disappeared in Experiment 2.

Unlike Japanese, English does not overtly mark the topic with a morpheme. Thus, when two subject NPs are presented consecutively in a sentence such as 'The woman Ken hated praised the senator', readers might find a difficulty in figuring out which NP ('The woman' or 'Ken') is the matrix subject or the subordinate subject. However, relative pronouns and commas would be the clue for readers to find the boundary between matrix clauses and subordinate clauses. Compare the following sentences.

- (7) a. The woman Ken hated praised the senator.
b. The woman, who Ken hated, praised the senator.

The sentence (7b) is predicted to be comprehended easier than (7a) because the relative pronoun 'who' and the commas present the clear boundary between the matrix clause 'The woman praised the senator' and the subordinate clause 'who Ken hated'. The author predicts that, without relative pronouns and commas, English sentences with non-center-embedded relative clauses would be comprehended more accurately than sentences with center-embedded relative clauses (equivalently to Experiment 1 in this study), but the accuracy would be equalized between them with relative pronouns and commas (equivalently to Experiment 2 in this study). This can be tested in a future study.

VI. CONCLUSION

This study investigated native English speakers' comprehension of L2 Japanese sentences that include relative clauses. Experiment 1 showed that they prefer (i.e., more accurately comprehended) sentences with non-center embedded clauses to sentences with center-embedded clauses, whereas they did not show a preference for sentences with short phrases before long phrases. Experiment 2 showed that the comprehension difficulty for sentences with center-embedded clauses is decreased because of the function of the topic-morpheme *wa*.

As described, the present study suggests further related studies. One is the English version of Experiment 1, which examines the comprehension of English relative clause sentences by native Japanese speakers, who are L2 English learners (see Section III. Discussion). The other one examines the comprehension of English relative clause sentences with or without relative pronouns and commas (see Section V. Discussion), which could test both native English speakers and L2 English learners. These future studies together would ensure the results and analyses of the present study and contribute to more comprehensive understanding of the comprehension of sentences with relative clauses.

REFERENCES

- [1] Arnold, J., T. Wasow, A. Losongco & R. Grinstead. (2000). Heaviness vs. newness: the effects of structural complexity and discourse status on constituent ordering. *Language* 76, 28-55.
[2] Gibson, E. (2000). The dependency locality theory: A distance-based theory of linguistic complexity. In Y. Miyashita, A.

- Marantz & W. O'Neil (eds.), *Image, Language, brain*. Cambridge, MA: MIT Press, 95-126.
- [3] Gordon, P. C., R. Hendrick, M. Johnson & Y. Lee. (2006). Similarity-based interference during language comprehension: Evidence from eye tracking during reading. *The Journal of Experimental Psychology: Learning, Memory, and Cognition* 32(6), 1304-1321.
- [4] Hawkins, J. (1994). *A performance theory of order and constituency*. Cambridge: Cambridge University Press.
- [5] Heycock, C. (2008). Japanese -wa, -ga, and information structure. In S. Miyagawa & S. Saito (eds.), *The Oxford handbook of Japanese linguistics*. Oxford: Oxford University Press, 54-83.
- [6] Kerkhofs, R., V. Wietske, H. Schriefers & D. J. Chwilla. (2008). Sentence processing in the visual and auditory modality: Do comma and prosodic break have parallel functions? *Brain Research* 1224, 102-118.
- [7] Lewis, R. L. & M. Nakayama. (2002). Syntactic and positional similarity effects in the processing of Japanese embeddings. In M. Nakayama (ed.), *Sentence processing in East Asian languages*. Stanford, CA: SCLI, 85-110.
- [8] McElree, B., S. Foraker & I. Dyer. (2003). Memory structures that subserve sentence comprehension. *Journal of memory and language* 48, 67-91.
- [9] Sawasaki, K. (2009). Meishi-ko renzoku to 'ga' kaku renzoku-bun no nanido to memori supan no kankei [Working memory span and its effect on difficulty ratings of sentences with repeated NP arguments and repeated NP-ga]. *Ars Linguistica* 16, 15-31.
- [10] Shoji, S. (2014). Suki and kirai with the accusative case marker o. *Proceedings of the 29th Southeastern Association of Teachers of Japanese* 63-88.
- [11] Shoji, S. (2017). English speaker acquisition of clausal constraints for topic and subject in Japanese. Manuscript submitted for publication.
- [12] Uehara, K. (1997). Judgments of processing load in Japanese: The effect of NP-ga sequences. *Journal of Psycholinguistic Research* 26.2, 255-263.
- [13] Yamashita, H. & F. Chang. (2001). "Long before short" preference in the production of a head-final language. *Cognition* 81, B45-B55.

Shinichi Shoji received a PhD in linguistics focusing on reference resolution in Japanese from the University of South Carolina, Columbia, SC, USA, in 2016, with his dissertation *The Repeated Name Penalty and the Overt Pronoun Penalty in Japanese*. Currently he is an Assistant Professor at Organization for the Development of Higher Education and Regional Human Resources, Mie University, Japan. He was previously an Instructor of Japanese language at Winthrop University, Rock Hill, SC, USA, University of North Carolina at Charlotte, Charlotte, NC, USA, University of South Carolina, Columbia, SC, USA, and Clemson University, Clemson, SC, USA. Dr. Shoji is a recipient of The Hanako Ito Chaplin Memorial Award for Excellence in Japanese Language Teaching.