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Decoding case markers: L1 Chinese L2 Japanese learners' comprehension of Japanese OSV sentences

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Abstract: It is widely acknowledged that L2 learners whose native language lacks case markers often encounter difficulties when trying to acquire the usage of case markers in a second language. This article investigates whether L2 Japanese learners whose native language lacks case markers are able to use case marking information to comprehend Japanese OSV sentences in real time. A picture-sentence matching truth value judgment experiment was created in both listening and reading versions. A proficiency test was also developed to measure the Japanese proficiency of L2 learners. A group of L1 Chinese L2 Japanese learners and a control group of L1 Japanese speakers were recruited for this study. The findings suggest that L1 Chinese L2 Japanese learners can utilize case markers to interpret Japanese OSV sentences online, with their accuracy strongly predicted by their Japanese proficiency.

Keywords: case markers; experiment; interpretation; Japanese; OSV sentences

1 Introduction

It has been well established in the literature that second language (L2) learners with a native language (L1s) that lacks case marking often face challenges when trying to acquire case markers in their L2s (e.g., Iwasaki 2003; Kilborn and Ito 1989). Previous research has moreover shown that Subject-Object-Verb (SOV) languages are much more likely to involve case marking than Subject-Verb-Object (SVO) languages (e.g., Dryer 2002; Greenberg 1963). Among the 502 languages investigated by Dryer (2002), 181 out of 253 SOV languages have case marking, while only 26 of 190 SVO languages have it. VanPatten and Smith (2019) argued that the correlation between word order and case marking is not coincidental. Following Gilligan (1987) and Dryer (2002), they argued that in SOV languages that allow subject/object drop, case marking can help people identify the syntactic role of a specific noun phrase (NP) as either a subject or

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an object. This enables the parser to disambiguate the grammatical functions of preceding NPs without having to wait for the verb. It helps them build a syntactic structure at an early stage (e.g., Miyamoto 2002; Ueno and Polinsky 2009). VanPatten and Smith (2019) further observed that case-marking SOV languages almost always allow both SOV and Object-Subject-Verb (OSV) word orders. Since case particles are marked features of SOV languages, the question arises as to whether native speakers of case-less SVO languages are able to use case markers to comprehend scrambled OSV sentences in SOV languages. The present article addresses this question by conducting an experiment to investigate whether L1 Chinese L2 Japanese learners can rely on case markers to interpret Japanese OSV sentences in both online and offline tasks.

It is well recognized that the canonical order of Japanese sentences is SOV (Kuno 1978; Kuroda 1980), see (1):

(1) *nezumi-ga* *neko-o* *oikake-ta*. (Japanese)
mouse-NOM cat-ACC chase-PST
'The mouse chased the cat.'

In (1), the subject *nezumi* 'mouse' is marked by the nominative case marker *-ga* and the object *neko* 'cat' is marked by the accusative marker *-o*. On the other hand, OSV sentences are also possible in Japanese, as in (2):

(2) *neko-o* *nezumi-ga* *oikake-ta*. (Japanese)
cat-ACC mouse-NOM chase-PST
'The mouse chased the cat.'

However, OSV sentences are rare compared to SOV sentences. Yamashita (2002) found only three OSV sentences among the 2,635 sentences in her corpus.[1] Many studies have argued that Japanese OSV sentences are derived from their SOV counterparts by movement (e.g., Kuroda 1980; Saito 1985). For example, the accusative NP *neko-o* in (1) can be moved to a position that linearly precedes and is structurally higher than the nominative NP *nezumi-ga*, which results in the OSV sentence in (2). According to Saito (1985), this movement analysis is supported by three pieces of evidence: pronominal coreference, crossover and quantifier floating. Thus, OSV sentences should be syntactically more complex than SOV sentences.

The canonical word order of Chinese sentences is SVO (e.g., Li and Thompson 1981). The Chinese equivalent of (1) is given in (3):

1 Yamashita's (2002) corpus comprises both written texts and conversational scripts of different levels of formality. Also, Kuno (1978) claimed that the frequency ratio for Japanese SOV and OSV sentences is 17:1. However, no source or evidence was provided to support this statement.

(3) *laoshu zhui-le mao*. (Chinese)
mouse chase-PST cat
'The mouse chased the cat.'

As shown in (3), Chinese does not have case markers, just like English. Thus, for L1 Chinese speakers learning Japanese as an L2, it is predicted that they will encounter difficulties when trying to associate Japanese case markers with their corresponding syntactic elements.

The article is organized as follows. Section 2 summarizes previous research on L2 comprehension of Japanese OSV sentences. Section 3 presents the research questions, and Section 4 provides an overview of the experimental design, procedure, and materials. The findings are reported in Section 5, followed by a discussion in Section 6. Section 7 concludes this paper and offers suggestions for future research.

2 Previous studies on L2 comprehension of Japanese OSV sentences

Most previous studies adopted the competition model (Bates and MacWhinney 1989) to analyze L2 learners' comprehension of Japanese OSV sentences. According to Bates and MacWhinney (1989), language processing involves a concurrent competition of multiple cues such as phonological, syntactic, and semantic cues. Some cues are more reliable than others and will eventually win out to determine the interpretation of a given sentence. In languages like Chinese and English, word order is a more reliable cue than semantic meaning, as in (3) and (4).

(4) *The mouse chased the cat.*

In (4), the three lexical components, *mouse*, *cat* and *chase* are more likely to be interpreted as 'the cat chased the mouse' if we rely solely on their semantic meanings. However, the word order of this sentence overrides the semantic cues, leading to the only possible interpretation: 'the mouse chased the cat'. This interpretation also applies to the equivalent Chinese sentence in (3). On the other hand, Japanese is a language where case markers are more reliable cues than others such as word order and semantic meaning. As demonstrated in (1) and (2), although the two sentences have different word orders, the interpretation remains consistent because the NPs are case-marked in the same way.

Many previous studies carried out comprehension tasks involving lexical strings to examine what linguistic cues native speakers/L2 learners rely on more (e.g., Bates and MacWhinney 1981). In these experiments, participants hear strings of words that contain two nouns and one verb, which may be varied in terms of the word order

(i.e., NVN, NNV and VNN), agreement (whether the first or second noun agrees with the verb in number/gender), and animacy (animate/inanimate). Then participants are asked to identify which word is the agent/doer. (5) and (6) are examples of English word strings of this type:

(5) him sees Mary

(6) eats the apple he

Kilborn and Ito (1989) conducted an experiment of this type with L1 Japanese speakers and L1 English L2 Japanese learners. The L2 Japanese group was divided into two categories: advanced learners, who were Japanese language instructors, and novice learners, who were regular Japanese learning students. Three factors were included: word order (NVN, NNV, VNN), animacy (animate/inanimate), and case markers. For the factor of case markers, there were four types of word strings: (i) no case markers at all; (ii) only one noun is modified by the nominative case marker *-ga*; (iii) only one noun is modified by the topic marker *-wa*; (iv) one noun is modified by *-ga* and another is modified by *-wa*. Kilborn and Ito's (1989) findings demonstrated that L1 Japanese speakers and advanced L2 Japanese learners consistently relied on *-ga* to identify an agent. However, novice learners were unable to do so, and they tended to depend on word order, identifying the first heard noun they heard as the agent. Although this finding suggested a difference between advanced and novice learners in their interpretation of nominative marked nouns, it may be premature to conclude that advanced Japanese learners are able to rely on case markers to comprehend Japanese sentences. First, when performing Kilborn and Ito's listening task, the advanced learners may have made use of the knowledge that *-ga* marks the agent, which can be easily taught in Japanese language classrooms. For novice learners, this knowledge may not have been fully acquired. However, knowing that *-ga* can be used to modify an agent does not necessarily mean that L2 Japanese learners can rely on case markers to comprehend sentences.[2] Moreover, in Kilborn and Ito's listening experiment, only strings of words were used as stimuli, and there were no complete sentences involved. Therefore, to explore whether L2 Japanese learners can depend on case markers to comprehend Japanese sentences, it is crucial to create experimental materials that include full sentences with at least two different case markers. These materials should also involve sentences in which case markers are more reliable cues than the sentence's word order and the semantic meaning of each noun.

2 Later, we will see that the experimental data from the present study confirm this argument, demonstrating that L2 Japanese learners who know that *-ga* is used to mark agents are unable to rely on case markers for interpreting OSV sentences.

Kilborn and Ito's experimental design served as a model for many subsequent studies. Ito et al. (1993) also found that when identifying an agent in a word string containing two nouns and one verb, L1 Japanese speakers are more inclined to rely on *-ga*, compared to L2 Japanese learners. However, their study involved only eight L1 Japanese speakers and eight L2 Japanese learners, so the data cannot be generalized to a broader population. Moreover, the L2 Japanese learners' Japanese proficiency was not formally assessed. Sasaki (1994) reached similar conclusions and further observed a positive correlation between the Japanese proficiency of L2 learners and their tendency to rely on case markers for identifying agents. Nonetheless, in Sasaki's study, the L2 Japanese participants were simply categorized into two levels (beginning and intermediate) based on the level of classes they were enrolled in, and no Japanese proficiency test was conducted. In addition, each proficiency level group had only ten learners, which may potentially have compromised the reliability of the data.

Furthermore, Iwasaki (2003) conducted multiple experiments to examine whether L1 English L2 Japanese learners can acquire Japanese OSV sentences. She categorized her participants into three different proficiency groups (elementary, intermediate and advanced), based on their results of the American Council on Teaching of Foreign Languages (ACTFL) proficiency test and the Simple Performance Oriented Test (SPOT) (e.g., Ford-Niwa and Kobayashi 1999). The first experiment was a picture description task, where participants were asked to describe items that were specifically marked. For instance, in one picture, a man was depicted eating a hamburger. If the man was marked, participants were instructed to start their sentences by describing the man. Conversely, if the hamburger was marked, participants were instructed to start their sentences by describing the hamburger. The data showed that participants at all proficiency levels were less accurate in producing OSV sentences than SOV sentences, with no statistically significant differences between the groups of varying proficiency levels. However, due to the lack of native Japanese speakers' data in her study, the L2 participants' unsuccessful production of OSV sentences might be attributed to other factors, such as the design of the elicited production task. It is possible that even native Japanese speakers struggle to produce OSV sentences in the same task. Moreover, as stated by White (2003) and Ionin et al. (2021), production data may not necessarily reflect what grammatical properties are missing. That is, if they fail to produce OSV sentences, this does not necessarily mean that this sentence structure has not been acquired. Thus, experiments targeting the comprehension of OSV sentences were also needed.

The second experiment in Iwasaki (2003) was a fill-in-the-blank task, where participants saw one picture at a time and filled out case markers for a sentence describing the given picture. The mean accuracy for SOV sentences was 0.83, while for OSV sentences it was 0.75. Regarding the accuracy for OSV sentences, similar to

the picture description task, no significant difference was observed among participants of different proficiency levels. The third experiment was a grammaticality judgment task, in which participants were presented with an SOV or OSV sentence alongside a corresponding picture. Their task was to judge whether the sentence matched the picture. The mean accuracy scores for SOV sentences and OSV sentences were 0.81 and 0.78, respectively. Nevertheless, no main effect of proficiency was identified, based on which Iwasaki argued that as L2 Japanese learners develop their Japanese proficiency, they do not necessarily enhance their knowledge of OSV sentences.

To summarize, Iwasaki's experimental data suggested that L2 Japanese learners have lower accuracy in understanding and producing OSV sentences than SOV sentences. Additionally, they do not seem to develop their knowledge of OSV sentences when their Japanese proficiency increases. Note that both the fill-in-the-blank task and the grammaticality judgment task in Iwasaki (2003) were offline metalinguistic experiments, where participants might simply rely on their explicitly taught knowledge about case markers and OSV sentences. Typically, this knowledge can be explicitly taught in elementary Japanese language classrooms: *-ga* marks the subject while *-o* marks the object. According to Schwartz (1993), explicitly taught knowledge only contains information about the language, which does not function as input to grammar. The knowledge *about* the language is considered domain-general/non-language-specific knowledge, which fundamentally differs from the knowledge *of* the language, the language-specific knowledge that human beings use to comprehend sentences (Schwartz and Sprouse 2013). Also, in all three tasks, participants with different proficiency levels were assigned different numbers of experimental items. For example, in the fill-in-the-blank task, participants with low proficiency saw 68 sentences, those with intermediate proficiency saw 111 sentences, and those with high proficiency saw 173 sentences. The long list of items for participants with high proficiency may have induced fatigue and thus affected their performance in this task.

In summary, numerous studies have sought to test whether L2 Japanese learners can rely on case markers to interpret Japanese OSV sentences. Although their data indicated that L2 Japanese learners might be able to utilize the case marker *-ga* to identify the agent in sentences, their experimental design faced several issues: (i) the use of lexical strings rather than full sentences; (ii) insufficient numbers of participants; (iii) the potential for participants to use explicitly taught knowledge to associate *-ga* with the agent; (iv) the lack of a Japanese proficiency test. The current study aims to address these concerns in the experimental design. In addition, Iwasaki (2003) conducted a production experiment with L2 Japanese learners, the results of which indicated that producing OSV sentences was difficult for L2 Japanese learners, and their accuracy did not improve with increasing Japanese proficiency. The present study employs a comprehension experiment to investigate whether

Iwasaki's findings apply to the comprehension of OSV sentences. Specifically, it examines whether L2 Japanese learners can rely on case markers to interpret OSV sentences and whether Japanese proficiency plays a role in this process.

3 Research questions

As reviewed, Kilborn and Ito's (1989) study and many related ones only included word strings in their experiments, where participants were asked to identify which words are agents. In many cases, only one word was marked by the nominative case marker *-ga*, or no case markers were used at all. If our goal is to investigate whether L2 Japanese learners can successfully rely on case markers to understand OSV sentences in Japanese, it is crucial to create contexts in which both the nominative marker *-ga* and the accusative marker *-o* are simultaneously interpreted. To that end, the present study developed a picture-sentence matching truth value judgment task (TVJT) (Crain and Thornton 1998). In each trial sentence, there was a noun marked by the nominative case and another noun marked by the accusative case, and these had to be interpreted within a given context. Also, according to Kim et al. (1995), research examining the role of case markers in comprehending OSV sentences should situate test sentences within an appropriate context. Hence, instead of asking participants to listen to a string of words and identify an agent noun without a specific context, this study instructed participants to judge whether a given sentence matched a provided context, which is illustrated by a picture.

The research questions are as follows:

(i) Can L1 Chinese L2 Japanese learners rely on case markers to comprehend OSV sentences in Japanese?
(ii) If yes, is this ability predicted by their Japanese proficiency level?

4 Experiments

This study used a sentence-picture matching TVJT. Two versions of this task were created: a listening version and a reading version. In the listening task, participants saw a scenario through a picture, listened to a target sentence, and verbally provided their answers. In the reading task, participants were presented with pictures and written sentences on a booklet, and they wrote their answers on a separate sheet of paper. There was no time limit for participants to respond in either task. In addition, a Japanese proficiency test was included to measure the Japanese proficiency of each L2 participant.

4.1 A listening comprehension task versus an offline reading task

Listening comprehension tasks are generally considered as real-time online activities that involve processing at semantic, syntactic, neurological and pragmatic levels (e.g., Buck 2001; Rost 2011). Listening comprehension shares many similarities with reading comprehension in that both are receptive in nature and require linguistic and world knowledge (Bae and Bachman 1998; Kintsch 1998). However, listening comprehension is often regarded as more cognitively challenging than reading comprehension because readers can take time to analyze the input while listeners must process information in real time (Bril et al. 2022; Goh and Vandergrift 2012). Real-time online tasks, such as listening comprehension, have been argued to tap into more implicit language knowledge, whereas offline, untimed tasks target explicit knowledge (e.g., Ellis 2005; Ionin et al. 2021; Jiang 2007). Therefore, if our goal is to examine whether L2 Japanese learners can use case markers to comprehend Japanese OSV sentences, a listening comprehension task would be more appropriate than an offline reading task. A successful performance in a listening comprehension task would strongly indicate that these learners have truly integrated the knowledge of case markers into their L2 grammars. Nevertheless, this study employed both a listening comprehension task and an offline untimed reading task. The reason for including the offline reading task was that we intended to determine whether our L2 Japanese participants have the knowledge that Japanese has OSV sentences, regardless of whether this knowledge comes from input or classroom instruction. The data revealed that all our L2 Japanese participants had knowledge of case markers and were able to apply it to interpret OSV sentences in the offline reading task. However, not all of them were able to rely on case markers to interpret OSV sentences in the listening comprehension task.

4.2 Procedure

All experiments were conducted on Zoom/VooV Meeting, with the experimenter conducting one-on-one interactions with each participant. At the beginning of the experiment, the experimenter went through the consent form with each participant and obtained their verbal consent. All participants completed the listening TVJT first, followed by the Japanese proficiency test and a language background questionnaire. Then the L2 Japanese participants proceeded to complete the reading TVJT. Participants were compensated for their participation.

4.3 Participants

A total of 35 L1 Chinese L2 Japanese learners were recruited. They were undergraduate and graduate students, with an age range of 19–26, majoring in Japanese in various universities in China. All participants started learning Japanese upon entering college at the age of 17–19 and had been learning Japanese intensively for at least two years by the time of the experiment. All of them were born and raised in China and identified Chinese as their sole native language. No participants had experience of living outside China before the age of 18. Moreover, they all started learning English in their elementary or middle school years. Strictly speaking, Japanese is their third language. But for the sake of convenience, this paper still refers to them as L1 Chinese L2 Japanese learners. Furthermore, given the fact that both Chinese and English lack case markers and share canonical SVO word order, we do not consider English as a factor that can contribute to the acquisition of case makers in Japanese. In addition to the L2 participants, a group of 13 L1 Japanese speakers (age range: 18–50) were recruited as native controls. All of them were born and raised in Japan and had resided there until at least the age of 18. They participated in the listening TVJT only.

4.4 Japanese proficiency test

A listening fill-in-the-blank test was developed to measure our participants' Japanese proficiency. There were 30 test items in total and participants were presented with one item at a time on PowerPoint slides. In each item, participants listened to a sentence with one missing particle. They were not able to see the sentence in its written form. Instead, they were presented with a string of 'X' letters, with a blank space indicating the location of the missing particle, as shown in (7).

(7) XXXXX XXX XXX_X.

After hearing the sentence, participants were expected to verbally fill in that missing blank with a particle. They were allowed to listen to the sentence up to three times. (8) is an example:

(8) *kyoo* *kara-wa* *motto* *ganbara* *<u>na</u>kya.*
today from-TOP more work hard must
'From today I must work harder.'

In (8), the underlined particle *na*, which is part of the negation in Japanese, was removed. In the meantime, a two-second pause was inserted into its place. In other

Table 1: Japanese proficiency test results of L1 Japanese and L2 Japanese participants.

	M	SD	SE	Highest score	Lowest score
13 L1 Japanese participants	29.08	0.76	0.21	30	28
35 L2 Japanese participants	19.66	4.84	0.82	28	10

words, participants heard (8) without the particle *na*, but there was a pause between *ra* and *kya*. Participants were presented with the string of 'X' letters in (7) while listening to the sentence.

If participants successfully produce *na*, they received one point. Since there were 30 test items in total, the full score was 30 points. Each missing particle was either a grammatical particle or part of a noun or verb. The test sentences and missing particles were created by consulting grammar points from a variety of Japanese textbooks and reference books, as well as the grammar points tested in the SPOT test (e.g., Ford-Niwa and Kobayashi 1999). All participants' scores are summarized in Table 1.

The data in Table 1 shows that L1 Japanese speakers performed at the ceiling, whereas there was a wide range of performance levels among L2 Japanese learners. The data analysis section will examine whether Japanese proficiency level significantly predicts L2 learners' accuracy in comprehending OSV sentences in real time.

4.5 Materials

A sentence-picture matching TVJT was created in both listening and reading versions. Let us start with the listening TVJT, which was the primary task. In the listening TVJT, all sentences were pre-recorded by a native Japanese speaker with a natural tone. Each sentence was played only once to participants, accompanied by a corresponding picture. All experimental stimuli were created and presented on Microsoft PowerPoint.

Four characters were used in the TVJT, *Monkey* (9a), *Pig* (9b), *Panda* (9c) and *Dog* (9d).

(9) a.

b.

c.

d.

Each experimental item had one picture depicting an interaction between two characters. (10) is an example, where *Pig* kicks *Monkey*.

(10)

There were two factors: (i) the word order (SOV/OSV) and (ii) the compatibility of semantic roles with the given context (Match/Mismatch). The two factors lead to four conditions for each experimental item, stated in (11):

(11) a. Condition I: SOV & Match: the target sentence follows the SOV order and matches the picture.
b. Condition II: SOV & Mismatch: the target sentence follows the SOV order and does not match the picture.
c. Condition III: OSV & Match: the target sentence follows the OSV order and matches the picture.
d. Condition IV: OSV & Mismatch: the target sentence follows the OSV order and does not match the picture.

The target sentences corresponding to the four conditions of (11) are shown in (12):

(12) a. *buta-ga* *saru-o* *ket-ta*. (SOV+Match)
Pig-NOM Monkey-ACC kick-PST
'Pig kicked Monkey.'
b. *saru-ga* *buta-o* *ket-ta*. (SOV+Mismatch)
Monkey-NOM Pig-ACC kick-PST
'Monkey kicked Pig.'
c. *saru-o* *buta-ga* *ket-ta*. (OSV+Match)
Monkey-ACC Pig-NOM kick-PST
'Pig kicked Monkey.'
d. *buta-o* *saru-ga* *ket-ta*. (OSV+Mismatch)
Pig-ACC Monkey-NOM kick-PST
'Monkey kicked Pig.'

The sentences in (12a) and (12b) exhibit SOV order, where the first element is marked by the nominative case *-ga* and the second element is marked by the accusative case *-o*. The sentence in (12a) and (10) match in meaning so it is a 'match' condition. In contrast, the sentence in (12b) does not match (10), making it a 'mismatch' condition. Meanwhile, the sentences in (12c) and (12d) have OSV order. In (12c) and (12d), the first element is marked for accusative case, while the second element is marked for nominative case, which is in contrast to the pattern in (12a) and (12b). The sentence in (12c) matches (10) so they constitute a 'match' condition. However, the sentence in (12d) does not match (10), leading to a 'mismatch' condition. For each experimental trial, participants were asked to judge whether the sentence and the picture matched by saying *hai* 'yes' or *iie* 'no' in Japanese.

A list of 20 different Japanese verbs that can involve interactions between two animate characters were created, including *homeru* 'to praise', *kaku* 'to draw', *kakusu* 'to hide', *kazaru* 'to decorate', to mention a few examples (see the Appendix for a complete list of experimental sentences and pictures). Afterward, each verb was assigned to two pairs of characters: 'Monkey and Pig' and 'Panda and Dog.' Thus, there were 40 items of different lexicalizations. Since the experiment involved four conditions, as illustrated in (11) and (12), each of the 40 items were then combined with four different pictures, resulting in a total of 160 sentence-picture pairs. These 160 pairs were then distributed across four lists using a Latin square design so that each list contained 40 critical items, with each condition consisting of ten items. Note that in each experimental sentence, the agent and the patient were semantically reversible because they were both animate. Thus, our participants had to use their grammatical knowledge to understand the sentences. Since each condition had ten items, based on the binomial cumulative distribution, participants' judgments would be considered consistent if they accepted or rejected eight items or more out of ten.[3] All items were randomized in each list. Before the listening TVJT, each participant was given a vocabulary list containing the 20 verbs used in the TVJT and was instructed to review the vocabulary list for 5–10 min to ensure that they knew the meaning of each verb.

Regarding the reading version of the TVJT, all experimental trials were identical to those in the listening version, except that each experimental trial was printed on a PDF file, and the target sentence was displayed below the corresponding picture. Participants judged whether the sentence matched the picture by encircling 'true' or 'false' on an answer sheet. The reading TVJT was a baseline task to determine whether L2 Japanese participants can rely on case markers for interpreting Japanese OSV sentences in offline tasks.

3 The cumulative probability of having eight or more successes out of ten independent trials is 0.05.

4.6 Predictions

Since Conditions I and II only involved SOV sentences, they were baseline conditions, which served the purpose of monitoring the following two aspects: (i) whether our participants' Japanese proficiency was good enough to comprehend Japanese sentences with canonical SOV order; (ii) whether our participants had fully understood how to do this experiment and paid enough attention to each experimental trial. Thus, qualified participants are supposed to perform well in the two conditions. That is, they are expected to accept eight or more items in Condition I and reject eight or more items in Condition II. If participants fail to do so, they will be excluded from the data analysis. Therefore, Condition I and Condition II are considered as screening conditions.

Since the objective of this study is to examine whether L1 Chinese L2 Japanese learners can rely on case marking to comprehend Japanese OSV sentences in real time, Conditions III and IV in the listening TVJT were the critical conditions. If participants are able to use case markers to understand OSV sentences in real time, we expect them to consistently accept items in Condition III and consistently reject items in Condition IV.

5 Findings

Given that the listening TVJT was the primary task and the reading TVJT was the baseline task, we examine the data from the listening TVJT first. We start by analyzing the Japanese data from the 13 L1 Japanese participants. Table 2 summarizes their mean accuracy scores in each condition of the listening TVJT:

Recall that Conditions I and II served as baseline conditions, with a cutoff point of eight items to select qualified participants. That is, participants were expected to accept eight items or more in Condition I and reject eight items or more in Condition II. An initial screening of their responses in both conditions revealed that all

Table 2: Summary of the L1 Japanese participants' mean accuracy in each condition of the listening TVJT.

Condition	Mean accuracy	SD	SE
I: SOV & match	0.99	0.03	0.01
II: SOV & mismatch	0.96	0.05	0.01
III: OSV & match	0.95	0.08	0.02
IV: OSV & mismatch	0.96	0.07	0.02

Table 3: Summary of the 35 L2 Japanese participants' mean accuracy in each condition of the listening TVJT.

Condition	Mean accuracy	SD	SE
I: SOV & match	0.97	0.06	0.01
II: SOV & mismatch	0.9	0.13	0.02
III: OSV & match	0.45	0.34	0.06
IV: OSV & mismatch	0.37	0.33	0.06

participants met the criteria and passed the screening process. Then we analyze their individual data for Condition III and Condition IV. The data demonstrated that all participants accepted a minimum of eight items in Condition III and rejected a minimum of eight items in Condition IV, which was expected for L1 Japanese speakers.

Now we check the data of the 35 L1 Chinese L2 Japanese learners in the listening TVJT. Table 3 provides a summary of the mean accuracy of their judgments in each condition.

An examination of their responses in Condition I revealed that all participants accepted eight or more items in that condition. However, in Condition II, there were five participants who failed to reject eight or more items. This inconsistency indicates that either their Japanese proficiency was insufficient for comprehending regular SOV sentences, or they may have had difficulties understanding how to do the experiment. Thus, the five participants' data were removed, leaving us with the remaining 30 L2 participants' data. Table 4 summarizes the mean accuracy scores of the 30 qualified participants' judgments for each condition.

We used R (R core team 2021) and *lme4* (Bates et al. 2015) to run a linear mixed-effects analysis (using *glmer*) on the L2 participants' data. The dependent variable was the participants' answers, with correct responses coded as 1 and incorrect responses coded as 0. The fixed factors were *Word Order* and *Compatibility*, with *Japanese Proficiency* (*z*-scores) included as a covariate. Participants and items were treated as random intercepts. The results are shown in Table 5.

Table 4: Summary of the 30 L2 Japanese participants' mean accuracy in each condition of the listening TVJT.

Condition	Mean accuracy	SD	SE
I: SOV & match	0.98	0.04	0.01
II: SOV & mismatch	0.94	0.07	0.01
III: OSV & match	0.43	0.35	0.06
IV: OSV & mismatch	0.38	0.36	0.07

Table 5: Output of the binomial generalized linear mixed model fit by maximum likelihood.

	Estimate	Standard error	*z*-value	*p*-value
Intercept	−0.48	0.33	−1.45	0.15
Word Order (SOV vs. OSV)	5.41	0.53	10.17	<0.001***
Compatibility (match vs. mismatch)	−0.45	0.24	−1.87	0.06
Proficiency	1.41	0.32	4.37	<0.001***
Word order: compatibility	−0.76	0.58	−1.3	0.19
Word order: Japanese proficiency	−0.73	0.51	−1.43	0.15
Compatibility: Japanese proficiency	0.34	0.26	1.30	0.19
Word order: compatibility: Japanese proficiency	−1.12	0.61	−1.85	0.06

Model: Score ~ Word Order + Compatibility + Japanese Proficiency + Word Order: Compatibility + Japanese Proficiency: Word Order + Japanese Proficiency: Compatibility + Japanese Proficiency: Word Order: Compatibility + (1|Participant) + (1|Item).

The results show highly significant main effects for Word Order ($p < 0.001$) and Japanese Proficiency ($p < 0.001$). First, regarding Word Order, a positive effect of 5.41 on the log-odds of success for interpreting SOV sentences was observed when compared to OSV sentences. Second, the estimate of Japanese Proficiency is 1.41, which means that as proficiency develops, the log odds of success will increase if other variables are held constant.

Recall that Conditions I and II were baseline conditions for screening out unqualified participants. The critical conditions were Conditions III and IV, both of which involved OSV sentences. A linear mixed-effects analysis was conducted again using the L2 participants' data, focusing only on Conditions III and IV. Again, the dependent variable was the participants' answers, with correct responses coded as 1 and incorrect responses coded as 0. The fixed factor was Compatibility, with Proficiency (z-scores) included as a covariate. Participants and items were considered as random intercepts. The results are shown in Table 6.

The results revealed highly significant main effects for Proficiency ($p < 0.001$) and Compatibility ($p = 0.04$). Also, there was no significant interaction between

Table 6: Output of the binomial generalized linear mixed model fit by maximum likelihood for Condition III and Condition IV.

	Estimate	Standard error	*z*-value	*p*-value
Intercept	−0.55	0.37	−1.49	0.14
Compatibility (match vs. mismatch)	−0.51	0.25	−2.01	0.04*
Proficiency	1.55	0.37	4.18	< 0.001***
Compatibility: proficiency	0.35	0.27	1.31	0.19

Model: Score ~ Compatibility + Proficiency + Proficiency: Compatibility + (1|Participant) + (1|Item).

Compatibility and Proficiency ($p = 0.19$), which suggests that the relationship between Compatibility and comprehension does not vary based on proficiency level. To sum up, the data analysis of Conditions III and IV also indicates that Japanese proficiency is a robust predictor for L2 Japanese learners' performance in comprehending OSV sentences.

We now analyze the individual data of the 30 L2 Japanese participants. As previously discussed, these 30 participants all passed the screening process by consistently accepting Condition I (SOV & Match) items and consistently rejecting Condition II (SOV & Mismatch) items. However, concerning Condition III (OSV & Match) items, nine (30 %) consistently accepted them, while 13 (43.3 %) participants consistently and wrongly rejected them. Condition IV (OSV & Mismatch) items seemed to be more difficult, with only seven (23.3 %) participants consistently rejecting the items, and half of the participants consistently accepting them. Notably, for both Conditions III and IV, six (20 %) participants consistently accepted Condition III items and simultaneously consistently rejected Condition IV. This performance aligns with that of native Japanese participants, suggesting that these L2 Japanese learners were successful: they were able to rely on case markers to comprehend Japanese OSV sentences in real time. On the other hand, ten (33.3 %) participants consistently rejected Condition III items and consistently accepted Condition IV items, which implies that they relied solely on SOV word order to comprehend Japanese sentences, without considering case markers.

In conclusion, the group data from L2 Japanese participants suggests that OSV sentences are significantly more difficult to comprehend than SOV sentences. However, accuracy in interpreting OSV sentences significantly improves when participants' Japanese proficiency develops. Along with the individual data that 20 % of the participants exhibited nativelike performance, we can conclude that L1 Chinese L2 Japanese participants are able to use case markers for real-time comprehension of Japanese OSV sentences, and this ability grows as their Japanese proficiency level increases.

Recall that following the listening TVJT, the L2 Japanese participants also completed a reading version. Each participant was provided with an experimental list that is different from what they saw in the listening TVJT. Table 7 summarizes the mean accuracy of the 30 L2 Japanese participants' judgments for each condition.

The data in Table 7 show that all participants performed almost perfectly across the four conditions. Given the ceiling effects observed in their performance, group data analysis was not conducted. An examination of their individual data revealed that each participant accepted eight or more items in Conditions I and III but rejected eight or more items in Conditions II and IV, which indicates that their responses to items in Conditions I and III were consistent, as were their responses to items in

Table 7: Summary of the 30 L2 Japanese participants' mean accuracy in each condition of the reading TVJT.

Condition	Mean accuracy	SD	SE
I: SOV & match	0.99	0.04	0.01
II: SOV & mismatch	0.98	0.06	0.01
III: OSV & match	0.98	0.4	0.01
IV: OSV & mismatch	0.97	0.05	0.01

Conditions II and IV. This observation further suggests that the 30 L2 Japanese participants were aware that Japanese allows OSV sentences, and they were able to use case markers to interpret Japanese OSV sentences in offline tasks.[4]

6 Discussion

The experimental results of the listening TVJT revealed that one third of the L2 Japanese participants consistently rejected Condition III items and simultaneously consistently accepted Condition IV items. Since they had no problem comprehending the baseline SOV sentences in Conditions I and II items, it can be inferred that they relied solely on the canonical SOV word order as a strategy for comprehending Japanese sentences, without considering case markers. For these participants, each Japanese sentence should follow SOV word order, which was also observed in Sasaki (1994) and Kilborn and Ito (1989). In addition, as pointed out in Iwasaki (2003), even L1 Japanese children tend to rely on SOV word order as a default strategy (e.g., Hayashibe 1975; Lakshmanan and Ozeki 1996; Sano 1977). Thus, under the competition model (Bates and MacWhinney 1989), it is possible that both L1 Japanese children and L2 Japanese learners initially rely on word order as the most reliable cue for interpreting Japanese sentences. Later, with increased exposure to Japanese input, case markers emerge as stronger cues for identifying theta roles. Hence, when native speakers of case-less L1 languages learn Japanese, they need to acquire the knowledge that case markers are stronger cues than word order. Then a question arises: if L2 Japanese learners' L1 shares similarities with Japanese, such as having case

4 One reviewer suggested two possible explanations for the finding that only 20 % of the L2 Japanese learners were able to successfully utilize case markers to interpret OSV sentences. First, OSV sentences might be too infrequent, and many L2 Japanese learners may never have the opportunity to encounter them. Second, Japanese language instructors may not explicitly teach OSV sentences in the classroom. However, the data from the reading task suggests that the L2 Japanese participants in this study all know that Japanese has OSV sentences, regardless of whether this explicit knowledge was acquired from input or instructions.

markers and allowing OSV sentences, are they able to initially rely on case markers as strong cues to interpret Japanese OSV sentences? Future studies may include learners of Japanese whose native language has the following properties: (i) to have nominal and accusative case markers, (ii) to have the SOV word order as its default structure, (iii) to allow a scrambled OSV order. If this group of people can well comprehend Japanese OSV sentences, even at relatively low proficiency levels, it would suggest a positive transfer from their native language. That is, their native language can significantly facilitate their comprehension of Japanese OSV sentences. Koda (1993) conducted a study with L2 Japanese learners of English, Chinese and Korean. The results indicated that the Korean group outperformed the other two groups in comprehending both SOV and OSV sentences in Japanese. However, the study's sample size was limited (12 Chinese-speaking and 13 Korean-speaking participants), and no proficiency assessment tool was used. Further research involving a larger participant pool is required.

On the other hand, the experimental findings of this study also yielded a positive outcome: 20 % of the L2 participants successfully acquired Japanese case markers and demonstrated the ability to rely on them for comprehending OSV sentences. Their performance was on par with that of the native Japanese controls. Therefore, we can conclude that L2 Japanese learners whose native language lacks case markers can indeed acquire the knowledge of case markers and apply it to comprehend Japanese OSV sentences in real time.

Moreover, the present study confirms that the Japanese proficiency of L2 Japanese learners is a significant predictor for their ability to use case markers to interpret Japanese OSV sentences. In other words, the higher a learner's Japanese proficiency level, the more likely they are to understand OSV sentences in Japanese. This finding regarding the comprehension of Japanese OSV sentences contradicts the L2 production data in Iwasaki (2003), which suggested that high Japanese proficiency does not aid L2 Japanese learners in producing Japanese OSV sentences. As previously mentioned, Iwasaki's production experiment lacked data from native speakers so it remains unknown whether native speakers can accurately produce OSV sentences in her experiment. Future studies may explore whether Iwasaki's experiment can be smoothly completed by native Japanese speakers or whether her findings can be replicated through other types of production tasks.

Furthermore, the data from the reading TVJT revealed that all L1 Chinese L2 Japanese participants were able to make a distinction between OSV and SOV sentences when reading them offline. They successfully associated the nominative marker *-ga* with agents and the accusative marker *-o* with patients. Then what caused the differences in their performance between online and offline tasks? Recall that only 20 % of the L2 Japanese participants were able to interpret OSV sentences like native Japanese speakers. For the remaining 80 % of the participants, one

possible explanation is that they might have already acquired the grammatical, implicit knowledge of case markers but were unable to apply it when processing sentences in real time. An alternative account is that they had not fully acquired the target grammatical knowledge. Instead, they relied on their explicitly taught knowledge about case markers when reading OSV sentences offline. As stated earlier, this knowledge is generally explicitly taught in elementary Japanese language classrooms: *-ga* marks the subject and *-o* marks the object. However, explicitly taught knowledge is considered as knowledge *about* the language that cannot directly inform grammar (Schwartz 1993). Regardless of which explanation is true, it is clear that the knowledge that L2 learners employ in online tasks can be very different from the knowledge they use in offline tasks.

The next question is how some L1 Chinese L2 Japanese learners have successfully acquired the ability to rely on case markers for interpreting Japanese OSV sentences. Filipović and Hawkins (2013, 2019) proposed the Complex Adaptive System Principles (CASP) model for bilingualism, which outlines five general principles to account for bilingual speakers' behavior: (i) minimize learning efforts; (ii) minimize processing effort; (iii) maximize expressive power; (iv) maximize efficiency in communication; (v) maximize common ground. I argue that this model well accounts for the data in this study: the desire to maximize the efficiency in communication can indeed serve as a catalyst for L2 Japanese learners to develop the ability to interpret OSV sentences.

According to Filipović and Hawkins (2019), communication efficiency can be maximized via two oppositive routes: using simple forms or complex forms. Complex forms, such as relative clauses and passives, are considered more appropriate in certain situations. For example, when there is a need to give detailed information about a referent, using relative clauses is more efficient than providing multiple simple clauses.

Now we revisit OSV sentences. As discussed in the introduction, Japanese OSV sentences are considered structurally more complex than their SOV counterparts due to syntactic movement. In the meantime, they were found to be very rare compared to SOV sentences. However, according to Sasaki (1997), there are situations where OSV sentences are preferred by native Japanese speakers. One such situation is related to communication efficiency: when the object involves a modifying relative clause, it is often placed before the subject, as in (13):

(13) *kouen-de* *okane-o* *nakushi-ta* *kodomo-o* *Mary-ga* *seme-ta.*
park-at money-ACC lose-PST child-ACC Mary-NOM blame-PST
'Mary blamed the child who lost mokey at the park.'

Sasaki pointed out that if the object is not moved to the front, there will be a momentarily ambiguous interpretation, as in (14):

(14) *Mary-ga kouen-de okane-o nakushi-ta kodomo-o seme-ta.*
Mary-NOM park-at money-ACC lost-PST child-ACC blame-PST
'Mary blamed the child who lost money at the park.'

(14) is a garden-path sentence, where hearers/readers initially interpret the person who lost money to be Mary until they encounter *kodomo* 'child', causing them to reassess and rebuild their interpretation. However, such momentary ambiguity can be resolved if the OSV order is used, as demonstrated in (13). Thus, (13) is more efficient than (14) in terms of communication because it avoids the need for sentence reanalysis. It is not surprising that native speakers of Japanese prefer to use the OSV order when there is a potential ambiguity issue.

Here we can see that Filipović and Hawkins' (2013, 2019) CASP model well predicted the data of the present study. Recall that one crucial principle of CASP for L2 learning is to maximize efficiency in communication. When L2 learners attain a high level of proficiency in the L2, compared to those with lower proficiency, we expect them to have a richer repository of grammatical forms and utilize more complex sentence structures to enhance communication efficiency. This was strongly supported by the findings of the present study: as L1 Chinese L2 learners develop their Japanese proficiency, they are more likely to accurately interpret Japanese OSV sentences by relying on case markers. This contradicts Iwasaki's (2003) claim that high Japanese proficiency does not help L2 Japanese learners' acquisition of OSV sentences. Although OSV sentences are considered uncommon in Japanese, they are still expected to occur in input from native Japanese speakers, especially when they aim to be efficient in communication by avoiding potential ambiguity in certain sentences. Thus, it is possible for L2 Japanese learners to encounter and learn OSV sentences in their Japanese input.

7 Conclusions

This study used an experiment to investigate whether L2 Japanese learners whose native language lacks case markers are able to rely on case markers to interpret Japanese OSV sentences in real time. A group of L1 Chinese L2 Japanese learners were recruited, along with a control group of native Japanese speakers. The experimental data showed that L1 Chinese L2 Japanese learners can successfully acquire case markers and depend on them to comprehend OSV sentences online. Also, the data suggested that Japanese proficiency is a strong predictor for the L2 learners' accuracy: the higher their Japanese proficiency, the more likely they are to interpret Japanese OSV sentences appropriately. This finding contradicts Iwasaki's (2003) claim that high Japanese proficiency does not contribute to the comprehension of OSV sentences. Future studies may include L2 Japanese learners whose native

language also allows case markers as well as OSV structures. If these learners demonstrate an advantage in comprehending Japanese SOV sentences online, even with relatively lower Japanese proficiency, we can infer a positive transfer of the case marker-based strategy from their native language.

Data availability: All experimental materials and data are accessible on the Open Science Framework via the following link: https://osf.io/jcr7q/.

Appendix

Below are the 40 test items for the sentence-picture truth value judgment task (TVJT). Each test item has four conditions. Only Japanese SOV sentences are listed below.

Item	Japanese	English translation
1	ぶたがさるをほめた。	Pig praised Monkey.
2	ぶたがさるをかいた。	Pig drew Monkey.
3	ぶたがさるをかくした。	Pig hid Monkey.
4	ぶたがさるをかざった。	Pig decorated Monkey.
5	ぶたがさるをなでた。	Pig patted Monkey.
6	さるがぶたをパンチした。	Monkey punched Pig.
7	さるがぶたをさした。	Monkey stabbed Pig.
8	さるがぶたをさわった。	Monkey touched Pig.
9	さるがぶたをしばった。	Monkey bound Pig.
10	さるがぶたをなぐった。	Monkey hit Pig.
11	ぶたがさるをうめた。	Pig buried Monkey.
12	ぶたがさるをあらった。	Pig washed Monkey.
13	ぶたがさるをたすけた。	Pig saved Monkey.
14	ぶたがさるをそうじした。	Pig cleaned Monkey.
15	ぶたがさるをあいした。	Pig loved Monkey.
16	さるがぶたをけった。	Monkey kicked Pig.
17	さるがぶたをおした。	Monkey pushed Pig.
18	さるがぶたをおいかけた。	Monkey chased Pig.
19	さるがぶたをハグした。	Monkey hugged Pig.
20	さるがぶたをだっこした。	Monkey carried Pig.
21	パンダがいぬをほめた。	Panda praised Dog.
22	パンダがいぬをかいた。	Panda drew Dog.
23	パンダがいぬをかくした。	Panda hid Dog.
24	パンダがいぬをかざった。	Panda decorated Dog.
25	パンダがいぬをなでた。	Panda patted Dog.
26	いぬがパンダをパンチした。	Dog punched Panda.
27	いぬがパンダをさした。	Dog stabbed Panda.
28	いぬがパンダをさわった。	Dog touched Panda.
29	いぬがパンダをしばった。	Dog bound Panda.
30	いぬがパンダをなぐった。	Dog hit Panda.
31	パンダがいぬをうめた。	Panda buried Dog.

(continued)

Item	Japanese	English translation
32	パンダがいぬをあらった。	Panda washed Dog.
33	パンダがいぬをたすけた。	Panda saved Dog.
34	パンダがいぬをそうじした。	Panda cleaned Dog.
35	パンダがいぬをあいした。	Panda loved Dog.
36	いぬがパンダをけった。	Dog kicked Panda.
37	いぬがパンダをおした。	Dog pushed Panda.
38	いぬがパンダをおいかけた。	Dog chased Panda.
39	いぬがパンダをハグした。	Dog hugged Panda.
40	いぬがパンダをだっこした。	Dog carried Panda.

Pictures

1. to praise

2. to draw

3. to hide

4. to decorate

5. to pat

6. to punch

7. to stab

8. to touch

9. to bind

10. to hit

11. to bury

12. to wash

13. to save

14. to clean

15. to love

16. to kick

17. to push

18. to chase

19. to hug

20. to carry

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