Differential Effects of Early Verb Planning on Reaction Time in L2 English Production

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Abstract

In the current study two experiments were conducted to examine how L2 speakers of English plan the verb of a simple sentence prior to utterance onset. In the experiments, a variation of Rapid Serial Visual Presentation (RSVP) displayed pictured elements of an event in a sequence (e.g., buy [verb] - bed [object] - woman [subject]; bed [adjunct] - sleep [verb] - boy [subject]). RSVP was used to induce verb planning at different timings (initial or middle) in the serial presentation. The variables were position of the verb, and type of sentence elements (e.g., subject) presented around the verb. The effects of these variables on reaction time (latency before articulation) were observed. The results revealed that when speakers saw a verb in the initial position, reaction time was generally shorter, but the effect of position of the verb varied depending on the number of choices which an element around the verb had: For instance, when an element (e.g., bed) preceding a verb had two functional choices (either an adjunct as in sleep in the bed, or an object as in buy the bed) reaction was delayed. A control experiment was carried out to test the effect from the number of choices observed in the main experiment. The results of this study suggest that learners should be given a chance to practice using different types of verb (transitive, intransitive, or be) in a single task.

1. Introduction

It has been indicated both by language teachers and by psycholinguistics researchers that L1 word order affects the processing of L2. Hasegawa (1979), for instance, stated from his long experience of teaching English composition to Japanese students that the difference in word order between languages is one of the trouble spots in writing English. Santesteban and Costa (2006) concluded from the results of their psycholinguistic experiments on word order that L1 syntax does affect the production in L2, even for highly proficient bilingual speakers. Han (2000) also argued that L1 influence was persistent based on an analysis of English passive structures produced by L1 Chinese speakers. The current study focused on the role of the verb in sentence production in English, an SVO language, by native speakers of Japanese, an SOV language. As the following example from a student’s utterance in the author’s English class demonstrates, planning of an English verb and related sentence elements (the object and adjunct phrase) appears
1.1 Planning of the verb in L1 English

Hwang and Kaiser (2014) investigated whether the verb of a sentence in a picture description task (e.g., a zebra chasing a chef) is planned prior to speech onset in two typologically different languages, English, an SVO language, and Korean, an SOV language. The results of their experiment with a picture-word interference paradigm showed that in the condition of verb-related distractors (e.g., stalk for chase) onset latencies (reaction time) in English were longer than in the condition of unrelated distractors, whereas no such interference was observed in the production of a Korean sentence. Furthermore, an eye tracking examination in their study revealed that the action region in a pictured scene was looked at by the English speakers at a very early time (400- to 600-milliseconds) after the onset of a picture. The fixation on the action region indeed occurred much earlier than the subject region. These results from Hwang and Kaiser (2014) suggest that speakers of L1 English plan the verb (action) before speech onset and begin their construction of a sentence around the verb.

Schnur (2011) and Flecken, Gerwien, Carroll, and Stutterheim (2015) obtained similar results to support the assumption that the verb is planned before articulating a sentence in English. Applying a picture-word interference paradigm, Schnur (2011) conducted an experiment in L1 English to examine advance planning of verbs at the phonological level. The results showed that a distractor phonologically related to a target verb (e.g., cat for catch) slowed down initiation of utterances to describe transitive scenes, suggesting that English verbs were phonologically retrieved prior to speech onset. As to evidence from an eye tracking analysis, a cross-linguistic study conducted by Flecken et al. (2015) also supports the early planning of the verb by English speakers. The study compared the length of eye fixation on an action (verb) region of a video clip (e.g., a man folding a paper airplane) between L1 English speakers and L1 German speakers. Their analyses revealed that prior to speech onset English speakers saw action regions longer and more frequently than German speakers, while both groups of speakers generally paid more attention to actions than agents in the video clip. Flecken et al. suggested the reason for English speakers’ preference for action regions in terms of the role of aspect in the two languages, but it is beyond the scope of the current paper to examine their reasoning in detail.

However, Schriefers, Teruel, and Meinshausen (1998) presented evidence to argue against proposals for advance planning of the verb, although the language studied in their experiments
was L1 German. Schriefers et al. used picture-word interference tasks and found no interference effect in the verb-final sentence construction. They concluded that verbs were not necessarily part of advance planning (for similar argument for L1 Japanese, see Iwasaki, 2011). A recent proposal by Schriefers and his colleagues seems plausible to interpret the mixed results on advance sentence planning (Wagner, Jescheniak, & Schriefers, 2010). They claimed that the scope of sentence planning can be flexible depending on the complexity of sentence structures and associated cognitive load. The present study is also an attempt to examine if there is any flexibility in planning a verb in varied sentence structures.

1.2 Learners’ planning of the verb in L2 English

Little is known about how far ahead an L2 speaker plans a simple sentence before speech onset, much less about the timing of planning of the verb. No reference to the study of the planning scope of a sentence in L2 is found in Kormos (2006), which offers a comprehensive review of language production in both L1 and L2. Research into the role and selection of the verb in planning a sentence, however, is very important for teaching an L2 in which the position of the verb in a sentence is different from that in L1, for instance, teaching English to Japanese students, because it is generally assumed that L1 syntax affects production in L2 (Han, 2000; Santesteban & Costa, 2006).

Recently, Yanai, Seguchi, Hirakawa, Li, and Umeno (2014) and Choe (2010) explored the role of the verb in constructing an English sentence as L2. Yanai et al. (2014) examined whether the verb and object of a sentence are phonologically planned before speech onset by Japanese learners of English, following the picture-word interference paradigm applied in Schnur’s (2011) study mentioned above. Yanai et al. obtained nonsignificant results for advance planning of either the verb or the object, but the experimental materials seem to have included some ineffective distractor words. Thus their results may need further verification. In an experiment conducted in Choe (2010), participants were asked to describe a scene in a picture as quickly as possible. The picture (e.g., a panda eating a cookie) was divided into four pieces which were presented in a particular order so that the whole picture became visible. In the topic-first order, part of the topic (subject) appeared first and gradually the rest of the picture appeared till the action (verb) could be recognized in the fourth piece. The result showed that L1 Korean speakers started uttering a sentence in L1 as soon as they thought they could tell the subject, whereas L1 English speakers never started uttering a sentence in L1 until they could identify the action (verb). Interestingly, L2 English – L1 Korean speakers showed a pattern similar to the L1 Korean group though they spoke in a non-native language, English. This experiment thus suggests that planning of the verb in L2 English may occur in the same way as in the native language.

The current study adopted the procedure of another experiment in Choe (2010) (Experiment 3), which needs to be reviewed in detail here. Participants in his experiment saw a series of three pictures depicting an action (verb) and two animate characters, and then uttered a transitive
sentence. Each picture was displayed on the screen for a very short time (500 milliseconds). L1 speakers of English produced a sentence in the shortest time when a pictured verb was displayed initially, followed by pictures of the subject or the object (e.g., chase – woman – bear). In contrast, L1 speakers of Korean produced a Korean sentence most quickly when a pictured verb appeared in the final position, i.e., the canonical position in the SOV language. L2 English – L1 Korean speakers uttered an English sentence most quickly when a pictured verb appeared in the middle position, i.e., the canonical position in English, and delayed most when the verb appeared in the initial position. These results suggest that L1 English speakers can construct a sentence in a shorter time once planning of a verb is induced to occur in the early phase of sentence production. The results also imply that L1 Korean speakers of L2 English do not take advantage of obtaining the verb information in the initial stage of sentence planning.

The presentation method of the three sentence elements (subject, verb, and object) in Choe's (2010) experiment can be regarded as a variation of Rapid Serial Visual Presentation (RSVP) used in experimental psychology (e.g., Löw, Bradley, & Lang, 2013; Potter & Lombardi, 1998). The assumption of his experiment was that the time for producing a sentence from memory which had been formed by RSVP would be shorter if the presentation order of the three pictured elements, particularly the position of the verb, matched the order of linguistic encoding (planning). In other words, if L1 English speakers have a habit of planning the verb in the earliest phase of sentence construction, they will produce a sentence in a shorter time under the verb-initial condition in RSVP.

2. Variables in the present study and research questions

The present study applied a version of RSVP similar to the one used in Choe (2010) to examine learners’ planning of a sentence in L2 English. Figure 1 demonstrates a serial presentation of pictures used in the current experiment. Two variables were assumed to affect the time required for sentence planning before speech onset: position of the verb in the serial presentation, and type of sentence elements to be presented before or after the verb during RSVP.

The position of the verb in RSVP is the primary concern of this study. As mentioned above, Choe’s experiment found that Korean speakers of L2 English uttered an English sentence more quickly when a verb appeared in the middle position than when it appeared in the initial position in the serial presentation of sentence elements. Does this hold true for Japanese learners of English or do they, in a certain experimental condition, take advantage of getting the verb information initially in the serial presentation just like a native speaker of English would? Incidentally, it should be noted that the present experiment tested the effects of verb positions for only two levels—the initial and middle positions in a series of three sentence elements (e.g., V-S-O, or S-V-O), excluding the verb-final position (e.g., S-O-V). This is because previous studies of verb planning

Notes

Verbs in this figure: build, buy, clean, dance, sleep, smile, steal, swim; ‘other element’ is either an object (e.g., buy the bed) or an adjunct (e.g., sleep in the bed).
in L2 English (Choe, 2010; Yanai, 2015, August) did not yield significant results for the verb-final condition, and also because inclusion of the verb-final condition was predicted to add unduly to the complexity of the experiment and interpretation of the results.

<table>
<thead>
<tr>
<th>Position of verb</th>
<th>Elements around verb</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X=subject (y = other element)</td>
</tr>
<tr>
<td>V-X-y (verb-initial)</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>X-V-y (verb-middle)</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td>X = other element (y = subject)</td>
</tr>
<tr>
<td>V-X-y (verb-initial)</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>X-V-y (verb-middle)</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

*Figure 1. Examples of serial visual presentation employing the two variables—position of verb and elements around verb.*

*Notes. Verbs in this figure: build, buy, clean, dance, sleep, smile, steal, swim; ‘other element’ is either an object (e.g., buy the bed) or an adjunct (e.g., sleep in the bed).*

The other variable, the type of sentence elements (e.g., the subject) to be presented before or after the verb, was considered to be another important factor to be examined in the present experiment. Momma, Slecv, and Phillips (2016), in their experiment with a picture-word interference paradigm, found that planning of a verb in L1 Japanese occurred before object noun articulation, but not before subject noun articulation. The participants in their experiment were asked to produce sentences with either the Object-Verb structure (e.g., Neko-o naderu [cat-pet]) or the Subject-Verb structure (e.g., Inu-ga hoeru [dog-howl]) while ignoring a distractor verb (e.g., sasuru [rub] for naderu [pet]) written on the experimental picture. An interference effect was observed solely for the Object-Verb structure, and no effects were seen for the Subject-Verb structure. Similar results were obtained for English passive sentences in another study by the same researchers (Momma, Slecv, & Phillips, 2014). As for L2 English, Nakagawa and Yokokawa (2011) reported that for novice level speakers producing the subject noun was easy, but construction of the verb phrase (the verb and other elements) was demanding. Taken together, it...
seems likely that the dependency relationship between the verb and the subject is different from the relationship between the verb and other elements, which may lead to different timings of verb planning. Therefore the current experiment was designed to examine whether the timing of verb planning is associated with the type of sentence elements around the verb, namely, the subject and other sentence elements.

Furthermore, for sentence elements other than the subject, this study prepared multiple kinds: the object and the adjunct. As Figure 1 illustrates, the effect of the first variable, position of the verb (initial or middle), may differ between a sentence containing an object (*buy the bed*) and a sentence containing an adjunct (*sleep in the bed*). This prediction came from previous studies about the processing cost of verb arguments (object nouns) and adjuncts (Lee & Thompson, 2011), and studies about the need to vary sentence structures in the examination of sentence planning (Momma, Slevc, & Phillips, 2016; Wagner, Jescheniak, & Schriefers, 2010; Wheeldon, Ohlson, Ashby, & Gator, 2013).

The following research questions (RQs) were established to examine the effects of the above two variables on reaction time. Separate experiments were conducted to test these questions. The main experiment that follows was carried out to examine RQ1 and RQ2. A control experiment was carried out to test if the results obtained in the main experiment could still be observed under the condition of using a single type of sentence element (e.g., solely the subject) throughout an experiment (RQ3).

RQ1: Does the position of the verb in the serial visual presentation affect reaction time (latency before articulation)?
RQ2: Do sentence elements around the verb in the serial visual presentation affect reaction time if the type of elements is varied during an experiment?
RQ3: Does a single type of element around the verb in the serial visual presentation affect reaction time if the type is used throughout an experiment?

3. Main experiment

3.1 Method

3.1.1. Participants

The participants in the present experiment were 20 college students randomly selected from participants in the author’s General English class.

3.1.2. Materials

Sixteen English sentences were prepared for the experiment. Several examples can be seen in Figure 1 (all the sentences are shown in ‘Appendix’). An inanimate noun (e.g., *bed*) was used twice for the experimental sentences: once as the object of a transitive verb (e.g., *The woman will buy the bed*).
throughout an experiment (RQ3). Observed under the condition of using a single type of sentence element (e.g., solely the subject) the experiment was carried out to test if the results obtained in the main experiment could still be generalized to other sentence elements.

The main experiment that follows was carried out to examine RQ1 and RQ2. A control group was included to examine the effect of the type of elements around the verb on reaction time. Separate experiments were conducted to test these questions. The following research questions (RQs) were established to examine the effects of the type of elements around the verb in the serial visual presentation on reaction time:

RQ1: Does the position of the verb (verb-initial or verb-middle) affect reaction time?
RQ2: Do sentence elements other than the subject (e.g., object nouns, adjuncts) affect reaction time if the type is used throughout an experiment?
RQ3: Does a single type of element around the verb in the serial visual presentation affect reaction time if the type is varied during an experiment?
RQ4: Does the type of elements around the verb affect sentence planning?

These questions were addressed in a series of experiments that used a controlled environment to examine the effects of sentence structure on reaction time.

3.1. Method

3.1.1. Participants

The participants in the present experiment were 20 college students randomly selected from the author’s General English class.

3.1.2. Materials

Sixteen English sentences were prepared for the experiment. Several examples can be seen in Figure 1 (all the sentences are shown in ‘Appendix’). An inanimate noun (e.g., ‘bed’) and a verb (e.g., ‘buy’) were used in each sentence. An error analysis was also carried out as a subsidiary analysis.

3.1.3. Design

The experiment was designed to test the effects of two within-group variables, position of the verb (2 levels: verb-initial, and verb-middle), and type of sentence elements to be presented around the verb (2 levels: subject, and elements other than subject). The dependent variable was reaction time, which was obtained by measuring the latency between the offset of the final stimulus picture of a trial and the onset of speech. A 2 × 2 Analysis of Variance (ANOVA) was applied. An error analysis was also carried out as a subsidiary analysis.

For balanced presentation of materials, firstly, two lists of the 16 experimental sentences were prepared. On one of the lists, a pair of experimental sentences containing the same inanimate noun (e.g., ‘The woman will buy the bed’ / ‘The boy will sleep in the bed’) appeared in the verb-initial condition (e.g., ‘buy’ - woman - bed / ‘sleep’ - boy - bed) in the experiment. At the same time, on the other list, the same pair of sentences appeared in the verb-middle condition (e.g., ‘woman’ - buy - bed / ‘boy’ - sleep - bed). Conversely, another pair of sentences appeared in the verb-middle condition on the first list, while the same pair of sentences appeared in the verb-initial condition on the second list. In this way, the position of the verb was balanced between the two lists. Secondly, the 16 sentences on each list were grouped into two blocks so that no pair of sentences containing the same inanimate noun (e.g., ‘bed’) should appear in the same block. Then the order of the two blocks was changed to form another list, avoiding order effect. In the end, four lists of the same 16 sentences with varied verb positions and different presentation orders were prepared. Thirdly, the sentences in one block (eight sentences) were further divided into two smaller blocks so that sentences with the same type of verb (transitive or intransitive) in the same condition (e.g., verb-initial) should not appear consecutively in the experiment. Lastly, the presentation order of the sentences in the smaller block was randomized. The four lists were then rotated across participants. All the materials were programmed for presentation in the experiment by using a software, SuperLab. Reaction times were automatically measured by a voice key in cooperation with the software.
3.1.4. Procedure

Participants were tested individually in a quiet room. Firstly, the participants were asked to remember, by reading aloud, the English words for the pictures used in the experiment without being told how the words would be used in sentences. Then their familiarization with the words and pictures were checked and words they failed to name were practiced. Secondly, looking at the computer screen, participants were given an account of the task which they would perform. They were given the following directions:

a. In a trial, after seeing a series of three pictures, start to say a sentence by properly using one of the sentence frames, “The ( ) will ( ) the ( ).” or “The ( ) will ( ) in the ( ).” Try to say the sentence as quickly and as accurately as possible.

b. For the first slot of the sentence frame, use one of these persons: man, woman, boy, girl.

c. Try to avoid making a clicking sound or a cough before you speak.

Practice trials were then given with six sentences which were not included in the main experimental session. Correct sentences were shown after each practice trial.

In the main session, a trial started with fixation crosses, followed by an initial picture, a middle picture, and a final picture. Durations for displaying each picture were 2000 milliseconds (ms) for the initial, 500 ms for the middle, and 500 ms for the final. The initial picture was displayed very much longer than the other two because it was expected that with such a long duration the first pictured entity or action would be processed deeply (for the discussion about 2000 ms as a critical duration for processing of a scene, see Hafri, Papafragou, & Trueswell, 2013). At the offset of the final picture, a blue screen appeared and it remained on the screen for 8000 ms, during which time participants were to complete an utterance.

3.2. Results

3.2.1. Reaction time

Data were excluded from the analysis of reaction time only in the case that a filler sound (e.g., um) or a clicking sound was uttered before articulation. All other mistakes were accepted, such as substitution of a word (e.g., man for woman), repetition and reformulation (e.g., the, the woman), grammatical mistakes (e.g., dropping or unnecessary addition of the, will, or prepositions; wrong forms of a verb), and incomplete sentences, given that the aim of the experiment was to observe the time speakers took to plan a sentence before articulation. In calculating each participant’s mean score, data deviating more than two standard deviations from the person’s grand mean were regarded as outliers and discarded from analyses. The rate of data exclusion turned out to be 4.4 percent.

Table 1 shows the mean reaction times in milliseconds as a function of verb position and elements around the verb. A two-way ANOVA revealed a marginally significant main effect of verb position, \( F(1, 19) = 3.304, p = .085 \), and a significant main effect of elements around the verb, \( F(1, 19) = 6.612, p = .019 \). Importantly, the interaction of the two factors also reached
significance, \( F(1, 19) = 13.118, p = .002 \). Then, an analysis of the simple main effect was performed. Firstly, the effect of verb position was found to be significant solely for the condition where elements around the verb were those other than a subject, i.e., an object or an adjunct noun, \( F(1, 19) = 16.645, p = .001 \), whereas no such effect was observed if elements around the verb were subjects, \( F(1, 19) = 1.560, p = .227 \). Secondly, the effect of the type of elements around the verb reached significance for the condition of verb-middle, \( F(1, 19) = 12.094, p = .003 \), but not for the condition of verb-initial, \( F(1, 19) = 0.323, p = .577 \).

Table 1

<table>
<thead>
<tr>
<th>Elements around verb</th>
<th>V-X-y (verb-initial)</th>
<th>X-V-y (verb-middle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X = Subject</td>
<td>M = 1424, SD = 276</td>
<td>M = 1349, SD = 263</td>
</tr>
<tr>
<td>(y = other element)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X = other element</td>
<td>M = 1400, SD = 279</td>
<td>M = 1620, SD = 322</td>
</tr>
<tr>
<td>(y = subject)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These results of the main experiment will be examined in ‘Discussion’ which follows ‘Control experiment’ reported below.

3.2.2. Error analysis

The mistakes mentioned in the preceding section, namely, substitution of a word, repetition and reformulation, grammatical mistakes, and incomplete sentences, were counted for each participant and put into a two-way ANOVA in the same way as the reaction times were analyzed. The mean proportion of errors observed for each cell in Table 1 (e.g., verb-initial & subject following verb) was used for analysis. The result of error analysis was similar to the one for reaction times except that no interaction of the two factors (position of the verb and type of sentence elements) was observed, \( F(1, 19) = 1.462, p = .242 \). It became clear from this error analysis that speakers frequently made mistakes when a verb appeared in the middle position accompanied by an object or adjunct preceding the verb, just as speakers took the longest reaction time (1620 ms) in this condition. The analysis of errors also revealed that grammatical errors were mostly the dropping or unnecessary addition of the preposition in (e.g., *run the house; *drive in the bus). This suggests that the participants either had incomplete knowledge about the distinction of transitive and intransitive verbs, or performed poorly in rapid sentence production.
4. Control experiment

4.1 Purpose of the Control experiment

The main experiment revealed that the effect of the position of the verb on reaction time varied depending on the type of elements around the verb. An important question at this point is whether the effect of the position of the verb is significant if there is only a single type of element (e.g., subject) around the verb throughout an experiment. To examine this question, a control experiment was conducted with different groups of participants. One group of participants took part in an experiment where they produced sentences with the SVO word order after viewing serial pictures presented by the RSVP procedure. The subject nouns of the sentences were the only element presented around the verb for this group. The other group of participants took part in an experiment with the same sentences with the same word order and the same procedure as the first group, but in their case, the object nouns of the sentences were the only element presented around the verb. Sentences containing adjuncts were excluded from the control experiment.

4.2 Method

4.2.1. Participants

The participants in the control experiment were 24 college students randomly selected from participants in the author’s General English class. None of these students participated in the main experiment of this study. The 24 students were divided into two groups for the control experiment: One group was formed of 13 randomly selected students, while the remaining 11 students formed the other group.

4.2.2. Materials

The control experiment used sentences with a single structure, SVO. Twelve English sentences were prepared: the same eight sentences with transitive verbs as were used in the main experiment, and four newly prepared filler sentences with transitive verbs. The filler sentences were added to ensure that participants were unaware of repeated elements around verbs: For instance, filler sentences with a subject around the verb were included in the experiment where the target sentences had an object around the verb. Except for the smaller size of the target sentences, the organization of the materials was the same as in the main experiment.

4.2.3. Design

The control experiment was designed to test the effect of the position of the verb presented by RSVP on reaction time, under the condition where a single type of element (either subject or object) comes around the verb throughout the experiment. One of the groups of participants \((N = 11)\) took part in an experiment where the target element type around the verb was the subject of a
sentence. The other group (N = 13) joined an experiment where the target element type around the verb was the object of a sentence.

**4.2.4. Procedure**

The procedure was similar to that of the main experiment except that participants were directed to use a single sentence structure (*The ( ) will ( ) the ( )*). It should be noted that, as was the case in the main experiment, the initial picture in RSVP was displayed very much longer (2000 milliseconds) than the other two pictures (500 milliseconds) so that deeper processing of the initial picture would be activated.

**4.3. Results**

The data were also analyzed in the same way as in the main experiment. In calculating each participant’s mean score, data deviating more than two standard deviations from the person’s grand mean were regarded as outliers and discarded from analyses. Because of malfunction of the apparatus, several observations were discarded. For these reasons, the rate of data exclusion turned out to be 5.2 percent.

Table 2 and Table 3 show the mean reaction times in milliseconds obtained from the two groups of participants. No significant difference was found between the mean reaction times for either group: for V-S or S-V order, \( t(12) = 0.396, p = .699 \); for V-O or O-V order, \( t(10) = 0.521, p = .613 \).

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Mean Reaction Times (in milliseconds) for V-S or S-V Order of Presentation</th>
<th>Table 3</th>
<th>Mean Reaction Times (in milliseconds) for V-O or O-V order of Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V-S-</td>
<td>S-V-</td>
<td>V-O-</td>
</tr>
<tr>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>1273</td>
<td>281</td>
<td>1310</td>
<td>169</td>
</tr>
</tbody>
</table>

Note: N = 11

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Mean Reaction Times (in milliseconds) for V-O or O-V order of Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V-O-</td>
</tr>
<tr>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>1498</td>
<td>457</td>
</tr>
</tbody>
</table>

Note: N = 13

**5. Discussion**

The aim of this study was to explore how speakers of L2 English plan an English verb before they begin to utter a sentence. The main experiment was conducted to examine whether early presentation of the verb by Rapid Serial Visual Presentation would affect reaction time (RQ1), and whether the sentence elements around the verb would also affect reaction time if the type of elements was varied during the experiment (RQ2). All the participants were Japanese college students learning English as L2. The results of the main experiment revealed that if
speakers were induced to plan a verb in the early phase of sentence production, reaction time (latency before articulation) was shorter, but the effects from timing of the presentation of the verb (verb-initial and verb-middle) varied depending on the type of sentence elements presented around the verb. The control experiment was carried out to examine whether the effect of early presentation of the verb would be observed if a single type of sentence element was used around the verb throughout an experiment (RQ3). The results from the control experiment showed that the timing of the presentation of the verb had no effects on reaction time.

These findings have theoretical implications for the study of advance planning in sentence production and practical implications for language teaching. As Momma, Slevc, and Phillips (2016) suggested for L1 production, the dependency relationship between the verb and the subject seems different from the relationship between the verb and other elements, and this difference may give rise to different roles the verb plays in advance planning of a sentence. The results from the main experiment in this study appear to support Momma et al.’s suggestion. The results revealed no effect of the position of the verb when the element around the verb was a subject (V-S and S-V order in the serial presentation), whereas the effects were highly significant ($p = .001$) when the elements were other than subjects. In linguistics, it is generally recognized that the object is an internal argument of a verb and functions as part of a verb phrase, whereas the subject is an external argument and exists in a sentence regardless of the meaning and subcategorization property of the verb (for review of literature on the property of arguments, see Momma et al., 2016). Therefore, it appears plausible to consider that no effect of the positions of the verb on reaction time was obtained because the element that came before or after the verb was an external argument, namely, the subject. Momma et al.’s thoughts, however, do not explain why, in the control experiment, no effect of the position of the verb was observed when the type of element around the verb was always object, an internal argument of a verb. It is possible to arrive at a more convincing explanation by applying Hick’s Law of choice reaction time. Hick (1952) proposed that the reaction time to make a choice increases as the number of possible choices increases. In the main experiment of the present study, an experimental sentence had solely one element that refers to the agent of an action, namely, the subject, whereas the sentence had another element which could be either an object (e.g., clean the pool) or an adjunct to indicate the location of an event (e.g., swim in the pool). Therefore a speaker must have been entirely uncertain about the grammatical function of a pictured entity (e.g., pool) when it appeared initially in the serial presentation. This uncertainty for the speaker seems to have led to the delay in response. In contrast, when shown a verb initially in the presentation, the speaker seems to have been able to predict the grammatical function of the entity which would appear next to the verb. This prediction must have led to a shorter reaction time.

The results from this study have some implications for language teaching. Learners should be given a chance to practice producing English sentences in a task where different types of verbs (transitive, intransitive, or he) are used. This kind of task is recommended because, as the current...
results suggest, uncertainty on the part of speakers about the relationship between an action (verb) and entities in a scene may cause a delay in reaction time. Thus, practice is necessary to select a proper type of verb from among options and accordingly assign proper grammatical functions (e.g., object or adjunct) to the entities. Let us see again an utterance from a student shown in ‘Introduction’ of this paper:

So, the many, the park, the many flowers, she can’t see the many flowers in this park.

It can be assumed that this student looked at entities in the picture which would form part of an adjunct (park) and an object (flowers) early in the time course, said the words in isolation without expressing grammatical relations, and then retrieved (planned) the verb to construct a sentence. Proper practice in planning a verb early may help this speaker arrange elements of a sentence with less disfluency. The materials in this study could be used for a pedagogical purpose as well as to let learners be aware of the importance of verb information in sentence production in English. Further work is under way to examine the applicability of the findings from the current experiment to training of practical skills for picture description.

The present study has some limitations. Firstly, for a picture description task, the experiment did not use a single stimulus picture where all the components of an event (i.e., subject, verb, and object for a transitive event) were drawn together. Instead, each component was drawn on a separate stimulus sheet and displayed rapidly in a sequence. This procedure is different from the usual behavior of seeing and describing an event. Therefore the findings in this study need further verification by using a more usual stimulus picture. Secondly, the control experiment did not include a test which used an adjunct as a single element around the verb, although it was highly predictable that the test would yield nonsignificant effects of the position of the verb, because the target element was single throughout the experiment (see Hick’s Law mentioned earlier).

6. Conclusion

The current study has demonstrated that the effect of the timing of verb planning varies in relation to the sentential elements coming before or after the verb. The results from the experiments in this study contribute to understanding of advance planning of a sentence in L2 in that differential effects of the variables were observed in varied linguistic contexts. It seems particularly important in future research to consider the different dependency relationship between the verb and its arguments (subject and object), and also a different mechanism for producing verb arguments and adjuncts. It is also important to develop pedagogical materials which aim to enhance learners’ fluency in using English verbs.
Note

1. Three groups of participants took part in the present study: 20 participants in the main experiment, 13 participants in one group of the control experiment, and 11 participants in the other group. The results of a test for English ability (writing and speaking) showed no significant difference across the three groups, $F (2, 36) = 0.296, p = .746$. Three participants and two participants from each group of the control experiment failed to take the test, but an examination of their scores in a different English test showed that their participation in the experiment would not change the equality of English ability across the three groups.

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References


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Appendix: List of sentences used in the Main Experiment

The woman will buy the bed.
The boy will sleep in the bed.
The man will drive the bus.
The boy will talk in the bus.
The man will steal the car.
The woman will smile in the car.
The man will build the house.
The woman will dance in the house.
The girl will clean the pool.
The girl will swim in the pool.
The girl will paint the room.
The boy will jump in the room.
The boy will find the store.
The girl will run in the store.
The man will chase the train.
The woman will work in the train.