JSL Learners’ Processing and Reconstruction of Complex Sentences

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Abstract:
The current study examines difficulties Japanese as a second language (hereafter JSL) learners face when hearing aural input. Studies have suggested that second language (hereafter L2) learners’ ability to process sentences develops in continuum, and the use of syntactic cues is located at the end of continuum (Johnston & Doughty, 2007). Among syntactic cues, morphemes are particularly difficult to acquire for L2 learners (N. Ellis, 2008; R. Ellis et al., 2006; Lardiere, 1998). Given the complicated nature of Japanese inflection systems, acquisition of inflectioanal morphemes may be particularly challenging for JSL learners. To explore particular factors that may cause difficulty in processing, the current study examines JSL learners’ ability to reconstruct complex sentences that include inflectional morphemes. A technique named Elicted Imitation was used to explore how entire complex sentences were processed and reconstructed. During the experiment, participants were asked to repeat original sentences as accurately as possible. The results showed that verb conjugations and inflectional morphemes were more difficult to reproduce for JSL learners compared to other syntactic elements, lending support to the argument that morphemes impose a particular challenge for L2 learners when they process input aurally. The current study suggests that frequency in input, a location of a particular item in a sentence and a semantic value play major roles for learners’ successful sentence processing.

Keywords: processing of Japanese as a second language learners, segmentation, inflectional morphemes, reconstruction

1. Introduction
Studies have found that elementary-and intermediate-level JSL learners tend to produce relatively short and simple sentences in a free production task such as a picture description or an interview (Ichikawa, 1998; Kiyama, 2003; Kondo, 2004). These studies suggest that creating cohesion using inflectional morphemes is considerably challenging for JSL learners. Kondo discovered that the number of verb morphology in JSL learners’ utterances was considerably fewer than those in first language (hereafter L1) speakers’. JSL learners even failed to use the te-form, which they were fully familiar with, to connect sentences. Thus, lack of complexity in JSL learners’ production may be attributable to failure to use verb morphology.

Considering the time that JSL learners spend learning a variety of verb morphology in the classroom, the paucity of it in free production tasks is problematic. The lack of cohesive devices indicates that a va-
riety of inflectional morphemes is not yet internalized in JSL learners’ interlanguage system. Learners have explicit knowledge about verb morphology, and they are probably able to use it if they are encouraged to use it by their instructors. However, without explicit instruction, learners are not able to retrieve it from memory; thus, learners are unable to process or produce it efficiently. The goal of this study is to identify JSL learners’ problems associating input processing in a situation where any explicit explanation is unavailable. In particular, the current study intends to elucidate specific elements learners struggle to process, and offer some evidence that elements that are low in salience are less likely processed by L2 learners.

2. Literature review

In general, L1 speakers can understand the meaning of spoken words instantly without explicit knowledge. The ability to detect meaningful units in continuous speech is referred to as segmentation (Sanders et al., 2002). Semantic, prosodic, and syntactic information all contribute to the segmentation process (Sanders & Neville, 2000). To comprehend a second language spoken at a normal speed, L2 learners must be able to segment a sound stream into meaningful units. According to the meta-analysis of L2 listening processing by Johnston and Doughty (2007), L2 learners’ ability to utilize cues develops in continuum. In their scale, the ability to utilize syntactic cues is located at the end of the continuum. Proficient listeners use a variety of acoustic and syntactic cues for segmentation, while low proficiency L2 listeners heavily rely on acoustic and semantic cues.

Among various syntactic elements, the acquisition of morphemes, such as English past tense markers (e.g. R. Ellis et al., 2006; Lardiere, 1998) and German nominals (Parodi et al., 2004), is particularly challenging for L2 learners. There are multiple reasons that explain the difficulty of processing morphemes. First, lack of perceptual salience creates difficulty in processing morphemes (Bates & Goodman, 1997; N. Ellis, 2008; Slobin, 1985). In natural speech, bound-morphemes are often fused with surrounding elements so that boundaries between morphemes and words become vague (N. Ellis, 2008). Additionally, morphemes are short and unstressed even in slow speech (Bates & Goodman, 1997). Second, morphemes place high cognitive demands on L2 learners. Processing of morphemes usually requires retention of other syntactic information; thus, it involves high cognitive demands. R. Ellis et al. demonstrated that L2 English learners were unable to repeat the past tense marker –ed from aural input despite explicit knowledge that they demonstrated during a grammaticality judgment task. To process –ed, a learner must retain information about tense that they hear at the beginning or at the end of the sentence. Retaining such information from a sound stream imposes a particular challenge on L2 learners.

Miyake and Friedman (1998) argue that global cues, such as agreement and word order, demand high memory load, because a learner must retain the initial syntactic information in memory while analyzing the rest of the syntactic information to understand the entire sentence. In contrast, local cues such as animacy or case marking can be processed without considering other words in a sentence or other phrases in a clause. Therefore, not all syntactic cues pose equal difficulties for L2 learners. Studies have revealed that frequency affects the acquisition of language regardless of L1 or L2 (N. Ellis, 2002, 2008; Lieven & Tomasello, 2008). This means that the order of acquiring a certain syntactic element, say morpheme,
is influenced by its frequency in input. Ellis and Schmidt (1997) tested the effect of frequency for acquisition of morphology by examining the acquisition of plural forms using an artificial language. The target items included both regular and irregular plural forms, and both types were further divided into high and low frequency. A significant effect of frequency was found from the experiment, and the frequency effect was larger for the irregular items.

It is also worth noting that the difficulty of processing a particular syntactic element depends on its location in a sentence. In general, regardless of L1 or L2, the middle part of a sound string is difficult to recall when language learners are asked to repeat. This phenomenon is known as the serial order effect (Lewandowsky & Murdock, 1989). For instance, the same type of a relative clause in a sentence initial position is considered to be easier to process than one in a sentence internal position (Bley-Vroman & Chaudron, 1994). Thus far, studies have revealed that there are several factors that affect L2 learners' sentence processing. However, many questions still remain unanswered. A majority of studies that dealt with the processing of L2 morphology are predominantly concerned with morphological agreement markers. However, these studies have not provided a full picture concerning the way L2 learners process complex sentences. Given the fact that Japanese has a variety of inflectional morphemes that create cohesiveness between clauses, exploring the way L2 Japanese learners process inflectional morphemes may contribute to a better understanding of L2 processing issues. Factors such as the length of exposure and the serial order effect may be worth investigating to elucidate problems involving the processing of complex sentences.

3. Research Questions

The main goal of the current study is to examine how multiple syntactic elements in a complex sentence would influence sentence processing. The following research questions are posed to seek answers for issues discussed in the previous section.

1. Which syntactic elements in a complex sentence cause difficulties in processing for L2 Japanese learners?

2. How do L2 Japanese learners respond when they fail to process input correctly?

Concerning the first question, the current study hypothesizes that inflectional morphemes are the most difficult to process, given their low salience (N. Ellis, 2008; Miyake & Friedman, 1998). In particular, a morpheme in the sentence internal position is more difficult to process compared to sentence initial and final positions due to the serial order effect. Among different types of morphemes, the one to which learners had been exposed most in class is easier to process compared to newly learned morphemes due to the frequency effect (Ellis & Schmidt, 1997). As for the second question, learners either skip or replace unfamiliar elements in input. The current study predicts that an unfamiliar item is replaced by a more familiar item, given the results of Ellis and Schmidt (1997).

4. Methods

Participants were 32 students enrolled in the second-year Japanese at a university located in the U.S. Their L1 was English. The experiment was conducted in the beginning of their fourth semester of Japa-
nese courses in the university. Each stimulus in this experiment consists of four verbs and includes two target structures. Table 1 indicates each of the three types of inflectional morphemes that serve as target structures and its function used in the current study. The target structures were chosen according to the length of exposure during the Japanese courses, assuming that the length of exposure is associated with frequency of input. It is expected that the easiest form for learners of this experiment is the te-form and most difficult form is the tara-form.

Table 2 shows the five types of stimuli. The current study assumes that the location of the structure within the sentence influences learners’ sentence processing. To examine the effect of location in a sentence on Inflectional morpheme, five sentence types were used. All lexical items used in this experiment were chosen from those participants learned during previous semesters (mainly from the first year Japanese textbook). Prior to the experiment, a pilot test was conducted to see if there is any lexical item that is particularly more difficult than others. Such items were eliminated from the main study. Sentence length was also controlled. The length of stimuli used in the study is approximately 29 morae; the shortest stimulus has 26 morae and the longest stimulus has 32 morae. The results of a pilot test suggested that the sentence length was durable for participants of the main study. In order to avoid practice effect and prevent participants from discovering patterns embedded in stimuli, special care was taken. First, this experiment employed six unique varieties of sentences for each sentence type; thus, the total number of stimuli is 30. In addition, 30 distracters were inserted between stimuli. Participants of the pilot study did not report specific patterns in stimuli when they were asked if they recognized any particular patterns.

<table>
<thead>
<tr>
<th>Form</th>
<th>Function</th>
<th>Learners’ exposure to the structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The te-form</td>
<td>Chronological order of activities</td>
<td>Approximately two semesters</td>
</tr>
<tr>
<td>2. The tari-form</td>
<td>Inexhaustive listing of activities</td>
<td>Approximately one semester</td>
</tr>
<tr>
<td>3. The tara-form</td>
<td>Timing of activities</td>
<td>Approximately half of a semester</td>
</tr>
</tbody>
</table>

Table 2. Sentence types in stimuli

a. …te, ...te, ...tara, -masu

e.g. baa ni itte ongaku o kiite osake o nondara uta o utaimasu.

= (I’m) going to a bar, then (we’ll) listen to music and after (we) drink (we’ll) sing.

b. ...tara, ...te, ...te, -masu

e.g. Asa okijara mado o akete, shavaa o abite shibun o yomimasu.

= After (I) wake up, (I) open the windows, take a shower and read a newspaper.

c. ...te, ...tara, ...te, -masu

e.g. hon o yonde shukudai ga owattara konbini ni itte arubaito o shimasu.

= (I’ll) read a book, do my homework and after (I’m) finished, (I’ll) go to a convenience store and work.

d. ...te, ...tari, ...tari, coordinating verb shimasu

e.g. kooen ni itte, shashin o tottari, tenisu o shitari simasu.

= (I’ll) go to the park and do things such as take photos and play tennis.

e. ...tara, ...tari, ...tari, coordinating verb shimasu

e.g. shiken ga owattara, arubaito o shitari, kanojo to dekaketari shimasu.

= After the exam is over, (I’ll) do things such as work and go out with my girlfriend.
The current study adopts a technique called Elicited Imitation (hereafter EI) to illustrate the way L2 learners process the entire sentence. EI allows researchers to observe how an element is affected by serial order effect. During EI, participants are asked to repeat a given sentence as accurately as possible. The basic assumption is that if participants’ interlanguage system is close to a given cue, their imitation of the cue should be accurate. Therefore, participants’ performance under this task is most likely a reflection of their interlanguage system (Mackey & Gass, 2005). Studies have proved that EI is a reliable method to measure linguistic competence (Bley-Vroman & Chaudron, 1994; Vinther, 2002).

Participants engaged in the EI task individually in a small room at a language laboratory. They were asked to repeat sentences they heard from aural input as accurately as possible and were allowed to listen to each sentence only once. Before engaging in the task, the researcher demonstrated how to do the task. After the demonstration, participants were given an opportunity to practice EI. They practiced on five sentences from distracters, and the volume of the sound was adjusted to the level at which each participant could hear sentences comfortably. They were asked to count 1, 2, 3 before repeating. The purpose of asking this is to prevent them from repeating without understanding the meaning (Cowan, 1993). All sentences were digitally recorded to keep the speed and volume of voice consistent throughout the experiment, and were read at a natural speed by a native speaker of Japanese. Recorded sentences were separated by a pause using the digital audio editor Audacity. There was a less than 0.5-second pause between clauses. The recorded sentences were designed to start when the researcher clicked a mouse to ensure that learners listened to each stimulus only once. No time limitation was imposed on participants when they repeated stimuli. This allowed participants to rephrase words or sentences if they wished. Participants’ performances were also digitally recorded for analyses.

5. Analyses

All elements in stimuli that participants imitated were analyzed to visualize a serial order effect. Since this study hypothesizes that inflectional morphemes are more difficult to process than other syntactic elements, the location of four verbs’ inflectional morphemes must be clearly identified when visualizing serial order effect. Thus, each verb participants produced was further dissected into three parts: appropriate choice of a verb, appropriate conjugation of a verb and appropriate choice of an inflectional morpheme. As shown in Table 3, sentence types a, b, and c are divided into 20 components, so that 20 points are awarded if a learner perfectly repeats a stimulus. Similarly, sentence types d and e are divided into 18 components; therefore, the highest possible score for these types is 18 points. The numbers that correspond to these components are plotted along the X axis to capture serial order effect, and the percentage of accurate repetition of each component was indicated on the Y axis.

<table>
<thead>
<tr>
<th>Sentences types a, b and c</th>
<th>Table 3. Unit of analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 p v c i n p v c i n p v c i n p v c i</td>
<td>2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
</tr>
</tbody>
</table>

—107—
Sentence types $d$ and $e$

<table>
<thead>
<tr>
<th>n</th>
<th>p</th>
<th>v</th>
<th>c</th>
<th>i</th>
<th>n</th>
<th>p</th>
<th>v</th>
<th>c</th>
<th>i</th>
<th>n</th>
<th>p</th>
<th>v</th>
<th>c</th>
<th>i</th>
</tr>
</thead>
</table>

$n$: noun; $p$: particle; $v$: choice of a verb; $c$: conjugation; $i$: Inflectional morpheme

Participants' performances were scored in terms of production and accuracy. As for production scoring, one point was awarded when each element was produced irrespective of accuracy. When a learner rephrased a noun or a verb multiple times, only the one the learner produced last was counted. Concerning accuracy scoring, one point was awarded only if a correct item was produced in a correct position. In other words, no point was given when an item was produced in a different location from the original sentence even when the learners' production was grammatically correct. During the experiment, learners sometimes rephrased the original lexical items with others that were compatible in meaning. For instance, instead of saying "gohan o tsukuru" (to make a meal) some learners said "ryoori o suru" (to cook). In such a case, 0.5 points were given for an appropriate substitution. Pronunciation errors were ignored as long as they did not confuse the meaning of the original sentence. Two raters individually transcribed and scored twenty percent of the data. The agreement rate of two raters' scoring was approximately 96%. After approximately 4% of discrepancies were discussed and fixed, the first rater scored the rest of the data.

6. Results

Table 4 indicates descriptive statistics for participants' performances on repetition of the five components in stimuli. The results showed that participants reproduced nouns most accurately while verb conjugations least accurately. A One-Way ANOVA was used to find particular syntactic elements that may be more difficult to reproduce than other elements. The results revealed significant differences among five elements, $F(4, 155) = 5.43, p < .001$. Multiple comparisons by Bonferroni revealed that significant differences were found between nouns and verb conjugations ($p = .002$), and nouns and inflectional morphemes ($p = .006$). To determine whether the location in a sentence affects participants' processing of a particular element, participants' performances on EI were illustrated according to the unit shown in Table 3 by sentence types. Figure 1 shows participants' performances on sentence type $a$. The dotted line with diamonds represents the average percentage of production irrespective of accuracy, and the solid line with triangles shows the average percentage of accurate repetition.

| Table 4. Descriptive statistics of all components reproduced accurately |
|-----------------|-------|-------|-------|
|                 | N     | Mean score | Std. Deviation | Std. Error |
| Nouns           | 32    | 43.11   | 10.41           | 1.84       |
| Particles       | 32    | 39.70   | 11.68           | 2.07       |
| Verb Choice     | 32    | 38.90   | 12.91           | 2.28       |
| Conjugation     | 32    | 31.17   | 13.48           | 2.38       |
| Inflectional Morpheme | 32  | 32.31   | 13.21           | 2.33       |
| Total           | 160   | 37.04   | 13.06           | 1.03       |
As mentioned in the previous section, the numbers on the X axis correspond to each element in a complex sentence in Table 3. In sentence type \(a\), the most recently learned Inflectional morpheme –tara is located on the 15\(^{th}\) position on the X axis. As the figure shows, the accuracy rate of repeating the tara-form is 9.4\%, which is the worst accuracy rate among all elements involved in this sentence type. The te-form is located at the 5\(^{th}\) and the 10\(^{th}\) positions. Unlike the tari-form, participants’ performances on the te-forms did not drop sharply. To examine whether there was a significant differences among learners’ accurate repetition of inflectional morphemes in this sentence type, a One-Way ANOVA was employed. The results indicate significant differences among inflectional morphemes, \(F(3, 124) = 15.04, p < .001\). Multiple comparisons by Bonferroni showed significant differences between the tara-form and all other inflectional morphemes. Learners reproduced the te-form in the first verb phrase (hereafter VP), the tef-form in the second VP, and the masu-form significantly better \((p < .001)\) than the tara-form respectively. The left circle of Figure 2 shows percentages of the forms that participants produced at the 15\(^{th}\) of sentence type \(a\). Other refers to grammatical forms that are not listed in this chart, and ? refers to ungrammatical forms. Participants did not produce anything 56\% of time when they heard the tara-form located at the 15\(^{th}\) position. The most frequently produced form that replaced the tara-form was the te-form. When participants heard -te, -te, -tara, -masu, there was a tendency of repeating -te, -te, -masu (omitting the -tara) or te, -te, -te, -masu. Participants produced the correct form only 2\% of time, and the number

![Figure 2. The forms that were produced at the position of -tara](image-url)
of participants who produced the correct form at least once was nine out of 32 participants.

Participants’ performance on sentence type b is shown in Figure 3. Similar to sentence type a, the worst accuracy rate was found when the *tara*-form was located in the 5th position. However, in this sentence type, the accuracy rate of the *tara*-form was 20%, which was approximately twice as better than that of the *tara*-form located at the 15th position. A One-Way ANOVA revealed that there were also significant differences among the accurate production of inflectional morphemes in this sentence type, $F(3, 124) = 6.38, p < .001$. Multiple comparisons revealed significant differences between the *tara*-form and the masu-form ($p < .001$), and between the *te*-form in the third VP and the masu-form ($p = .036$).

Figure 4 illustrates participants’ performance on sentence type c, $F(3, 124) = 19.65, p < .001$. Again, the worst accuracy rate was found at the *tara*-form which was located at the 10th position in this sentence; it was 5%. It is worse than the accuracy rate of the *tara*-form in sentence type a, which was 9.4% at the 15th position. Sentence type c exhibited a more salient serial order effect compared to sentence types a and b due to the worst repetition rate observed right in the middle of the sentence.

There were also significant differences among the accurate production of inflectional morphemes. Multiple comparisons found significant differences between the following inflectional morphemes: the *tara*-form and the *te*-form in the first VP, the *tara*-form and the *te*-form in the third VP ($p < .001$ respectively), and the *tara*-form and the masu-form ($p < .001$). Percentages of the forms learners produced when the *tara*-form was located in the 10th position are shown in the right circle of Figure 2. The distribution of the forms was similar to sentence type a. Learners most frequently skipped the verb in the *tara*-
form, which was 61% of time. When learners heard -te, -tara, -te, -masu, there was a tendency to repeat -te, -te, -masu (omitting the -tara) or te, -te, -te, -masu, and this pattern was also similar to sentence type a.

![Graph showing production and accuracy percentages](image)

**Figure 5. Serial order sentence type d [-te, -tari, -tari shimasu]**

Sentence type d includes the tari-forms, and participants’ performances on this sentence type are illustrated in Figure 5. In this sentence type, the worst accuracy rate was observed at the 15th position where the second tari-form was located. Production rate also dropped after the 15th position. The accuracy rate of the second tari-form was 12%. A One-Way ANOVA found significant differences among inflectional morphemes, $F(3, 123) = 5.316, p = .002$. Multiple comparisons indicated significant differences between the second tari-form at the 15th position and the te-form ($p = .002$), and between the second tari-form and the masu-form in the coordinating verb ($p = .012$). To identify what participants produced at the 15th position where they heard the second tari-form, all participants’ productions at the location were examined.

The left circle of Figure 6 indicates percentage of the forms participants produced when they heard the second -tari form in sentence type d. The results indicate that participants omitted the second -tari and the coordinating verb shimasu together 53% of time. Following the omission of these elements, -tari was replaced with -masu 20% of time. A typical example is shown below.

**Original stimulus:**

*Heya ni haitte denwa o kaketari konpuutaa o tsukattari shimasu.*

=(I) enter a room and then do such things as telephone, use a computer, etc.

**Learners’ repetition:**

*Heya ni haitte denwa o kaketari konpuutaa o tsukaimasu.*

Participants accurately reproduced the correct form 14% of time. The number of participants who produced the second tari-form accurately at least once was 14 out of 32 participants.

Sentence type e also includes the tari-forms, and Figure 7 illustrates the similar tendency found in sentence type d. That is, production sharply declined after the 15th position. In this sentence type, the accuracy rate of the second tari-form at the 15th position was 16.7%. Interestingly, the accuracy rate of the tara-form at the 5th position was 45.8%, and this percentage is more than twice as better than that of the tara-form in sentence type b, in which the tara-form was also located at the 5th position. A One-Way ANOVA indicates significant differences among inflectional morphemes, $F(3, 123) = 11.68, p < .001$. Significant differences were found between the following forms: the tara-form and the second tari-form in the third
VP (p < .001); the second tari-form and the masu-form in the coordinate verb (p = .001); the first tara-form and the second tari-form (p < .001); and the first tara-form and the masu-form in the coordinating verb (p = .018). The right circle of Figure 6 indicates percentage of the forms participants produced when they heard the second -tari form in sentence type e. The distribution is similar to that of sentence type d.

![Figure 6. The forms that were produced at the position of the second -tari form.](image)

Figure 6. The forms that were produced at the position of the second -tari form.

![Graph showing serial order sentence type e [-tara, -tari -tari shimasu]].](image)

7. Serial order sentence type e [-tara, -tari -tari shimasu]

Table 5. Percentages of accurately reproduced morphemes by sentence type

<table>
<thead>
<tr>
<th>Sentence types</th>
<th>1st morpheme</th>
<th>2nd morpheme</th>
<th>3rd morpheme</th>
<th>4th morpheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>type a [-te, -te, -tara, -masu]</td>
<td>-te 50.9</td>
<td>-te 37.5</td>
<td>-tara 9.4</td>
<td>-masu 38.8</td>
</tr>
<tr>
<td>type b [-tara, -te, -te, -masu]</td>
<td>-tara 20.0</td>
<td>-te 32.5</td>
<td>-te 28.8</td>
<td>-masu 45.0</td>
</tr>
<tr>
<td>type c [-te, -tara, -te, -masu]</td>
<td>-te 42.2</td>
<td>-tara 5.0</td>
<td>-te 28.1</td>
<td>-masu 37.5</td>
</tr>
<tr>
<td>type d [-te, -tari, -tari shimasu]</td>
<td>-te 32.8</td>
<td>-tari 26.0</td>
<td>-tari 12.0</td>
<td>shimasu 29.2</td>
</tr>
<tr>
<td>type e [-tara, -tari, -tari shimasu]</td>
<td>-tara 45.8</td>
<td>-tari 40.6</td>
<td>-tari 16.7</td>
<td>shimasu 22.4</td>
</tr>
</tbody>
</table>

This experiment revealed that multiple factors, such as the location and the length of exposure to particular syntactic items influenced L2 learners’ processing of complex sentences. In response to the first research question concerning syntactic elements that cause difficulties in processing sentences, this experiment found that verb conjugations and inflectional morphemes were main sources that cause difficulties for L2 learners when they heard complex sentences. When L2 learners were asked to repeat complex sentences, they reproduced nouns significantly better than verb conjugations and inflectional morphemes.
Table 5 represents accurately reproduced morphemes by sentence type, and the least accurately reproduced Inflectional morpheme was highlighted in bold. Among the three types of the target structures, the most recently-learned Inflectional morpheme -tara was the most difficult to process for L2 learners of this experiment when they heard sentence types a, b and c. In particular, when the tara-form was located in the sentence internal position as in sentence types b and c, accurate repetition of the form was particularly challenging for participants.

Regarding the second research question concerning learners' performances when they failed to process input accurately, this experiment found that unfamiliar items were typically either omitted or replaced by a more familiar item. Participants of this study frequently skipped the tara-form when it was located in a sentence internal position, or replaced it with the te-form, to which they were exposed much longer than the tara-form in class. However, the tara-form was not the most difficult morpheme in sentence type e. In this sentence type, the most difficult Inflectional morpheme to reproduce was the second tari-form. Learners frequently replaced the tari-form with a sentence final predicate -masu while omitting the coordinating verb "do" at the end of a sentence.

7. Discussion

The results of this study revealed that L2 learners' use of syntactic cue was limited so that their segmentation suffered when they encountered unfamiliar and low-salience items. The current study lends support to previous studies that found that inflectional morphemes create difficulties for L2 learners (Lardiere, 1998; Miyake & Friedman, 1998). Participants of the experiment have learned all lexical items and structures prior to the experiment during previous semesters, and they practiced how to use them in class. However, accurate processing of verbs included in complex sentences was particularly demanding for them. The results of the current study confirms the findings of previous studies that found L2 learned had difficulties in producing verb morphemes despite their explicit knowledge they had in class (R. Ellis et al., 2006; Kondo, 2004).

Learners' familiarity with items was one of the factors that influenced their processing in this experiment. The literature suggests that frequency of input has a great impact on language acquisition (N. Ellis, 2002, 2008; Ellis & Schmidt, 1997; Lieven & Tomasello, 2008). As participants of this experiment were exposed to the te-form since the second semester of the Japanese courses, it is reasonable to assume that they were exposed to the te-form many times in class, and were fully familiar with its function of describing events in a chronological order. In the current study, participants performed relatively well on nouns and particles, and this is probably due to the fact that all lexical items in the experiment were controlled so that participants were fully familiar with them. If learners were asked to reproduce sentences with a wider variety of nouns and particles with which they were unfamiliar, the results may be different. A second factor that may have affected participants' performance in this experiment was the serial order effect. Serial order effect indicates that the likelihood of recognizing a form increases when it is located at a sentence initial position. The tara-form at the 5th position of a complex sentence is more salient than that in the 10th and 15th position. Thus, learners were able to recognize it more at the 5th position despite the fact that they were not exposed to the tara-form as much as they were to the te-form. It is expected
that learners will be more susceptible to serial order effect if they are exposed to longer sentences, because a longer sentence possesses a larger number of elements in sentence-internal positions.

Another factor that might influence sentence processing is redundancy. The literature has shown that semantically redundant elements are less likely recognized. For instance, when a past event is described in English, an adverbial phrase usually provides temporal information; thus, learners would understand that an event occurred in the past without processing the English past tense marker -ed (N. Ellis, 2008). In case of the current study's stimuli including "-tari-tari shimasu" (do things such as...), the last "shimasu" does not represent any specific activity: It just coordinates two previously mentioned events. Thus, the lack of semantic value might affect learners' recognition of the tari-form and the coordinating verb "shimasu".

8. Future directions

EI was a useful method for the purpose of the current study, as the technique successfully elucidated the way learners processed complex sentences. However, it is important to remember that EI deals with highly controlled aural input, and it is not a free production task. Therefore, whether learners' performances on EI would predict their successful performance in a free production task, such as an interview, remains unclear. Another study is necessary to examine whether learners' ability to repeat input accurately contributes to their successful performance on a free production task. Apparently, there are other factors that may influence L2 segmentation which current study did not examine. Such factors include the influence of learners' L1 and the functions of inflectional morphemes. Future studies should examine these factors to better understand the nature of L2 segmentation issues.

The majority of participants in the current study had difficulties producing some structures during the experiment despite classroom instruction and practice opportunities, suggesting that their heavy dependence on explicit instruction. The current study suggests that learners should be given opportunities to practice sentence processing without explicit instruction. For instance, reconstruction of passages from aural input may facilitate learners' independence from explicit instruction. The current study offers evidence that L2 learners are less likely to recognize an unfamiliar inflectional morpheme in a sentence internal position and items that do not carry semantic information, such as "-tari shimasu". The Noticing Hypothesis (Schmidt, 1990) predicts that awareness plays a major role in second language acquisition. Under this hypothesis, instructions should direct learners' attention to important elements in input that may be otherwise overlooked, such as inflectional morphemes. Whether raising learners' attention to these low-salience elements may contribute to their successful segmentation and sentence processing needs to be investigated.

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日本語学習者による複文の解析と再生

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初中級の日本語学習者は、インタビューなど即時に文の産出を求められる場面では、既習の文型を用いて複文を構成するのが困難であることが報告されている（近藤2004等）。これには学習者にとって、接続助詞など文に結続性を与える要素は音声から把握しにくいことを示唆する。その理由としては、文の中央部分に位置する文法要素は記憶に残りにくいという現象（serial order effect）が考えられる。本研究では、学習者に複文を音声で聞き、できるだけ正確に再生させる誘導模倣の手法を用い、複文のどの部分が再生困難なのかを実証した。実験の結果、学習者にとって接続助詞は他の文法項目と比較し再生が困難であり、中でも学習期間が短く複文の中央付近に位置する接続助詞は特に再生が困難であることが明らかとなった。また、文全体の意味理解に直接影響を及ぼさない要素は、文末であっても正確に再生されにくい傾向も観察された。

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