The Effects of Lexical Processing and Proficiency on Syntactic Priming During Sentence Production by Japanese Learners of English

Eri NAKAGAWA  
Graduate School of Intercultural Studies, Kobe University  
Miwa MORISHITA  
Kobe Gakuin University  
Hirokazu YOKOKAWA  
Kobe University

Abstract

The present study aims to examine how the lexical retrieval process affects oral sentence production of second language (L2) learners through a syntactic priming experiment. Forty six Japanese EFL learners participated in a picture description task. The participants were divided into four proficiency groups. They were asked to read the prime sentence aloud, and then to describe a picture with a single sentence. In total, 60 different pictures were used. The participants encountered each picture twice during the experiment. The pictures were shown with the objects' names written on the pictures (with-word condition) one time, and were shown without the names written (without-word condition) one time. Overall, the syntactic priming effect was observed in the without-word condition. When compared by proficiency, the upper intermediate groups exhibited syntactic priming effects both in the with and without-word conditions. The priming effect was found only in the without-word condition, in the lower intermediate group. No syntactic priming effect was found in the upper or lower groups in either condition. Considering the residual activation account, the results indicate that the way the combinatorial nodes are activated differ depending on the learners' proficiency. The results also indicate that syntactic activation is suppressed when lexical processing requires a greater cognitive load.

1. Introduction

Speech production in L1 is usually a process that happens automatically, or unconsciously. On the other hand, even for long term learners who had explicitly learned the grammar, speaking in L2 is usually not a simple task. How does one's explicit knowledge become procedural, and how does L2 speech production process become automatized? The present study aims to answer
one aspect of the L2 automatization process, with a particular focus on oral sentence production by Japanese EFL learners.

Automaticity has a number of different technical meanings, and has been defined in various ways. It does not simply mean “fast processing.” For the purpose of our study, we agree with Segalowitz (2005). When we are able to perform a task with automaticity, it appears to be faster, more accurate, and more stable, without experiencing the need to invest additional effort and attention. In language learning, this increased automaticity can be seen as increased fluency, the ability to use language rapidly, smoothly and accurately, with little effort.

In normal fluent speech, it is said that people produce two to three words per second, which are continuously selected from the mental lexicon (Levelt, 1999). People do not need much effort to prepare for sentence production since this processing is done so quickly. However, in reality, various kinds of processing are done before the intended message is produced as overt speech. The processes of speech production can be largely divided into three parts, which are called conceptualization, formulation, and articulation (Levelt, 1989).

![Figure 1. Schematic representation of the processing components involved in spoken language use. Reprinted from Levelt (1993, p.2).](image-url)

Figure 1 is a model of spoken language use, and production process is indicated on the left
side of the figure. The processes of formulation involve translating the conceptual representation (the preverbal message) into a linguistic form, which can be divided into grammatical encoding and phonological encoding processes. The present study mainly focuses on grammatical encoding. The detail of this process is shown in Figure 2. This model shows that the grammatical encoding process consists of two components. One of the steps is called functional processing, which selects which words to use and assigns functions (e.g., subject or object) to them. The remaining step is positional processing, which arranges the order of the constituents.

**Figure 2.** Grammatical encoding process. Reprinted from Bock and Levelt (1994).

In short, grammatical encoding is a process of word selection and syntactic structure construction, which must be conducted immediately and unconsciously for quick and smooth communication to be possible. In other words, automatization of this processing is essential for fluent communication. It is most likely that the produced speech would be less fluent, if there were any problem in this sequence. However, speech production can be facilitated by the syntactic
priming effect (Pickering & Garrod, 2004).

Syntactic priming is the tendency to repeatedly use the same syntactic structures across sentences (Bock, 1986). Repetitive use of a particular structure can be seen in everyday language use. Levelt and Kelter (1982) found this phenomenon across speakers in “question and answer” sequences. They called several hundred merchants in the Netherlands and asked them (a) At what time does your shop close? or (b) What time does your shop close? (The actual language used in the research was Dutch). When the merchants were asked with a prepositional phrase such as (a), the answers tended to be something like “At five o’clock,” containing a prepositional phrase. On the other hand, when they were asked a question containing a simple noun phrase such as (b), their responses tended to consist of a simple noun phrase, for example, “Five o’clock.”

Bock (1986) conducted experiments to find out whether this effect was due to the tendency to reuse particular words, or to reuse the syntactic structures, using the picture description paradigm. In Bock’s experiment, the participants would first read a prime sentence and then describe a picture subsequently shown which could be described using the same structure as the prime sentence. For instance, the prime sentence might be an active transitive sentence such as “One of the fans punched the referee,” and the following picture would be another transitive event that is semantically different from the prime sentence, for example depicting lightning striking a church. Bock (1986) found the tendency for the participants to produce sentences containing the same structure as the prime sentences when describing the picture (e.g., an example response in the previous example would be, “Lightning is striking the church,” using the active voice instead of the passive voice). This effect was found not only with transitive structures, but also with dative structures.

Syntactic priming effect has been observed in various studies of L1, for instance in written sentence completion tasks (Pickering & Branigan, 1998), or in oral sentence recall tasks (Fox Tree & Meijer, 1999). The effect is not limited to monologue tasks, but is also found in dialogue tasks as well (Branigan, Pickering, & Cleland, 2000). Syntactic priming effect seems to be related to lexical processing. Wheeldon, Smith, and Apperly (2011) compared the response latency when participants described the relation between the two moving objects. The response latency of the target trial (The watch moves away from the sock) was shorter when the prime included the same word (The watch moves above the carrot) than when it did not have the same word (The house moves above the carrot) with the target. They claimed that lexical repetition with the same conceptual role and/or grammatical function induces a priming effect. This result indicates that syntactic priming may be affected by lexical retrieval processing itself.

Many researchers have discussed the mechanism of this phenomenon. Pickering and Branigan (1998) proposed an explanation saying that syntactic priming results in the activation of the verb’s combinatorial node, which does not disappear immediately (The residual activation account). This theory is based on the idea of the lexical representation. A word is said to be composed of the following three levels: the conceptual stratum (the concepts of what the word
refers to), the lemma stratum (which includes the syntactic properties of the word such as the lexical category, number, tense, aspect of the word), and the lexeme stratum (which holds the morphological and phonological information). Since it is thought that the nodes in each level are connected, when a sentence is produced and the lemma stratum of a verb is activated, the combinatorial nodes are also activated (Figure 3).

![Diagram of syntactic information](image)

*Figure 3. 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.*


Similar to L1, the syntactic priming effect is seen in L2 processing as well. A study of Japanese EFL learners found the syntactic priming effect to be proficiency dependent, and the priming rate was highest among middle proficiency learners, followed by upper level learners, and lower level learners in a written sentence completion task (Morishita, Satoi, & Yokokawa, 2010). Morishita (2011) compared the syntactic priming effect of Japanese EFL learners to that of L1 English speakers, using a sentence completion task in two modalities (spoken and written). It was found that while native speakers of English were significantly more affected by syntactic priming in spoken production than in written production, Japanese EFL learners did not show any difference in modality. However, the proficiency dependency for the syntactic priming effect was present, with upper level learners showing a more similar tendency to L1 English speakers than middle and lower level learners. Spanish-English bilinguals showed syntactic priming from L1 to L2 in picture description tasks with an interlocutor (Hartsuiker, Pickering, & Veltkamp, 2004). In
addition, there is evidence for priming from L2 to L1 and within the L2 by Dutch-English bilinguals (Schoonbaert, Hartsuiker, & Pickering, 2007).

As can be seen from Figure 2, lexical selection is also essential in speech production. While the influence of lexical processing to syntactic priming is considered in some L1 studies (e.g., Wheeldon, Smith, & Apperly, 2011), it is unclear in the case of L2 processing. In addition, there is no knowing whether a proficiency dependency for syntactic priming would be observed when lexical processing is controlled. For these reasons, the present study aims to examine how the lexical selection process affects oral L2 sentence production. We will focus on how lexical processing affects the syntactic priming by Japanese EFL learners of different proficiencies. If lexical retrieval process affects syntactic processing, that result would indicate the importance of training for lexical retrieval in order to realize fluent sentence production during L2 speech.

The experimental method used in this study is an oral picture description task, which is based on the picture description paradigm used by Bock (1986). The presence of vocabulary with the pictures was controlled in the present study, in order to find out whether the retrieval of vocabulary was causing a difficulty in oral sentence production. The reason why the picture description task was selected is because a picture would give a fixed concept to all participants. Since the conceptualization process is unnecessary in a picture description task, it makes it possible to compare the grammatical encoding process between participants. Describing a picture requires one to produce a message about the given concept, and the task is to select the appropriate vocabulary, construct the framework of the sentence, and insert the selected vocabulary into the appropriate slots. In order to control the lexical selection process in a picture description task, the present study compares the performance differences of the same picture with two different conditions: the lexically overt and covert conditions. Results will be analyzed to see how the lexically overt condition facilitates speech production depending on the participants' proficiency.

2. Method

2.1 Participants

Forty six Japanese EFL learners participated in the experiment (15 male, 31 female; mean age = 24.1 years, SD = 6.07 years). Participants were divided into four proficiency groups according to their Versant English Test (Pearson Kirihara K. K.) scores. The four groups correspond to the levels provided by the Common European Framework of Reference for languages (CEFR). Those in levels B2, C1 and C2 in CEFR will be called the high proficiency group or shown as “B2+” in tables and graphs (Versant scores 59-80, n = 12). Similarly, CEFR B1 level learners will be named as the upper intermediate group (Versant scores 49-57, n = 10), CEFR A2 level learners as the lower intermediate group (Versant scores 36-46, n = 12), and CEFR A1 level and under A1 level learners as the low proficiency group, and shown as “A1-” in tables and graphs (Versant scores 20-35, n = 12).
2.2 Materials

Verbs

Ten dative verbs (teach, show, give, hand, sell / write, tell, lend, pass, send) that allow both
prepositional-object (PO) and double-object (DO) constructions were selected from the database
of English vocabulary familiar to Japanese EFL learners (Yokokawa et al., 2006) for use in the
target trials. Vocabulary familiarity is a concept of how much people feel they hear or see a word.
In contrast to the actual frequency of a word, which is the degree of how often a word is actually
being used in newspapers, magazines, or in the language corpus, familiarity reflects the internal or
mental frequency, and it is scored in the range of 1 (least familiar) to 7 (most familiar). The
familiarity score of the selected dative verbs was above 5.6, except for lend (4.61). Five of the
verbs were used in prime sentences, and the remaining five verbs were used in the pictures.

Experimental pictures

120 black and white line drawings, which were selected from websites offering free
materials were used in the experiment. There were eight pictures per verb designated for the target
picture, which made forty dative event pictures. The events included an agent, an action, a patient,
and a beneficiary of the action. The remaining 80 pictures served as fillers. They depicted
transitive events (e.g., a man eating a cake), intransitive events (e.g., a baby crying), or other
events that could be described with a construction of dative predicate, for example, "the
building is tall" or, "the boy is angry."

Each picture was carefully selected to make sure that there were eight different events, and
sentences produced by the participants would not include a same direct object, in order to prevent
learning effects. All of the 120 pictures were processed into two versions. One of the versions only
had the intended verb printed on it and not the nouns. This lexically covert condition is expressed
as the without-word condition in the present study. The other version had both the verb and nouns
printed. This lexically overt condition is called the with-word condition (these will be shown as
word- and word+ in figures and tables). Pictures were divided into two groups of 60 to create two
test sets. Participants experienced only one of the test sets. Each test set included both versions of
one picture. Therefore, the same picture was presented twice during the experiment.

Prime sentences

There were 120 prime sentences (consulted Morishita et al., 2010) that were each paired
with the pictures. 40 prime sentences were of a dative construction. 20 of the 40 sentences were
PO construction sentences (e.g., The customer writes the letter to the engineer), while the
remaining half were DO sentences (e.g., The customer writes the engineer the letter) (See
Appendix). The direct objects of the sentences were all different. The filler sentences represented
constructions other than datives. They were composed of transitive verbs such as open,
intransitive verb such as smile, or of am, is, and are, which allowed for adjective predicate
constructions (e.g., *The new yellow car is fast*).

**Sound**

A short beep was sounded at the same time a picture was presented. This was used as an onset marker to measure the response latency and utterance length. Response latency was measured from the onset of the beep sound to the onset of the first utterance. Utterance length was measured from the speech onset to offset of the last word of the whole utterance.

**2.3 Procedure**

Participants were asked to read the prime sentence aloud, and then to describe the picture with a single sentence. Sixty different pictures were used. The participants encountered the same picture twice throughout the experiment, once with words (with-word condition) and once without words (without-word condition), so there were 120 pictures in total. Half of the pictures were shown with the objects' names written in the first half of the experiment and without the names in the latter half. The remaining pictures were shown without the names first.

Each participant was tested separately. Participants first took the Versant English Test, which took approximately 15 minutes. After this proficiency test had been completed, instruction for the experiment was given. Participants were told that the purpose of the experiment was to see how Japanese EFL learners would describe a given picture. The procedure of each trial was explained as follows. First, a message saying, “Ready?” would appear on the computer screen. When the space bar was pressed, the message would disappear and four cross marks (++++) would appear, they were instructed to look at it. After a few seconds, the marks were automatically replaced by an English sentence. The sentence was required to be read out loud, and whenever the reading was finished, the participants were told to press the space bar. A picture would appear on the computer screen, at the sound of a beep, and the participants were required to produce one sentence that best described the depicted scene as quickly and accurately as possible (Figure 4).

*Figure 4. An example of a trial.*
Participants were told to produce a sentence that contained a subject and the verb given, and not to produce imperative sentences or exclamatory sentences. In addition to this restriction, the sentences also had to include the other words printed on the pictures. However, the forms of the words were permitted to be changed, for instance into past tense or plurals (e.g., GIVE could be uttered gave, apple could be uttered as apples). This instruction was given since there were pictures that could be described using the progressive form or passive voice. Participants were informed that sometimes there was more than one word in the picture. After the participants heard the instructions, they went through four practice trials.

Stimuli were presented on a computer screen using SuperLab 4.0 by Cedrus Corporation. An IC recorder was used to record the participant’s utterance. The approximate time required for the actual experiment was 30 - 40 minutes, and the total experimental time was about 60 minutes per subject.

2.4 Scoring

The responses given by the participants were transcribed, and were classified as PO, DO or Other. Responses were scored as PO if subject and verb was followed by a noun phrase which behaved as the patient/theme, and then by a prepositional phrase beginning with to which behaved as the beneficiary. It was scored as DO if the verb in the utterance 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 responses, for example utterances with only one object (e.g., He is selling the necklace), or utterances with incorrect word order (e.g., He give to a girl a ring), were scored as Other. Even when the structure was either PO or DO, it was scored as Other when the designated verbs were not used in the utterance. PO and DO responses were divided into primed or unprimed. For instance, a PO response after a PO prime was classified as primed, and a DO response after a PO prime as unprimed.

3. Results

3.1 Proportion of primed responses

Table 1 shows the actual number of participants’ responses. These results show that overall, participants had a tendency to use PO constructions more than DO constructions. Such similar bias for PO construction was seen in Morishita et al. (2011), which might be a tendency for Japanese EFL learners. It can also be pointed out that the total number of Other responses was largest in the A1- group, and decreased as the proficiency level increased.
Table 1
The total number of responses

<table>
<thead>
<tr>
<th></th>
<th>Prime</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO</td>
<td>A1</td>
<td>A2</td>
<td>B1</td>
<td>B2+</td>
<td>DO</td>
<td>A1</td>
<td>A2</td>
<td>B1</td>
</tr>
<tr>
<td>All</td>
<td>154</td>
<td>174</td>
<td>154</td>
<td>144</td>
<td>34</td>
<td>33</td>
<td>22</td>
<td>63</td>
<td>52</td>
</tr>
<tr>
<td>DO</td>
<td>150</td>
<td>162</td>
<td>124</td>
<td>144</td>
<td>36</td>
<td>34</td>
<td>32</td>
<td>63</td>
<td>54</td>
</tr>
<tr>
<td>Total</td>
<td>304</td>
<td>336</td>
<td>278</td>
<td>288</td>
<td>70</td>
<td>67</td>
<td>54</td>
<td>126</td>
<td>106</td>
</tr>
<tr>
<td>word+</td>
<td>PO</td>
<td>85</td>
<td>89</td>
<td>78</td>
<td>75</td>
<td>25</td>
<td>22</td>
<td>17</td>
<td>38</td>
</tr>
<tr>
<td>DO</td>
<td>81</td>
<td>92</td>
<td>64</td>
<td>78</td>
<td>27</td>
<td>19</td>
<td>25</td>
<td>35</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>166</td>
<td>181</td>
<td>142</td>
<td>153</td>
<td>52</td>
<td>41</td>
<td>42</td>
<td>73</td>
<td>22</td>
</tr>
<tr>
<td>word-</td>
<td>PO</td>
<td>69</td>
<td>85</td>
<td>76</td>
<td>69</td>
<td>9</td>
<td>11</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>DO</td>
<td>69</td>
<td>70</td>
<td>60</td>
<td>66</td>
<td>9</td>
<td>15</td>
<td>7</td>
<td>28</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>138</td>
<td>155</td>
<td>136</td>
<td>135</td>
<td>18</td>
<td>26</td>
<td>12</td>
<td>53</td>
<td>84</td>
</tr>
</tbody>
</table>

Priming rate was obtained by dividing the number of primed responses by the sum of primed and unprimed responses. Other responses were excluded from the analysis, so that the sum of priming rate and unpriming rate would be 100%. In order to evaluate the priming effect, we subtracted 50% from the obtained priming rate, and analyzed in a one-sample t-test to see whether it was significantly larger than zero. Figure 5 shows the priming rate compared by with-word and without-word conditions.

![Figure 5. Priming effect (Priming rate - 50%).](image)
Overall, priming effect was significant in the without-word condition ($t(45) = 2.837, p = .007$). However it was not significant in the with-word condition. According to the participants’ proficiency, significant priming effect was found in the upper intermediate group (B1), both in with-word ($t(9) = 2.628, p = .027$) and without-word ($t(9) = 2.950, p = .016$) conditions. The lower intermediate group (A2) exhibited a nearly significant priming effect in the without-word condition ($t(11) = 2.160, p = .054$). No significance was found either in the high proficiency group (B2+) or the low proficiency group (A1-).

### 3.2 Reaction times

Response latency and utterance length was analyzed in a three-way analysis of variance (ANOVA). Word conditions (+/-) and prime (PO/DO) were the within-participants factors, and proficiency level (A1-/A2/B1/B2+) was the between-participants factor. Overall, no significant main effect of any factors was obtained by the ANOVA of response latency. However, there was a main effect of word ($F(1, 42) = 4.276, p = .045$) in the analysis of utterance length. No interaction was found between the factors. Further analysis by the participants’ proficiency was conducted only on PO responses. This was because there was very little data available for DO responses, especially for the low level proficiency group (only two participant’s data was valid).

![Figure 6. Mean utterance length of PO primed (left) and unprimed (right) responses.](image)

Figure 6 shows the mean utterance length of PO responses. The results of ANOVA showed that utterance length was significantly longer in the without-word condition, compared to the with-word condition when responses were primed, for A1- ($F(1, 41) = 18.35, p = .000$) and A2.
level participants \( F(1, 41) = 5.53, p = .024 \). No significant difference was found between with-word and without-word conditions when it was unprimed. In summary, the results show that the lexical selection process affects syntactic priming and appears as differences in utterance length in the lower intermediate group and the lower group.

4. Discussion

The present experiment shows that the priming effect is significant in the without-word condition, in which participants were required to select words by themselves. This tended to be more salient in intermediate level learners. One possible explanation for this result is that in the without-word condition, more cognitive load was required in word processing compared to the with-word condition, and as a result, there was little cognitive resource left for syntactic processing. Another possibility is that forced lexical processing may have affected the participants' responses. In other words, word processing suppressed syntactic processing. When words were given in the with-word condition, one must read and retrieve the meanings of the given words. Considering that the participants were foreign language learners, such forced lexical processing leads them to turn their attention to semantic processing, and reduces the cognitive resources available for syntactic processing. For this reason, learners could not make use of the syntactic template given by the prime. The results of the present study also indicate that the process of retrieval of the word affects syntactic priming. The words used in the present study were highly familiar, and thus the presence of the word should not affect the results if syntactic processing is independent of lexical processing.

Another finding of the present study is that there is a proficiency dependency in syntactic priming, similar to previous studies (Morishita, 2011; Morishita et al., 2010). This indicates that there are developmental changes needed to complete the learners' syntactic representation. We found an inverted U-shaped development for the syntactic priming rate. Intermediate level learners showed greatest priming effect, and almost no priming effect for the lower level learners. Additionally, after reaching a peak in the intermediate level, the priming effect dropped in the high proficiency level groups (Figure 5). It has been suggested that the syntactic priming effect is initiated by the residual activation of combinatorial nodes in the syntactic representation (Pickering & Branigan, 1998). The results of the present study indicate that the way the combinatorial nodes are activated differ by the learners' proficiency. We assume that the activation of a specific combinatorial node strongly persists within the intermediate level learners' syntactic representation. Since one of the nodes was strongly activated, intermediate level learners tended to reuse the same structure (priming effect). On the other hand, we assume that activation had spread to the other combinatorial node within the high proficiency learners, which allows them to use both of the constructions. This is a possible explanation why the priming rate was low in the high level learners. Substituting the high proficiency learners of the present study with the L1 speakers
of English in Morishita (2011), it can be said that the inverted U-shaped results in syntactic priming has been replicated. A study that compared syntactic priming between English speaking children and adults showed a linear increase in the priming rate from 3-4 year-olds, 5-6 year-olds, and to adults (Rowland et al., 2012). Although we cannot tell the equivalence of the participants’ proficiency, children older than 7 years old might behave similarly to the intermediate level learners of the present study.

Results of reaction times have given several implications. One thing is that syntactic structure is most likely to be processed in parallel with lexical retrieval. If lexical processing is completed before speech production is initiated, the effect of the printed word should have appeared both in response latency and utterance length. In reality, however, the effect of the word was seen only in utterance length.

If syntactic priming effect is significant, the time required for determining and building the syntactic structure should be shortened. Furthermore, if lexical processing affects syntactic processing, it is likely for the response latency to become shorter when words are present, since the cognitive load is smaller in that condition compared to the without-word condition. The results in the present study have constantly shown longer utterance length in the without-word condition, and in the unprimed condition. Contrary to the prediction, there was no significant difference in response latency. However, there is evidence for speeded response latency in syntactic priming experiments (Segaert et al., 2011), and in syntactic priming with repeated use of words (Wheeldon, Smith, & Apperly, 2011). The absence of changes in response latency in the present study may be due to the instructions given to the participants, since we did not emphasize that a quick response was one of the conditions. Participants could spend as much time as they wished, and so did not induce a priming effect. Although there was no significance in response latency, from the results of utterance length we infer that sentence production will not become fluent just by providing the words, if the structure is not ready for use. This is from the fact that the effect of word was found only in the primed condition. If only lexical retrieval processing inhibits automatic sentence production processing, the utterance length should have been longer always in the without-word condition, regardless of whether it was primed or unprimed. This indicates that automatization of lexical processing is a prerequisite for fluent sentence production, and therefore, activities that would enhance lexical processing abilities are even more required in foreign language classrooms.

The present study has shed light on one end of the process of automatization of sentence production by Japanese EFL learners. In summary, the present study found that lexical processing affects syntactic processing when Japanese EFL learners orally produce L2 sentences. Similar to the findings of the previous studies, the present study has shown evidence for proficiency dependency for syntactic priming. Although syntactic priming in the present study caused no significant difference in the response latency, modified instructions would possibly change this result, which requires further research on this topic. It has been suggested that syntactic priming might be caused by a temporal residual activation of combinatorial nodes in the syntactic
representation (Pickering & Branigan, 1998). However, some studies show that syntactic priming is not temporal but long lasting (Bock & Griffin, 2000). Therefore, it is necessary to investigate the potential of implicit learning by exploring persistence of syntactic priming effect. Based on the present findings, we aim to conduct a neurophysiological experiment, such as fMRI experiments, in order to reveal the neural substrates of L2 sentence processing.

Acknowledgments

This study was partially supported by JSPS Grant-in-Aid for Scientific Research (A) "An investigation of the automatization process in language processing with respect to the development of foreign language proficiency" (PI: Hirokazu Yokokawa, No. 21242013) and JSPS Grant-in-Aid for Scientific Research (C) "A psycholinguistic study on syntactic processing in speaking by Japanese EFL learners" (PI: Miwa Morishita, No. 23520778). We wish to express our deepest gratitude to all those who have cooperated with the research.

References


Appendix: Prime sentences (PO/DO)

1. The driver sends the car to the mechanic. / The driver sends the mechanic the car.
2. The student sends the money to the friend. / The student sends the friend the money.
3. The designer sends the jacket to the journalist. / The designer sends the journalist the jacket.
4. The grandmother sends the present to the girl. / The grandmother sends the girl the present.
5. The child tells the answer to the friend. / The child tells the friend the answer.
6. The secretary tells the news to the businessman. / The secretary tells the businessman the news.
7. The woman tells the story to the neighbor. / The woman tells the neighbor the story.
8. The hostess tells the time to the guest. / The hostess tells the guest the time.
9. The customer writes the letter to the engineer. / The customer writes the engineer the letter.
10. The student writes the report to the professor. / The student writes the professor the report.
11. The messenger writes the check to the lecturer. / The messenger writes the lecturer the check.
12. The secretary writes the e-mail to the manager. / The secretary writes the manager the e-mail.
13. The lawyer lends the book to the woman. / The lawyer lends the woman the book.
14. The lecturer lends the book to the professor. / The lecturer lends the professor the book.
15. The designer lends the magazine to the lecturer. / The designer lends the lecturer the magazine.
16. The customer lends the pen to the engineer. / The customer lends the engineer the pen.
17. The secretary passes the pen to the manager. / The secretary passes the manager the pen.
18. The student passes the report to the professor. / The student passes the professor the report.
19. The captain passes the lifejacket to the sailor. / The captain passes the sailor the lifejacket.
20. The mother passes the toy to the baby. / The mother passes the baby the toy.