The Effects of Context on the Strategies in Sentence Processing by Japanese Learners of English

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Abstract

The purpose of the present study is to investigate whether context affects the learner's on-line sentence processing. Yoshida (in press) found that Japanese advanced learners of English processed a sentence based on lexical forms retrieved from verbs. The results of the experiment showed that transitivity and the type of the complement structures affected the learner's on-line processing. When the sentence structure of the incoming material was not consistent with the lexical form the learner expected to appear, then, they needed to reanalyze the sentence and spent longer time. In the present study context which was relevant to the experimental sentence was presented, and whether contextual information affects learner's on-line sentence processing was investigated. However, the result showed no effect of the context was found. The possible factors which accounted for this result were discussed.

1. On-Line Sentence Processing

One of the central issues in the study of human sentence processing is what principles guide the parser. In particular, it is of interest to investigate how lexical information affects the course of the processing. Rayner, Frazier and their colleagues (e.g. Frazier, 1987; Frazier & Rayner, 1982; Rayner, Carlson, & Frazier, 1983) suggested that human senence processing is guided by structural principles (e.g. Minimal Attachment[1] , and Late Closure[2]). For example, in processing sentence (1a) and (1b), perceivers will find it more difficult to process (1b) than (1a), because the structure of (1b) is not consistent with the parser's structural decision (Minimal Attachment principle in this case). Thus, they need to reanayze the sentence, which is reflected in response time. The authors further claimed that the detailed lexical

(1a) The city council [vpargued [npthe mayor's position] [ADVforcefully.]]
(1b) The city council [vpargued [s[npthe mayor's position] [vpwas incorrect]]].

information (such as thematic roles) will come into play in the later stage. In other words, lexical information is used as a filter or a checking function.
Contrary to the structural principles, Ford, Bresnan and Kaplan (1982) proposed that each verb has some lexical forms which represent the complement

structures of a verb and there are strengths among the forms. Further, they suggested that the strongest lexical form affects perceiver's initial synatctic analysis [3]. For example, consider the verbs "want" and "postion". The lexical forms of these two verbs are <(SUBJ),(OBJ)> and <(SUBJ),(OBJ),(PCOMP)> [4]. However, the former is the strongest form for the verb "want" and the latter is for "position". Accordingly, the perceiver

(2a) The woman [$_{VP}$wanted [$_{NP}$the dress[$_{PP}$on that rack]]].
(2b) The woman [$_{VP}$positioned [$_{NP}$the dress] [$_{PP}$on that rack]].

processes the sentence based on the lexical information a verb provides. Although this study was based on the questionnair research, the studies by Mitchell & Holmes (1985), and by Holmes (1987) empirically supported the assumption. They showed that lexical information guides the initial synatactic analysis at on-line level.

2. Sentence Processing by EFL Learners

Based on the theories described above, Yoshida (in press) conducted a study to investigate whether the initial sentence processing by advanced Japanese learners of English is affected by lexical information retrieved from verbs. In this study the subjects were presented with sentences through a reader-paced reading task. The experimental materials were segmented into several portions and the reading time for each portion was measured. In one of the studies post verbal structure wes controlled to investigate whether learner's sentence processing was affected by the lexical information. In this experiment verbs were chosen and classified into those which prefer to take an object noun pharse as a post verbal structure (henceforth, "NP-bias verbs") and those which take a sentential complement ("That-bias verbs"). Sentences like (4a) and (4b) were presented to the subjects. When the sentences were

(4a) NP-bias Verb
        My neighbor found/ his small son and his dog/ had gone.
(4b) That-bias Verb
        The students knew/ several solutions to the problem/ would be possible.

segmented into three parts at the positions indicated by an oblique line ("/"), the noun phrase shown in the second display is temporarily ambiguous because they can be analyzed as a direct object of the verb or as a subject of the subordinate clause. However, this ambiguity is resolved when the subjects discover a verb in the third display. Thus, the increase of the time in the third display will indicate whether the subjects follow the structural principle or lexical information. If the subjects follow the structural principle, the response time in the third display will be longer for both of the types of the sentences. Alternatively, if lexical information guides the subjects processing, then, the response time in the third display will be longer only for those containing NP-bias verbs. The results of the experiment showed that the

response time siginificantly increased from the second display to the third diplay for (4a), but that the same phnomenon was not observed for (4b). This clearly indicated that the subjects employed the lexical information in the initial syntactic analysis.

3. Context Effects and Sentence Processing

The study mentioned above clearly indicates that sentence processing by advanced learners of English is guided by lexical information. In the experiment above the sentences were presented isolated from context. A question raised here is whether context affects the learner's lexical information-based sentence processing. To answer this question, in the present study, experimental sentences will be presented after the relevant context. It is possible that advanced learners of English may be able to integrate contextual information in the on-line sentence processing, so that it may guide the initial syntactic decision.

3.1 Experiment
3.1.1 Method
(a) Experimental Materials

The basic experimental materials consisted of 8 sentences. Verbs embedded in the sentence were selected from the preliminary study preceedingly conducted by the experiment[5]. The verbs were classified into NP-bias verbs and That-bias verbs. Each senetence was constructed so that either a direct noun phrase or a sentential complement clause appeared after the verb. Further, in half of the experimatal trials the sentences were presented with context which was assumed to induce the sentence structure presented (see Table 1 below). In (a) the context was assumed to lead a subject to expect a sentential complement because, when he or she comes across the verb "expect" and the following noun phrase "the birthday present", his or her natural interpretation will be that "the girl" expected the present would do something to "her grandfather"; such as, it would surprise him, or it would be delivered soon. On the

Table 1. A Sample of te Experimental Materials

(a) That-bias Verb with Context
   A girl was talking with her grandfather on the phone. She said to him, "I have
   sent a birthday present to you. You'll get it in a couple of days."
   The child expected/ the birthday present/ would please her grandfather.

(b) NP-bias Verb with Context
   A girl was talking with her grandfather on the phone. Suddenly he said to her, "I
   have sente a birthday present to you. You'll get it in a couple of days."
   The child expected/ the birthday present/ with great joy.

(c) That-bias Verb withou Context
   The child expected/ the birthday present/ would please her grandfather.

(d) NP-bias Verb without Context

The child expected/ the birthday present/ with great joy.

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other hand, in (b) the natural interpretation will be that the girl looked forward to the present itself which was to be sent to her. In addition to these two conditions, Material (c) and (d) were presented without preceding context. (Henceforth, material (c) is called a "That-construction" sentence, and material (d) a "NP-construction" sentence.) Other twenty senteces were presented as filler sentences.

The experimental sentences were segmented and presented on the computer screen. Each oblique line ("/") indicates where the sentence was segmented. The first portion contained the subject noun phrase and the verb. The second part included a noun phrase which could be interpreted as a direct object or as a subject noun phrase. The third portion, a disambiguating region, consisted of either a sentential complement or an adverbial phrase (such as a prepositional phrase). Thus, reading time for the third display will indicate how the subjects process the experimental sentences.

(b) Procedure

The material was presented through a reader-paced reading task. Each portion was presented on the display until the subject read and pressed the key to proceed to the next display. The reading time for each portion was measured. The subjects were instructed to concentrate on comprehending the material presented. However, to encurage them to do so, a simple question relevant to the material was given after theys pressed the key for the third display.

(c) Subjects

Subjects were 24 undergraduates majoring in English language education at Hiroshima University. Although the laguage proficiency of the subjects was not measured or controlled, but it is assumed to be between the advanced and the upper intermediate level.

3.1.3 Predictions

Predictions made are as follows:

(1) Under the condition that context is not presented, subject's perference for lexical forms will come into effect. That is, when the embeded verb is an NP-bias verb, the reading time for the third display (i.e. a disambiguating region) will be longer when the subject processes the sentence containing That-construction than NP-construction. The reverse will be observed for the sentences in which That-bias verbs were embeded.

(2) If the preceeding context guides the subject's sentence processing, the processing of the complement structure in the following part of the sentence will be facilitated. This can be described as the following ways; (a) when the complement structure of the sentence is preferred by the verb, the reading time will be shorter

when the context is presented; (b) even when the complement structure is not biased to the verb, the reading time in the third display will be shorter if the context is presented.

3.1.4 Results and Findings

Mean reading time (msec.) for the materials containing That-bias verbs and NP-bias verbs are shown in Table 2.1 and Table 2.2 respectively.

Table 3.1 Mean Reading Time of Each Display
for the Sentences containing "That"-bias Verbs

	Without Context		With Context	
	That-const.	NP-const.	That-const.	NP-const.
Display 1	77.82	82.21	76.88	88.71
Display 2	96.00	94.90	85.73	93.38
Display 3	95.55	119.33	105.34	121.18
Total	269.37	297.44	267.95	303.27

Table 3.2 Mean Reading Time of Each Display
for the Sentences containing NP-bias Verbs

	Without Context		With Context	
	That-const.	NP-const.	That-const.	NP-const.
Display 1	84.07	87.90	72.06	67.99
Display 2	97.30	91.62	88.16	64.17
Display 3	101.12	77.56	106.82	88.18
Total	282.49	256.08	267.04	212.15

When context was not presented, the structural bias clearly influeced the sentence processing. The reading time of Display 3 was longer for the structure which was not consistent with the bias of the verb. For the experimental material containing That- bias verbs, the reding time of Display 3 was longer for NP-construction (119.33 msec) than for That-construction (95.55). For the material containing NP-bias verbs, the reading time was longer for That-construction (101.12) than for NP-construction (77.56). However, these apparent differences were not statistically siginificant. Thus, it would be safe to say that there was a tendency that the perceiver spent more

time processing the structure which was not consistent with the strongest lexical form.

When context was · presented, the results of the experiment were problematic. That is, no effect of the context was found in each condition, except for the total reading time of the material containing NP-construction under an NP-bias verb condition (212.15). This total reading time was significantly shorter than the total reading time which was measured when the context was presented ($F(1,7)=2.70$, $10.<p<.25$). Except for this finding, there was no difference between when context was presented and when it was not.

4. Discussion

In this section I would like to argue why context did not affect the sentence processing. This problem can be argued in terms of a methodological problem, learner's proficiency, and the effect of lexical forms.

A methodological problem can be summarized like this: Did the context appropriately lead the subjects to predict the sentence structure following the verb? Although the context was assumed to have effect, this assumption might be biased one and did not affect the learner's processing[6] . Therefore, it will be necessary to reconsider what structures context can induce a subject to predict.

A second problem is about the subjects. In this experiment the subjects was assumed to be at an advanced level and to be able to employ the contextual information in the on-line processing. However, they may have not reached the level where they could integrate the contextual information into sentence processing. To solove this problem, it is necessary to employ subjects who are more advanced level and to ensure whether they can integrate the contextual information.

A third factor which may account for the result is the one that the lexical preference was so strong that the sentence processing based on it was not affected by the contextual information at all. If this is the case, acquiring lexical forms of a verb is one of the crucial factors for effeicient sentence processing.

NOTES

1. *Minimal Attachment principle:* Attach incoming material into the phrase-marker being constructed using the fewest nodes consistent with the will-formedness rules og the language.
2. *Late Closure principle:* When possible, attach incoming lexical items into the clauseor phrase currently being processed (i.e. the lowest possible nontermial node dominating the last item analyzed.) (Frazier & Rayner, 1982) .
3. Ford et al. (1982) propsosed Lexical Prefernce.
   Lexical Preference: If a set of alternatives has been reached in the expansion of a phrase structure rule, give priority to the alternatives that are coherent with the strongest form of the predicate.
4. (SUBJ) refers to a subject, (OBJ) to a direct object, and (PCOMP) to a preposi-tional complement.

4. (SUBJ) refers to a subject, (OBJ) to a direct object, and (PCOMP) to a preposi-
tional complement.
5. In the preliminary study, questionnairs like the one below was presented to the
31 subjects, who were students at English Language Education major, Faculty of
Education, Hiroshima University, and they were instructed to choose one of the
more natural sentence between (a) and (b), if the sentece fragment (1) is completed.
     (1) The students knew their teacher....
       (a) The students knew that the teacher would get married very soon.
       (b) The students knew the teacher in a white shirt.
6. In the experiment which investigated context effects, scholars used the material
which, for example, contained a sentential clause functioning a relative clause or
a direct object clause (see Altmann & Steedman, 1988, for example).

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