

How the Difference in Modality Affects Language Production: A Syntactic Priming Experiment Using Spoken and Written Sentence Completion Tasks

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Abstract

The present study aims to investigate syntactic representation in the mental lexicon of Japanese EFL learners compared to that of L1 English speakers, focusing on the difference in modality. A syntactic priming experiment using spoken and written sentence completion tasks was carried out to examine whether the participants used the same sentence structure in completion tasks as prime sentences which appeared earlier. There were 17 L1 English speakers and 53 Japanese university students involved in the investigation. In the experiment, prime sentences including 40 experimental sentences using dative verbs and 40 filler sentences were presented both in spoken and written forms for the participants to repeat aloud, before completing a sentence fragment that followed either in a spoken or a written form. It was found that L1 English speakers were affected by syntactic priming in spoken production significantly more than in written production, which is in line with the idea that priming effects decay with time. In contrast, there was no significant difference in modality in the case of Japanese EFL learners, with upper level students showing more similar tendency to L1 English speakers than medium and lower level students. These results are discussed from the viewpoints of syntactic representation in the mental lexicon and automaticity in language processing by Japanese EFL learners.

Key words: language production, syntactic priming, sentence completion tasks, modality

Introduction

It is essential to acquire well-balanced comprehension and production skills both in spoken and written languages for smooth interpersonal communications. Japanese EFL learners are, however, said to be weaker in language production, especially speaking, than language comprehension in general. Therefore, the present study focuses on language production and compares the speech process of Japanese EFL learners - an area in which research has been very limited so far - with the writing process in order to help provide a basis for an effective speaking pedagogy.

Processes on the right represent listening and those on the left represent speaking in Levelt's spoken language processing model (1993) as shown in Figure 1.

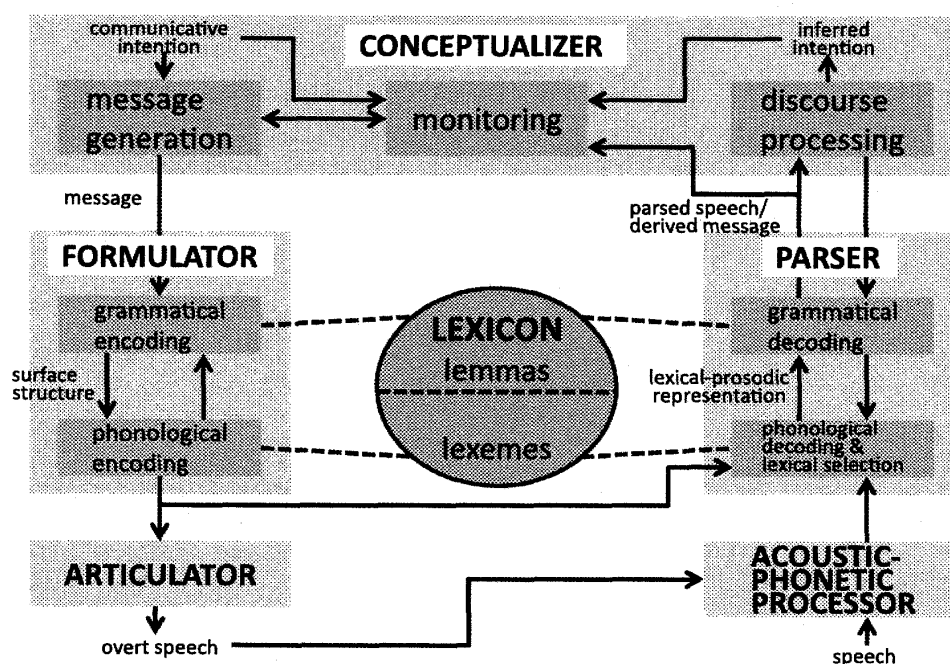


Figure 1. Schematic representation of the processing components involved in spoken language use. Reprinted from Levelt (1993, p. 2).

We first think about what we are going to say in the *conceptualizer*. Then, in the *formulator*, grammatical encoding accesses lemma information stored in one's mental lexicon and builds syntax, while phonological encoding accesses lexeme information to retrieve a phonetic or articulatory plan for each lemma. Finally, the *articulator* retrieves successive chunks of internal speech and unfolds them for execution (Levelt, 1989, 1999). Although this speech process is automatic and simultaneously processed in the case of L1 speakers, it is a demanding one for L2 learners and trade-off effects are often observed between fluency, complexity, and accuracy of the speech (Morishita, 2010, p. 21).

In order to investigate Japanese EFL learners' speaking ability from the perspective of productive vocabulary, Morishita (2008) analyzed their utterances in open question tasks compared to L1 English speakers. It was found that although both of them used similar vocabulary, Japanese EFL learners' average scores of tokens were less than half those of L1 English speakers. This might mean that Japanese EFL learners, even if they have basic vocabulary knowledge, could not combine words quickly and accurately to create proper sentences, possibly due to a lack of grammatical knowledge for syntactic processing. The results suggest that research on sentence-level production should be implemented in order to investigate their speaking ability in more detail.

Pickering and Branigan (1998) proposed a partial model of the representation of syntactic information, which is considered to be stored in the lemma stratum of one's mental lexicon, as shown in Figure 2.

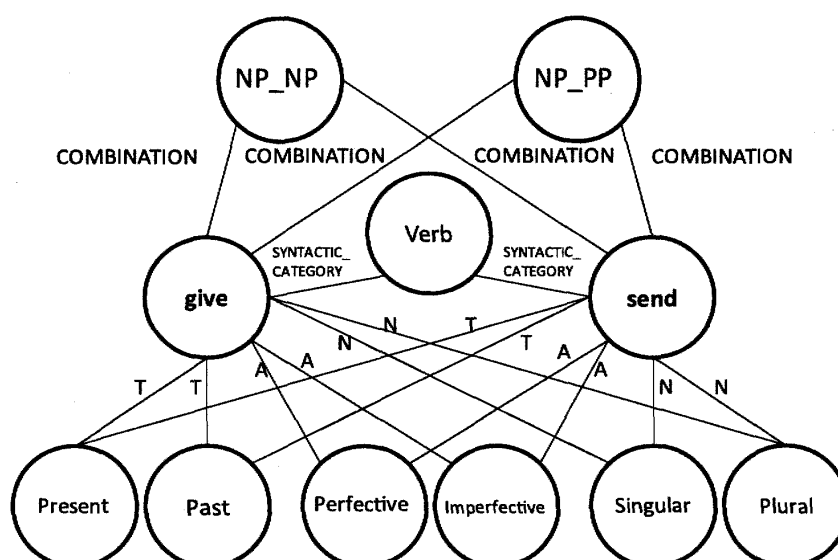


Figure 2. A partial model of the representation of syntactic information associated with verbs in the production lexicon. The labels T, A, and N refer to tense, aspect, and number, respectively. Reprinted from Pickering & Branigan (1998, p. 635).

There are said to be three types of syntactic information: (a) *category* information, which encodes the syntactic category of a word (e.g., noun, verb, adjective, etc.); (b) *featural* information, which is concerned with tense, aspect, number, etc.; and (c) *combinatorial* information, which specifies the way in which a word can combine with other linguistic units to form possible expressions of the language (i.e., syntactic structure) (Pickering & Branigan, 1998, p. 633).

It is believed that the use of one syntactic structure in one sentence increases the likelihood of the use of the same structure in another sentence during language production. Bock (1986) termed this phenomenon *syntactic priming*, which can be found in the following examples of responses in dialogue (Levelt & Kelter, 1982). The forms of the questions (1)a and (1)b appear to directly affect the forms of the responses (2)a and (2)b, respectively.

- (1)a. At what time does your shop close?
- (1)b. What time does your shop close?
- (2)a. At five o'clock.
- (2)b. Five o'clock. (Levelt & Kelter, 1982, p. 78)

Pickering and Branigan (1998) conducted a psycholinguistic experiment using sentence completion tasks to elicit written production data of L1 English speakers, hypothesizing that syntactic priming can be explained in terms of activation at the lemma stratum in Figure 2. They found that the participants tended to use the same structure for the target sentence as the prime sentence (i.e., either a prepositional object [PO] or a double object [DO] structure of the sentence using a dative verb) whether the target sentence had the same verb as well as the same internal structure of the verb (i.e., tense, aspect, and number) as the prime sentence

or not.

Although it was found that Japanese EFL learners, regardless of their proficiency levels, have syntactic representation in the mental lexicon similar to that of L1 English speakers in terms of written production (Morishita, Sato, & Yokokawa, 2010), it is not clear if the same is true of spoken production. Cleland and Pickering (2006) found that syntactic representation is shared between spoken and written production in the case of L1 English speakers based on the experimental method of Pickering and Branigan (1998). Although Pickering and Branigan (1999) suggest that syntactic priming might be effective for those less practiced in language use (p. 141), it should be examined between L1 and EFL speakers under the same experimental environment. Therefore, the present study aims to investigate the difference in syntactic representation, which plays a crucial role in language production, between spoken and written production by L1 English speakers and Japanese EFL learners in order to eventually obtain pedagogical implications for Japanese EFL learners.

Research Questions

The present study addresses the following research questions:

RQ 1: How does the difference in modality of target completions affect syntactic priming by L1 English speakers and Japanese EFL learners?

RQ 2: How does the difference in structures of prime sentences affect syntactic priming by L1 English speakers and Japanese EFL learners?

RQ 3: How does the difference in verbs between the prime sentence and the target fragment affect syntactic priming by L1 English speakers and Japanese EFL learners?

Method

Participants

A total of 17 L1 English speakers as well as 53 Japanese undergraduate and graduate students participated in the experiment. The latter were divided into three levels of English proficiency according to the scores of the Quick placement test (Oxford University Press, 2004). The numbers, score ranges (full score = 60), mean scores and SDs, as well as the level descriptions of the Common European Framework of Reference for Languages (Council of Europe, 2001) of each proficiency group are shown in Table 1.

Table 1
Proficiency levels of Japanese EFL learners

Levels	#	Score ranges	Mean and SD	CEFR level descriptions
Upper	17	40-58	47.4 (5.91)	Upper intermediate or above (B2, C1, C2)
Medium	19	30-38	34.5 (3.44)	Lower intermediate (B1)
Lower	17	12-28	22.0 (4.62)	Elementary or below (A1, A2)

Tasks

Twenty sets of prime sentences using PO and DO structures of seven dative verbs (*show, give, tell, send, lend, sell, and buy*) were prepared based on Morishita et al. (2010), with the

following modifications according to the results of a pilot study (Morishita, 2011): (a) the number of syllables in all experimental sentences were between 10 and 13 in order to conform the processability of each sentence; (b) all of the words in the experimental sentences were reconsidered so that their audio familiarity rates were 5.0 or above based on the audio version of the vocabulary familiarity list (Yokokawa, 2009) in order to conform the processability of each word; and (c) the noun subjects of the experimental fragments were not related to particular jobs or roles, which might make the participants too sensitive to the meaning (e.g., to take time to look for a particular word). Each set consisted of a prime sentence and a target fragment as follows (more detail in Appendix):

- (3)a. The driver showed the car to the policeman.
- (3)b. The driver showed the policeman the car.
- (3)c. The driver gave the car to the policeman.
- (3)d. The driver gave the policeman the car.

(4) The man showed....

The first sentence (3)a-d was the prime and the second fragment (4) was the target. Each prime sentence and target fragment contained a subject followed by a verb that could appear with the PO or the DO structure. The prime sentence also contained either a direct object and a prepositional object or an indirect object and a direct object. Each subject noun phrase and object noun phrase consisted of a definite article and a singular noun. Each prime sentence was either a PO (e.g., [3]a and [3]c) or a DO (e.g., [3]b and [3]d) sentence. The verbs in the prime sentences were the same as the verbs in the target fragments in (3)a and (3)b, and they were different in (3)c and (3)d.

The experimental items were placed into four lists (A, B, C, and D). Each list consisted of five items from each condition with one version of each item appearing in each list. Twenty filler sentences unrelated to the target structures were also prepared to reduce the likelihood that the participants recognized the target structures. Each test consisted of two out of four lists above, one for spoken production and the other for written production, and 20 filler sentences were repeated for spoken and written production. Each test was half-randomized and a total of eight tests (Test A-1 to Test D-2) consisting of 80 sets of a sentence and a fragment were finally created on SuperLab® 4.0.

Procedure

The participants were tested one on one and were informed that the purpose of the experiment was to determine what kind of sentences people produce. They were seated in front of the computer screen in a quiet room, wore a headset, and were given a set of written instructions. After four practice trials (two spoken and written sentence completions each), the main trials started. Each trial had the following structure:

1. A message "Ready?" is indicated on the computer screen at the beginning of each trial and the participants press the Enter key when they are ready to start.

2. A prime sentence (e.g., "The driver showed the car to the policeman") is simultaneously presented both in spoken and written forms. The participants repeat the sentence aloud and press the **Enter** key.
3. A prompt, either "Speak (indicating that a spoken response is required)" or "Write (indicating that a written response is required)," appears on the screen and automatically disappears in two seconds.
4. A target fragment (e.g., "The man showed....") is simultaneously presented both in spoken and written forms. The participants complete it either in a spoken or a written form (as directed) as quickly as possible with whatever came to mind first.
5. After completing the sentence, the participants press the **Enter** key to go to the next trial.

Spoken responses were IC recorded and then transcribed. Written responses were written down in a paper folder with a total of 40 lines provided for the completion of each sentence. The experiment was self-paced and lasted approximately an hour, on average, including the time for a break and a post-experiment questionnaire.

Scoring

The participants completed 40 experimental fragments, five in each of the eight priming conditions: spoken / written production, PO / DO prime sentences, and the same / different verbs. For each completed experimental fragment, the response given by the participant was classified as PO, DO, or "Other." Target completions were scored as POs if the verb given in the fragment was immediately followed by a noun phrase which behaved as the patient / theme and then by a prepositional phrase beginning with *to* (or *for*) which behaved as the beneficiary. Target completions were scored as DOs if the verb was immediately followed by a noun phrase which behaved as the beneficiary and then by a noun phrase which behaved as the patient / theme. All other target completions were scored as "Other."

Results

The responses (PO / DO target completions and "Other") were divided into "Priming" (i.e., target completions using the same structures as the prime sentences), "Alternate" (i.e., DO target completions for PO prime sentences or PO target completions for DO prime sentences), and "Other" groups, whose rates were then analyzed in a two-way analysis of variance (ANOVA) with proficiency levels as a between-participants factor and the difference in modality (spoken / written production) as a within-participants factor (significant level = .05). The ANOVA was also separately conducted for sentence structures (PO / DO prime sentences) as well as for verbs (same / different between the prime sentence and the target fragment) as within-participants factors. Tukey's HSD post hoc test was used for multiple comparisons.

Mean Proportions of Responses based on Modality of Target Completions

Table 2 shows the mean proportions of responses based on modality of target completions.

Table 2

Mean proportions of responses (%) and SDs based on modality

Speaking	Priming	Alternate	Other
L1	47.3 (0.17)	27.1 (0.12)	25.6 (0.21)
Upper	48.0 (0.23)	28.8 (0.14)	23.2 (0.20)
Medium	39.7 (0.23)	24.2 (0.12)	36.1 (0.24)
Lower	23.2 (0.17)	15.3 (0.11)	61.5 (0.23)
Writing	Priming	Alternate	Other
L1	37.9 (0.21)	27.7 (0.16)	34.4 (0.24)
Upper	43.5 (0.15)	32.1 (0.13)	24.4 (0.20)
Medium	41.3 (0.17)	24.7 (0.10)	34.0 (0.19)
Lower	24.7 (0.13)	18.8 (0.12)	56.5 (0.19)

In the case of “Priming,” the ANOVA obtained significant main effects for proficiency levels, $F(3, 66) = 5.27$, $p < .01$, $\eta_2 = .18$, and for modality, $F(1, 66) = 4.06$, $p < .05$, $\eta_2 = .00$. Two-factor interaction of proficiency levels and modality was also significant, $F(3, 66) = 3.90$, $p < .05$, $\eta_2 = .01$. The result of multiple comparisons for the interaction of proficiency levels and modality showed a significant difference between speaking and writing of L1 English speakers ($p < .05$).

In the case of “Alternate,” the ANOVA obtained a significant main effect for proficiency levels, $F(3, 66) = 4.42$, $p < .01$, $\eta_2 = .14$. Two-factor interaction was not significant.

In the case of “Other,” the ANOVA obtained a significant main effect for proficiency levels, $F(3, 66) = 9.48$, $p < .001$, $\eta_2 = .28$. Two-factor interaction of proficiency levels and modality was also significant, $F(3, 66) = 5.17$, $p < .01$, $\eta_2 = .01$. The result of multiple comparisons for the interaction of proficiency levels and modality showed significant differences between speaking and writing of L1 English speakers ($p < .05$) as well as between speaking of L1 English speakers and lower level students ($p < .05$), that of upper and lower level students ($p < .01$), and writing of upper and lower level students ($p < .05$).

Mean Proportions of Responses based on PO / DO Prime Sentences

Table 3 shows the mean proportions of responses based on PO / DO prime sentences.

Table 3

Mean proportions of responses (%) and SDs based on PO / DO prime sentences

PO	Priming	Alternate	Other
L1	40.0 (0.27)	30.6 (0.22)	29.4 (0.21)
Upper	59.7 (0.25)	18.2 (0.16)	22.1 (0.21)
Medium	58.4 (0.28)	7.1 (0.08)	34.5 (0.25)
Lower	23.5 (0.22)	16.2 (0.19)	60.3 (0.20)
DO	Priming	Alternate	Other
L1	45.3 (0.23)	24.1 (0.21)	30.6 (0.24)
Upper	31.8 (0.22)	42.6 (0.21)	25.6 (0.20)
Medium	22.6 (0.19)	41.9 (0.23)	35.5 (0.18)
Lower	24.4 (0.23)	17.9 (0.17)	57.7 (0.21)

In the case of “Priming,” the ANOVA obtained significant main effects for proficiency levels, $F(3, 66) = 5.27, p < .01, \eta_2 = .09$, and for PO / DO prime sentences, $F(1, 66) = 13.80, p < .001, \eta_2 = .07$. Two-factor interaction of proficiency levels and PO / DO prime sentences was also significant, $F(3, 66) = 7.11, p < .001, \eta_2 = .11$. The result of multiple comparisons for the interaction of proficiency levels and PO / DO prime sentences showed significant differences between PO / DO prime sentences of both upper level students ($p < .05$) and medium level students ($p < .001$), and PO prime sentences between upper and lower level students ($p < .01$) as well as medium and lower level students ($p < .01$).

In the case of “Alternate,” the ANOVA obtained significant main effects for proficiency levels, $F(3, 66) = 4.42, p < .01, \eta_2 = .05$, and for PO / DO prime sentences, $F(1, 66) = 14.25, p < .001, \eta_2 = .10$. Two-factor interaction of proficiency levels and PO / DO prime sentences was also significant, $F(3, 66) = 7.23, p < .001, \eta_2 = .15$. The result of multiple comparisons for the interaction of proficiency levels and PO / DO prime sentences showed significant differences between PO / DO prime sentences of both upper level students ($p < .05$) and medium level students ($p < .001$), PO prime sentences between L1 English speakers and medium level students ($p < .01$), and DO prime sentences between L1 English speakers and upper level students ($p < .05$), L1 English speakers and medium level students ($p < .05$), upper and lower level students ($p < .001$) as well as medium and lower level students ($p < .001$).

In the case of “Other,” the ANOVA obtained a significant main effect for proficiency levels, $F(3, 66) = 9.48, p < .001, \eta_2 = .28$. Two-factor interaction was not significant.

Mean Proportions of Responses based on the Same / Different Verbs

Table 4 shows the mean proportions of responses based on the difference in verbs between prime sentences and target fragments.

Table 4

Mean proportions of responses (%) and SDs based on the same / different verbs

Same	Priming	Alternate	Other
L1	44.4 (0.23)	25.3 (0.13)	30.3 (0.23)
Upper	49.1 (0.19)	28.2 (0.14)	22.7 (0.19)
Medium	43.2 (0.22)	22.6 (0.11)	34.2 (0.21)
Lower	25.3 (0.20)	14.1 (0.09)	60.6 (0.22)
Different	Priming	Alternate	Other
L1	40.9 (0.16)	29.4 (0.15)	29.7 (0.23)
Upper	42.4 (0.19)	32.6 (0.15)	25.0 (0.23)
Medium	37.9 (0.18)	26.3 (0.13)	35.8 (0.21)
Lower	22.6 (0.13)	20.0 (0.13)	57.4 (0.21)

In the case of “Priming,” the ANOVA obtained significant main effects for proficiency levels, $F(3, 66) = 5.27$, $p < .01$, $\eta^2 = .17$, and for the same / different verbs, $F(1, 66) = 7.45$, $p < .01$, $\eta^2 = .01$. Two-factor interaction was not significant. The result of multiple comparisons for proficiency levels showed significant differences between lower level students and other proficiency groups - i.e., L1 English speakers ($p < .05$), upper level students ($p < .01$) as well as medium level students ($p < .05$), which were also found in the case of the difference in modality (see Table 2) and the difference in PO / DO prime sentences (see Table 3).

In the case of “Alternate,” the ANOVA obtained a significant main effect for proficiency levels, $F(3, 66) = 4.42$, $p < .01$, $\eta^2 = .13$. Two-factor interaction was not significant.

In the case of “Other,” the ANOVA obtained a significant main effect for proficiency levels, $F(3, 66) = 9.48$, $p < .001$, $\eta^2 = .28$. Two-factor interaction was not significant.

“Other” Responses

It was found that the number of “Other” responses produced by lower level students was very large mainly due to a lack of basic grammatical knowledge. In contrast, there is little data of “Other” responses produced by L1 English speakers in previous L1 research, which only shows that they produced approximately the same proportions of three types of responses: “Priming,” “Alternate,” and “Other” (e.g., Pickering & Branigan, 1998).

Therefore, “Other” responses were analyzed in the present study to see the difference between each proficiency group. They were divided into (syntactically) correct and incorrect responses, each of which was further divided into three types. Hence correct responses consisted of (a) a sentence with only one object word (e.g., *give something*), (b) a sentence with reversed order of the patient and the beneficiary (e.g., *give something someone*, *give someone to something*), and (c) a correct sentence using other structures than PO / DO sentence structures (e.g., *give up*), while incorrect responses consisted of (d) an incorrect argument structure (e.g., *give someone*, *give to someone*, *give to something*), (e) an incorrect sentence using other structures than PO / DO sentence structures, and (f) no response.

The mean numbers of above six types of “Other” responses per participant were compared between each group as shown in Table 5.

Table 5

Mean numbers of "Other" responses based on six types

	Speaking						Writing					
	a	b	c	d	e	f	a	b	c	d	e	f
L1	4.1	0.0	1.0	0.0	0.0	0.0	5.2	0.0	1.5	0.0	0.2	0.0
Upper	3.9	0.2	0.3	0.0	0.3	0.0	4.2	0.3	0.1	0.1	0.2	0.0
Medium	5.1	0.4	0.5	0.1	0.8	0.4	4.9	0.6	0.5	0.1	0.7	0.1
Lower	9.7	0.8	0.1	0.5	0.9	0.4	9.1	0.9	0.1	0.4	0.7	0.1

Contrary to the experimenter's expectations, few (semantically and syntactically) incorrect responses (i.e., [b], [d], and [e]) were produced by each group, with lower level students producing the most and L1 English speakers producing the least. The number of (a), sentences with only one (correct) object word, was approximately four to five (out of 20) in the case of L1 English speakers as well as upper and medium level students, while with lower level students it occurred in almost half of all their responses, both in the case of speaking and writing. The number of (c) was somewhat larger in the case of L1 English speakers since they produced a greater variety of sentences, mostly using phrasal verbs, than other groups.

Discussion

This section discusses the findings of the present study and attempts to answer the three research questions presented in Section 2.1.

RQ 1: How does the difference in modality of target completions affect syntactic priming by L1 English speakers and Japanese EFL learners?

Overall, "Priming" rates were higher than "Alternate" rates, meaning that priming effects could be seen both in L1 English speakers and Japanese EFL learners. L1 English speakers were significantly more affected by syntactic priming in the case of spoken production than written production, while Japanese EFL learners were not affected by the difference in modality.

A possible explanation is that since written production is much more time-consuming than spoken production, if priming were to decay with time, there should be more decay in written production than in spoken production (Hartsuiker, Bernolet, Schoonbaert, Speybroeck, & Vanderelst, 2008, p. 233), leading to the L1 English speakers' increased priming rates in the case of spoken production. Upper level students tended to be more affected by syntactic priming in the case of spoken production than written production compared to medium and lower level students, showing relatively similar characteristics to L1 English speakers. In contrast, medium and lower level students might have responded at the same speed in cases of both spoken and written production, showing little difference in priming rates. The results indicate that syntactic information might not be fully represented in their mental lexicon or cannot be utilized effectively in the speech process. These findings imply that Japanese EFL learners, especially medium and lower level students, need more spoken input / output practice in order to increase their automaticity in language processing. It is essential, however, to take reaction time into account in future experiments employing spoken

responses in order to obtain as reliable data as possible.

Another possibility is that re-reading (repeating aloud) activated phonological representations and hence syntactic information associated with spoken language processing (Cleland & Pickering, 2006, p. 192) only in the case of L1 English speakers. It is also consistent with the motor theory, where people process spoken language based on the physical memory of pronunciation (Liberman, Cooper, Shankweiler, & Studdert-Kennedy, 1967).

The results of the questionnaire conducted at the end of the experiment show that a majority of the participants felt that spoken production was more difficult than written production because they felt pressured for time and/or could not review what they had produced in speaking, which was not the case with writing. However, the fact that Japanese EFL learners were primed both in spoken and written production to an equal degree might mean that syntactic representation in their mental lexicon is shared between spoken and written production. This points to the possibility of learning speaking effectively through writing (e.g., writing training for improving speaking accuracy) and vice versa (e.g., speaking training for improving writing fluency), producing a synergy effect, in the context of sentence-level production.

In addition, it was found that upper and medium level students produced relatively similar types of “Other” responses to those of L1 English speakers, while lower level students tended to give minimal responses rather than take the risk of making errors, showing their lack of practice in producing sentences both in spoken and written forms.

RQ 2: How does the difference in structures of prime sentences affect syntactic priming by L1 English speakers and Japanese EFL learners?

Upper and medium level students had significantly higher priming rates in the case of PO prime sentences than DO prime sentences. Considering that the British component of the International Corpus of English (ICE-GB) shows that PO sentences are numerically more common in written English than spoken English (Gries, 2005), it can be said that Japanese EFL learners were generally more exposed to PO sentences in written English in the classroom and affected by them in cases of both spoken and written production. Another possible explanation is that since infrequent structures tend to display stronger priming effects than more frequent structures (Ferreira, 2003), the former (i.e., PO sentences) were produced more than the latter (i.e., DO sentences) in the present study. Ferreira and Bock (2006) point out that although the possibility that learning occurs every time a sentence is processed raises the concern that syntactic knowledge could become crystallised and inflexible, especially in light of baseline differences between structures, the inverse-preference effect counteracts any such tendency (p. 1018).

In contrast, L1 English speakers and lower level students were affected by both sentence structures almost equally. However, L1 English speakers produced both PO and DO sentence structures as well as “Other” responses in a balanced manner, while priming rates of lower level students were way too low to observe any difference in sentence structures, which means that they do not share a similar syntactic representation in their mental lexicon. Another important point is that even if the participants quit producing a PO sentence in the

middle, it does not lead to an incorrect response (e.g., *give something*), while if they quit producing a DO sentence in the middle, it may lead to an incorrect response (e.g., *give someone*). Considering that lower level students produced a limited number of incorrect responses, it is possible that they tried in vain to produce PO sentences, unlike the case of upper and medium level students.

Furthermore, upper level students produced more PO / DO sentences, whether they were primed or not, and fewer “Other” responses than other proficiency groups, indicating that they used both structures more freely or stuck to their existing stylistic preferences. However, since verbs that are used in PO / DO sentence structures often have a clear bias towards being used in one structure or the other (Gries, 2005), which structures are originally preferred by each verb should also be examined. McDonough and Trofimovich (2009) point out that researchers can be more confident that priming is not due to a speaker’s pre-existing tendency to associate certain verbs with particular syntactic structures by carefully considering any distributional biases associated with individual lexical items (p. 135).

RQ 3: How does the difference in verbs between the prime sentence and the target fragment affect syntactic priming by L1 English speakers and Japanese EFL learners?

Although the participants were affected by syntactic priming both when the verbs used in the prime sentence and the target fragment were the same and when they were different, priming rates were higher in the case of the former. This result is consistent with previous L1 and EFL research (e.g., Cleland & Pickering, 2006; Morishita et al., 2010; Pickering & Branigan, 1998), indicating that although combinatorial information is shared between verbs, the link between a verb and a combinatorial node can itself be primed when the same verb is used in the prime sentence and the target fragment, regardless of modality. As an alternative interpretation, this may possibly be because the repeated verb acts as a retrieval cue, so that participants can use explicit memory of the prime sentence’s structure (Hartsuiker et al., 2008, p. 233).

Concluding Remarks and Future Research

The results of the present study replicate the finding of Morishita et al. (2010) which concludes that Japanese EFL learners have syntactic representation at the lemma stratum of their mental lexicon, as in the case of L1 English speakers (see Figure 2), and additionally show that this is also true of spoken production. Upper and medium level students were somewhat similar to L1 English speakers in terms of the tendency of syntactic priming, showing their sensitivity to syntactic structures and/or the use of the previously experienced sentence structure in a strategic way (i.e., in order to reduce the cognitive load of making a sentence from scratch). In contrast, lower level students were significantly less affected by syntactic priming, mainly because the grammatical information is not fully represented in their lemma stratum.

In addition to the above implications, several questions remain. First, the experiment was self-paced with no time restriction; therefore, some participants, especially lower level students, took much more time than others to complete the task. Since it may have affected the results, time-control should be taken into account in future research. Second, some

participants said that it was hard for them to pay enough attention to and remember the prompt “Speak” or “Write,” which appeared between the prime sentence and the target fragment and automatically disappeared in two seconds. Since this might have imposed an unnecessary load on their working memory, these prompts should have been presented along with the target fragments.

Furthermore, the results of L1 English speakers, where they were significantly more affected by syntactic priming in the case of spoken production than written production, seem inconsistent with those of Cleland and Pickering (2006), which conclude that there is no significant difference between spoken and written production, sharing the same syntactic representation. This could partly be because the test items and procedure of the present study were simplified for Japanese EFL learners and greatly different from Cleland and Pickering (2006), which was intended for L1 English speakers, in the following respects: First, the participants in Cleland and Pickering (2006) completed both prime fragments, which tended to provoke either PO / DO sentences, as well as target fragments, where they tended not to regard prime fragments as an example of target fragments, leading to more unconscious (implicit) responses. In contrast, the participants in the present study only completed the target fragments after repeating the prime sentences aloud. According to the post-experiment questionnaire, in fact, quite a few participants including L1 English speakers tended to regard prime sentences as an example of target fragments and tried or tried not to imitate prime sentences. Second, the number of fillers was three times as many as that of experimental items in Cleland and Pickering (2006), while they were the same in number in the present study, where a limited number of fillers caused the participants to complete experimental fragments explicitly rather than implicitly. Third, according to previous L1 research, speakers are less likely to use primed structures when messages are more complex, counter to the expectation that momentarily easier structures are more likely to be deployed (Ferreira & Bock, 2006; Szmrecsanyi, 2005). Therefore, simplified vocabulary and sentences in the present study might have increased priming rates of L1 English speakers in the case of spoken sentence completion.

Branigan, Pickering, and Cleland (1999) found that processing even one intervening neutral sentence causes syntactic priming to diminish with written production, while Branigan, Pickering, Stewart, and McLean (2000) showed that syntactic priming is robust over longer intervals under similar circumstances with spoken production (as cited in Ferreira & Bock, 2006, p. 1024). Since a full integration of speaking and writing models with the mechanisms of typical language production should be a high priority for the field (Alario, Costa, Ferreira, & Pickering, 2006, p. 784), there is a need for further research on the difference in modality from different perspectives.

Although the initial question of L2 research on syntactic representation was whether syntactic priming occurs in language production, current research has been investigating whether syntactic priming facilitates L2 development, and in most cases, the experimenters have found evidence for this. Therefore, it is imperative to also investigate whether syntactic priming facilitates EFL development as in the case of L2. Although upper and medium level students were greatly affected by syntactic priming in the present study, it was not true of lower level students. This means that there is the possibility for lower level students to

develop language production through the tasks like those used in the present study, where repeated exposure might incorporate such factors as imitation and practice, the primary processes in language development (Lightbown & Spada, 2006, p. 10). Therefore, future research that actually investigates development in language production through those tasks, where lower level students increase the overall availability of sentence structures, is definitely needed.

Furthermore, according to the alignment theory (Pickering & Garrod, 2004), interlocutors reach a mutual understanding of a situation by aligning their representations at all linguistic levels. This implies that the function of the ubiquitous repetition in dialogue is a convergence on the same expressions to refer to the same states of affairs (as cited in Hartsuiker et al., 2008, p. 234). Since the final goal of language production is to create sentences for more practical use in spontaneous communication, syntactic priming in dialogue should also be investigated in future research using Japanese EFL learners.

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Appendix: Experimental Items

- 1a. The driver showed the car to the policeman. The man showed....
- 1b. The driver showed the policeman the car. The man showed....
- 1c. The driver gave the car to the policeman. The man showed....
- 1d. The driver gave the policeman the car. The man showed....
- 2a. The secretary told the news to the businessman. The girl told....
- 2b. The secretary told the businessman the news. The girl told....
- 2c. The secretary sent the news to the businessman. The girl told....
- 2d. The secretary sent the businessman the news. The girl told....
- 3a. The captain gave the lifejacket to the passenger. The boy gave....
- 3b. The captain gave the passenger the lifejacket. The boy gave....
- 3c. The captain lent the lifejacket to the passenger. The boy gave....
- 3d. The captain lent the passenger the lifejacket. The boy gave....
- 4a. The artist sold the painting to the customer. The woman sold....
- 4b. The artist sold the customer the painting. The woman sold....
- 4c. The artist gave the painting to the customer. The woman sold....
- 4d. The artist gave the customer the painting. The woman sold....
- 5a. The student sent the report to the teacher. The man sent....
- 5b. The student sent the teacher the report. The man sent....
- 5c. The student showed the report to the teacher. The man sent....
- 5d. The student showed the teacher the report. The man sent....
- 6a. The mother gave the food to the baby. The girl gave....
- 6b. The mother gave the baby the food. The girl gave....
- 6c. The mother bought the food for the baby. The girl gave....
- 6d. The mother bought the baby the food. The girl gave....
- 7a. The assistant bought the ticket for the fan. The boy bought....
- 7b. The assistant bought the fan the ticket. The boy bought....
- 7c. The assistant sold the ticket to the fan. The boy bought....
- 7d. The assistant sold the fan the ticket. The boy bought....
- 8a. The designer sold the jacket to the customer. The woman sold....
- 8b. The designer sold the customer the jacket. The woman sold....
- 8c. The designer showed the jacket to the customer. The woman sold....
- 8d. The designer showed the customer the jacket. The woman sold....
- 9a. The child showed the magazine to the friend. The girl showed....
- 9b. The child showed the friend the magazine. The girl showed....
- 9c. The child gave the magazine to the friend. The girl showed....
- 9d. The child gave the friend the magazine. The girl showed....
- 10a. The grandmother bought the present for the girl. The man bought....
- 10b. The grandmother bought the girl the present. The man bought....
- 10c. The grandmother sent the present to the girl. The man bought....
- 10d. The grandmother sent the girl the present. The man bought....

- 11a. The woman lent the bike to the neighbor. The boy lent....
- 11b. The woman lent the neighbor the bike. The boy lent....
- 11c. The woman sold the bike to the neighbor. The boy lent....
- 11d. The woman sold the neighbor the bike. The boy lent....
- 12a. The traveler lent the picture to the boy. The woman lent....
- 12b. The traveler lent the boy the picture. The woman lent....
- 12c. The traveler bought the picture for the boy. The woman lent....
- 12d. The traveler bought the boy the picture. The woman lent....
- 13a. The assistant sold the dress to the customer. The man sold....
- 13b. The assistant sold the customer the dress. The man sold....
- 13c. The assistant lent the dress to the customer. The man sold....
- 13d. The assistant lent the customer the dress. The man sold....
- 14a. The secretary sent the letter to the chief. The girl sent....
- 14b. The secretary sent the chief the letter. The girl sent....
- 14c. The secretary gave the letter to the chief. The girl sent....
- 14d. The secretary gave the chief the letter. The girl sent....
- 15a. The lawyer told the news to the woman. The boy told....
- 15b. The lawyer told the woman the news. The boy told....
- 15c. The lawyer sent the news to the woman. The boy told....
- 15d. The lawyer sent the woman the news. The boy told....
- 16a. The nurse showed the flower to the patient. The woman showed....
- 16b. The nurse showed the patient the flower. The woman showed....
- 16c. The nurse bought the flower for the patient. The woman showed....
- 16d. The nurse bought the patient the flower. The woman showed....
- 17a. The teacher gave the book to the student. The man gave....
- 17b. The teacher gave the student the book. The man gave....
- 17c. The teacher sold the book to the student. The man gave....
- 17d. The teacher sold the student the book. The man gave....
- 18a. The student lent the money to the boyfriend. The girl lent....
- 18b. The student lent the boyfriend the money. The girl lent....
- 18c. The student showed the money to the boyfriend. The girl lent....
- 18d. The student showed the boyfriend the money. The girl lent....
- 19a. The manager bought the book for the employee. The woman bought....
- 19b. The manager bought the employee the book. The woman bought....
- 19c. The manager lent the book to the employee. The woman bought....
- 19d. The manager lent the employee the book. The woman bought....
- 20a. The customer sent the letter to the engineer. The boy sent....
- 20b. The customer sent the engineer the letter. The boy sent....
- 20c. The customer showed the letter to the engineer. The boy sent....
- 20d. The customer showed the engineer the letter. The boy sent....