COMPREHENSION, IMITATION, AND PRODUCTION OF SIMPLE SENTENCES IN MENTALLY RETARDED INDIVIDUALS.

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The purpose of this study is to investigate the relationships between sentence comprehension, sentence imitation, and sentence production in mentally retarded individuals. Thirty-two mentally retarded individuals, aged from 16 to 37 years old, with 29 males and 3 females, were tested. In the first experiment, subjects acted out simple sentences using miniature toys. In the second experiment, subjects were asked to imitate simple sentences. In the third experiment, subjects were asked to draw an event on a picture about the following; "one animal chased another". The results of these experiments indicated: 1) even the subjects who showed event probability strategy in sentence comprehension tasks could use the word order in the sentence production tasks; 2) the subjects of the event probability strategy apply wrong particles in sentence imitation tasks and sentence production tasks.

Introduction

Numerous attempts have been made by researchers to show problems of langauge learning in mentally retarded individuals. However, comprehension and production were researched separatively. A few attempts have been made in terms of the relationships between comprehension and production. The purpose of this study is to investigate sentence formats and assignment of actor-patient relationships in sentence production task for each sentence comprehension strategy.

Mentally retarded individuals and normal children are known to comprehend a simple sentence with different ways from that of adults'. Bever (1970) investigated sentence comprehension of children, finding a semantic strategy at 3 years old, and a word order strategy at 4 years old. The semantic strategy is to comprehend a sentence according to the semantic constraints. The children who use the strategy could correctly comprehend the probable sentences like "The mother pats the dog," but not the improbable sentences like "The dog pats the mother." The word order strategy is to comprehend a sentence according to the word order. The children of the word order strategy regard the first noun as an actor and the second noun as an object.

In sentence comprehension of Japanese children, the semantic strategy, the word order strategy, and the particle strategy were found (Hayashibe, 1975; Suzuki, 1977; Iwatate, 1980). Japanese language is an subject-object-verb (S-O-V) language with a relatively free word order. The case relation is expressed by postpositional particles,

and the subject is marked by the particle "ga", the object by the particle "wo". A form of Japanese simple sentence is 'noun-particle noun-particle verb'. Since the positions of "noun-particle" are exchangeable, the following two sentences are acceptable, that is, "subject-ga object-wo verb (SOV)" and "object-wo subject-ga verb (OSV)." Japanese children comprehend a sentence on the basis of the particles after 6 years old.

The sentence comprehension strategies of mentally retarded individuals were investigated by a few studies (Dewart, 1977; Bridges and Smith, 1984; Matsumoto, 1986, 1989). It is reported that mentally retarded individuals change the word order strategy for the semantic strategy between Mental Age (MA) 3 years old and 4 (Dewart, 1977; Bridges and Smith, 1984).

Matsumoto (1986, 1989) investigated the sentence comprehension of Japanese mentally retarded individuals that were asked to act out a simple sentence by using miniatures animals toys. He found the event probability strategy (the semantic strategy), the word order strategy, and the particle strategy in the mentally retarded individuals to be the same as in normal children. Furthermore, Matsumoto and Furutsuka (in press) examined the relationships between the sentence comprehension and the sentence imitation. They found that a) the subject who comprehended the particles could correctly imitate both SOV and OSV; b) some of the subjects who correctly imitated both SOV and OSV could not comprehend the particles; c) all subjects who participated in the experiment could correctly imitate the noun and the word order of the noun; d) some subjects change SOV for OSV in the imitation task. From the results they proposed a sentence comprehension model including two stages. In their model, at the first stage, the subject stores the simple sentence according to sentence formats in his linguistic repertoire. At the second stage, he/she decides the actor-patient relationship on the basis of a linguistic cue. The subjects having SOV and OSV formats can correctly store the sentences, and some of them use the particles for sentence comprehension. However some of them can not. Since the subjects having the SOV format alone miss the particles in the OSV sentences, they can not understand the OSV sentences. Some of them use the cue of the word order in sentence comprehension, and others comprehend the sentences on the basis of semantic constraints. The subjects who acquire neither the SOV format nor the OSV format can not use the cue of the particles in the comprehension tasks. Most of them comprehend the sentences according to semantic constraints.

In a similar way, the process of sentence production can be regarded as containing two stages, the sellection of a specific sentence format, and the assignment of an actor-patient relationship to the sentence format. In this sentence production experiment, the task is to describe the event that one animal chases another animal. The subject must understand the actor-patient relationships of the event, presenting it in a sentence some way. How do mentally retarded individuals represent the actor-patient relationship? What format do they use in sentence production tasks?

As mentioned in the above, the purpose here is to explore the relationships between sentence comprehension, sentence imitation, and sentence production in mentally retarded individuals. In the sentence comprehension experiment, the sentence comprehension strategy is identified. In the sentence imitation experiment, the

responses are analyzed in terms of the sentence format. In the sentence production experiment the sentence format and assignments of actor-patient relationships to word order are investigated.

Experiment I

Method

Subjects. The subjects were 32 mentally retarded individuals (29 males and 3 females), from a mental retardation institution in Sapporo City. Their chronological ages (CAs) ranged from 16 : 5 to 37 : 2 years (mean =26 : 11), their MAs assessed by Suzuki Binet Intelligence test ranged from 3 : 2 to 11 : 11 (mean=6 : 4), and their Intelligence Quotient (IQ) ranged from 20 to 74 (mean=41).

Materials. There were two variables in sentences : 1) sentence type (Subject-Object-Verb (SOV), or OSV) ; 2) semantic constraints (neutral, probable, or improbable). The combination of the two variables yielded six conditions. For each condition, four sentences were made.

The sentences used in this test were :

Probable and SOV sentences
- raion (lion) ga buta (pig) wo tsukamaeru (chases) (The lion chases the pig).
- raion ga hituji wo tsukamaeru (The lion chases the sheep).
- tora ga buta wo tsukamaeru (The tiger chases the pig).
- tora ga hitsuji wo tsukamaeru (The tiger chases the sheep).

Probable and OSV sentences
- buta wo raion ga tsukamaeru (The lion chases the pig)
- hitsuji wo raion ga tsukamaeru (The lion chases the sheep).
- buta wo tora ga tsukamaeru (The tiger chases the pig).
- hitsuji wo tora ga tsukamaeru (The tiger chases the pig).

Improbable and SOV sentences
- buta ga raion wo tsukamaeru (The pig chases the lion)
- hitsuji ga raion wo tsukamaeru (The sheep chases the lion).
- buta ga tora wo tsukamaeru (The pig chases the tiger).
- hitsuji ga tora wo tsukamaeru (The pig chases the tiger).

Improbable and OSV sentences
- raion wo buta ga tsukamaeru (The pig chases the lion)
- raion wo hitsuji ga tsukamaeru (The sheep chases the lion).
- tora wo buta ga tsukamaeru (The pig chases the tiger).
- tora wo hitsuji ga tsukamaeru (The pig chases the tiger).

Neutral and SOV sentences
- raion ga tora wo tsukamaeru (The tiger chases the lion).
- tora ga raion wo tsukamaeru (The lion chases the tiger).
- buta ga hitsuji wo tsukamaeru (The pig chases the sheep).
- hitsuji ga buta wo tsukamaeru (The sheep chases the pig).

Neutral and SOV sentences

tora wo raion ga tsukamaeru (The tiger chases the lion).
raion wo tora ga tsukamaeru (The lion chases the tiger).
hitsuji wo buta ga tsukamaeru (The pig chases the sheep).
buta wo hitsuji ga tsukamaeru (The sheep chases the pig).

The order of the presentations of sentences was pre-randomized.

The miniature toys corresponding to the nouns in the sentence were provided.

Procedure. To identify the sentence comprehension strategy were applied the tests used by Matsumoto (1986). The subjects were individually tested in a quiet room in the institution. At the beginning the subject were asked to name the miniatures or to point to the one called by the experimenter. Most of the subjects could correctly name or point to the toys. If a subject could neither name nor point, a few practices were given to the subject. Instruction in trails is as follows: "The tape recorder speaks a sentence. Listen carefully and act out the sentence by using these miniatures." If the subject couldn't understand the requirement of the task, some practice was given. At first in a trial, the experimenter sets up vertically an untransparent board and a transparent board in front of the subjects and place four miniature animals toys behind the boards. Then the experimenter removes the untransparent board and switches on the tape recorder to say a sentence. The transparent board on the table prevents the subject from operating miniature toys during the presentation of a sentence. After the presentation of a sentence, the experimenter takes away the transparent board and urged the subject to act out the sentence. The subject's responses were recorded with a video tape recorder.

Results

The effects of the event probability, the word order, and the particle on the response were analyzed to identify the sentence comprehension strategy for each subject. The effect of the event probability was valued by the number of responses in which a strong animal (lion or tiger) chases a weak animal (sheep or pig). If the number of the response was beyond 12 in the 16 trials in which probable and improbable sentences were presented, the subject was identified to use the event probability strategy. The effect of the word order was valued by the number of the responses indicating that an animal of expressed by the first noun chases an animal expressed by the second noun. If the number of the responses was beyond 18, the subject was recognized as using the word order strategy. The effect of the particles was valued by the number of the correct responses. If a subject could correctly act out the sentence according to the particles on more than 18 trials, the subject was recognized as using the particle strategy. In the responses, an animal of the noun marked by "ga" chases an animal of the noun marked by "wo".

The number of the subjects for each comprehension strategy is shown in Table 1. Eight subjects use the event probability strategy, 8 subjects the word order strategy, and 6 subjects the particle strategy. Ten subjects were not classified into any strategies.

Experiment II

Method

Subjects. The subjects were the same as Experiment I.

Materials. The sentences were the same as Experiment I.

Procedure. The subjects were individually tested at the same room in Experiment I.

The subjects were asked to imitate the sentence that the experimenter had called. In the training session, three sentences were presented: "boku/watasi no uthi (My house)", "uma ha ookii (The horse is big)", "Bokura/watasitachi ha yoru neru (We sleep at night)". The sentences in this experiment were presented with pre-randomized order through a tape recorder.

Results

Presented in Figure 1 are the percentages of correct responses for event probability strategy group, the word order strategy group, and the particle strategy group. The correct response is that a subject correctly imitates all words including the particles. The analysis of variance (ANOVA) with respect to the number of correct response indicates that the difference between the groups is significant ($F(2, 21)=8.55$, $p<.01$). Thus Multiple Range Test of Scheffe was done, indicating that the number of

TABLE 1

Predominant sentence format for each subject in the imitation and production tasks.

subject	strategy	formats	
		imitation tasks	in production tasks
1	probability	OTHERS	OTHERS
2	probability	UNCLASSIFIED	OTHERS
3	probability	OTHERS	OTHERS
4	probability	OTHERS	OTHERS
5	probability	OTHERS	SOV
6	probability	SOV	SOV
7	probability	SOV	SOV
8	probability	SOV	SOV
9	word order	SOV+OSV	U
10	word order	OTHERS	OTHERS
11	word order	SOV	SOV
12	word order	OTHERS	U
13	word order	OTHERS	OTHERS
14	word order	SOV	SOV
15	word order	SOV+OSV	OTHERS
16	word order	SOV+OSV	SOV
17	particle	SOV+OSV	OSV
18	particle	SOV+OSV	SOV
19	particle	SOV+OSV	SOV
20	particle	SOV+OSV	SOV
21	particle	SOV+OSV	OSV
22	particle	SOV+OSV	SOV

correct responses in the particle strategy group is significantly superior to both that in the event probability group and that in the word order group ($p<.05$).

The sentences in the responses were classified into three types: SOV, OSV, and OTHERS. The percentages of SOV, OSV, and OTHERS are shown in Figure 2. The differences between the sentence comprehension strategy groups were analyzed with ANOVA for each type of sentence. The analyses indicate that the difference of OSV between the sentence comprehension strategy groups is significant ($F(2, 21)=6.76$, $p<.01$). Then Multiple Range Test of Scheffe was done, displaying that the number of OSV in the particle strategy group is significantly superior to that in the other groups ($p<.01$). No significant difference between the sentence comprehension strategy groups was found with respect to SOV and OTHERS. Although the differences between the particles strategy group and other groups are very large about SOV, the difference is not significant.

In addition to these analyses, the predominant sentence formats were identified for each subject. If the number of a specified type of sentence was beyond 2/3 of the responses in a subject, it was judged to be the predominant format of the subject. If the number of a specified type of sentence was under 2/3 of the responses in a subject, the subject was judged to have more than two formats. In the subjects, the format that appears beyond 8 trials seemed to be his/her predominant formats. The predominant formats for each subject were shown in Table 1.

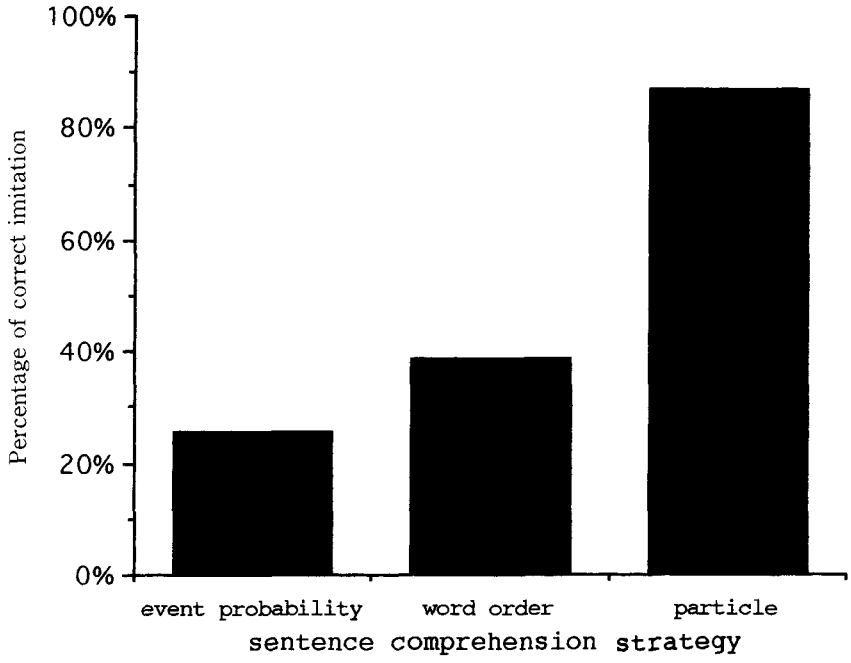

FIGURE 1 The percentage of correct imitation for each sentence comprehension strategy.

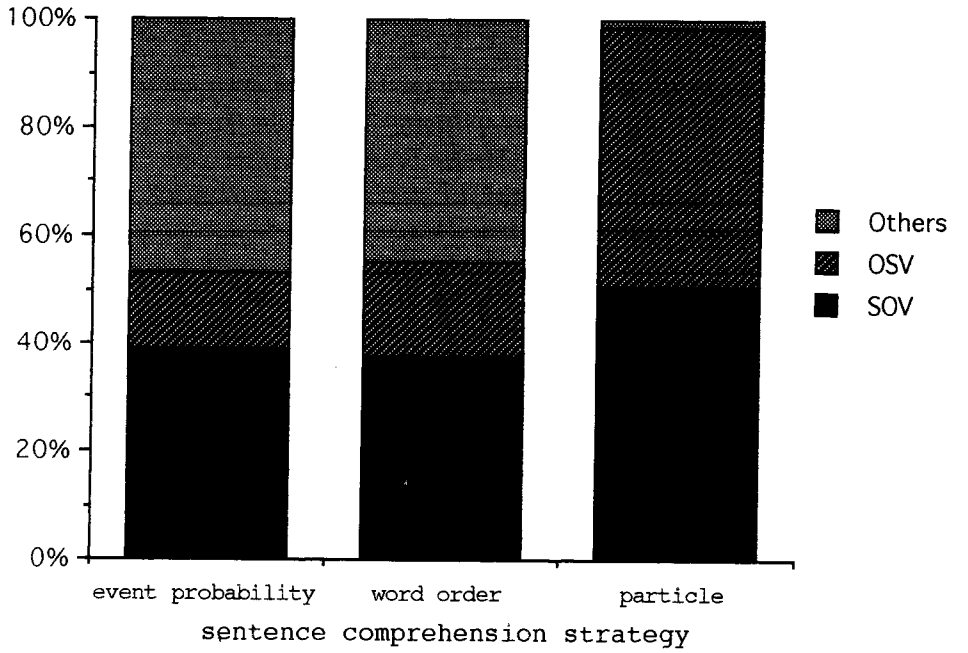

FIGURE 2 The percentage of SOV, OSV, and others in response of sentence imitation tasks.

Experiment III

Method

Subjects. The subjects were the same as Experiment I and II.

Materials. Twenty-four cards, on which there was a picture that showed one animal chaseing an other animal, were presented to the subjects. These animals were a lion, a tiger, a pig, and a sheep. There were six ways in pairing the animals: a lion and a tiger, a lion and a pig, a lion and a sheep, a tiger and a pig, a tiger and a sheep, a pig and a sheep. For each pair four cards were made. On the first card is a picture showing that an animal (A) on the right-hand side chases another animal (B) on the left-hand side, second, B on the right-hand side chases A on the left-hand side, third, A on left-hand side chases B on right-hand side, fourth, that B on left-hand side chases A on right-hand side.

Procedure. The room for the test is the same as in Experiment I. The experimenter sits in front of the subject. After the naming task of the animals, subjects were instructed as follows: "I will show you a picture in which an animal chases another animal. Would you describe the picture." While the subject was responding, the card was presented. The 24 cards were given in pre-random order.

Results

In the response, misnamings were found at six percent of the trials. No subject misnamed the animals in more than a half of the trials. Since misnamings seem to be triggered by carelessness, we eliminated the errors from our analysis.

We scored the figure of responses telling that the actor-patient relationship was

correctly described by using the particles, "ga" and "wo". Fig. 3 showed the percentage of the correct response for each strategy group. The differences between the sentence comprehension strategy groups were analyzed with ANOVA. The analysis indicates that the difference between sentence comprehension strategy groups is significant ($F(2, 21)=8.32$ $p<.01$). Thus Multiple Range Test of Scheffe was done, displaying that the number of correct production in the particle strategy group is significantly superior to that in the other groups ($p<.05$).

The assignment of the actor-patient relationship to word order was scored for each of the subjects. The assignment of the actor-patient relationship to word order was that the actor was assigned to the first noun and the patient was second noun. For example, when the subject had seen a picture where a sheep chases a pig, he/she describes the sentence as "hitsuji (a sheep)-particle-buta (a pig)-particle-tsukamaeru (chase)". If the number of the assignments for a subject was significantly superior to a chance level, the subject was identified as using the assignments predominantly. The percentage of the subjects using the assignment for each sentence comprehension strategy can be seen in Fig. 4: 75% for event probability strategy; 63% for word order strategy; 83% for particle strategy. There is no significant difference among the sentence comprehension strategy groups.

The sentences of the responses were classified in term of the sentence formats (Fig. 5). The differences between the sentence comprehension strategy groups were analyzed with ANOVA for each type of sentence. No significant difference was found because the variations among the subjects were too large. The differences between SOV, OSV, and OTHERS were analyzed in the same way for each sentence comprehension strategy group. For the particle sentence comprehension strategy group, the

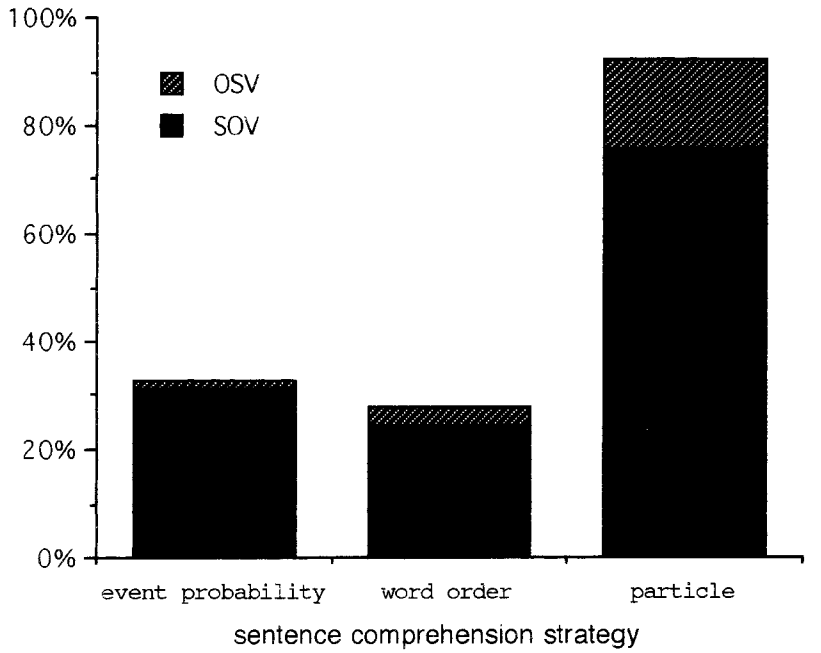

FIGURE 3 The percentage of correct production.

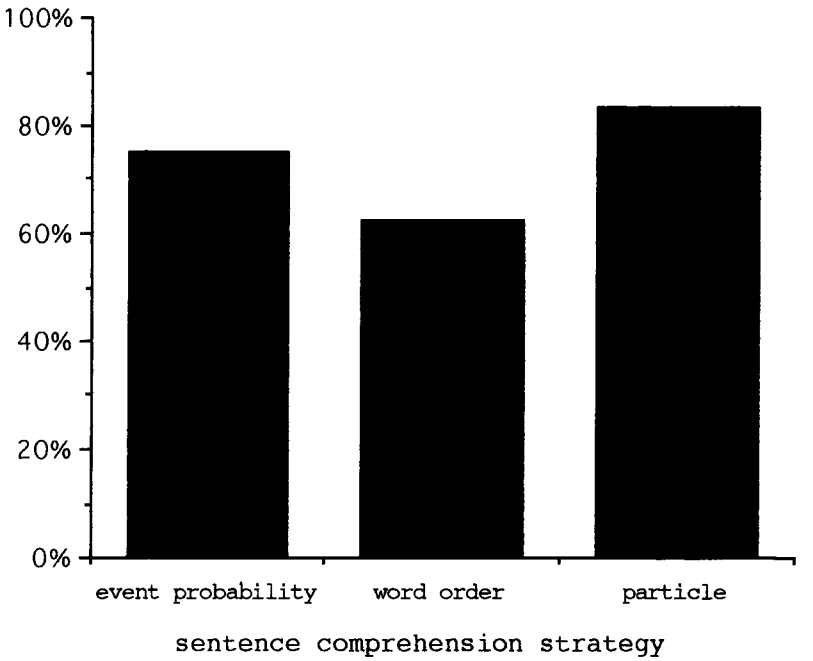

FIGURE 4 Percentages of the subjects who assign the actor-patient relationships to word order.

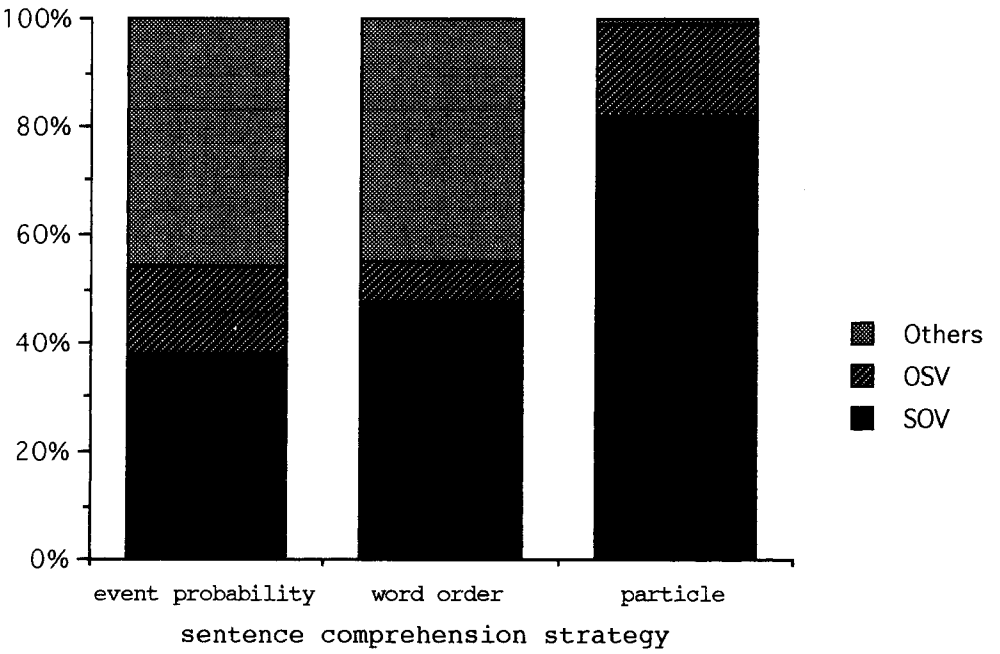

FIGURE 5 Percentage of SOV, OSV, and others in sentence production tasks.

main effect of sentence formats was found ($F(2,17)=10.17$, $p<.01$). The Multiple Range Test of Scheffe displayed that the number of SOV was significantly superior to both that of OSV and that of OTHERS ($p<.05$).

The sentence formats that are predominantly used in the responses are identified in the same way as in Experiment II. The predominant formats for each subject are presented in Table 1. Half of the event probability strategy group and the word order strategy group use neither SOV nor OSV formats in sentence production tasks, misusing the particles. The particle strategy group, on the other hand, correctly use the SOV or OSV formats.

Discussion

The result of the sentence imitation experiment is similar to that of Matsumoto and Furutsuka (in press). The subjects of the particle strategy group could correctly imitate both SOV and OSV. Many subjects of the event probability strategy group and the word order strategy group could not imitate the OSV. There is no difference between the event probability strategy group and the word order strategy group with respect to the sentence format.

The results of the sentence production tasks indicated that the subjects of the particle strategy group describe the event according to the sentences which include particle "ga" and "wo". The majority of the correct productions were SOV, and only a subject of the particle strategy group represents the event by using OSV. It is possible to built the two explanations for the reason that many subjects used the SOV format. First, the instruction, in which the experimenter presents the SOV formats as the model, leads to the usage of SOV. Second, the SOV is a canonical sentence in Japanese, and the subject is more familiar to the SOV formats than OSV formats.

A few researchers (Hakuta, 1972; Chapman and Miller, 1975; Goto, 1989) studied the relationships between sentence comprehension and sentence production. Chapman and Miller (1975) suggested that the production precede the comprehension. Goto (1989) found that the usage of the particle in production task precedes the comprehension of particles in Japanese normal children. In the present study some subjects of the word order strategy, who could not understand the particles in the sentence comprehension tasks, described the event on the picture by using the SOV format, which includes the particles. Taking into account the development of the sentence comprehension strategy (Hayashibe, 1975), it was obvious that the comprehension of the particles follows the utilization of particles in production in mentally retarded individuals.

We found the interesting fact in the assignment of the actor-patient relationship to the word order. The majority of the event probability groups, who cannot use the cue of word order in the sentence comprehension tasks, could assign the actor-patient relationship to word order in the sentence production tasks. In short, as for word order the production precedes the comprehension. No differences were found in the assignment between sentence comprehension strategy groups.

On the other hand, there are enormous differences of the sentence formats between the sentence comprehension strategy groups. In the event probability strategy group and the word order strategy group, nearly a half of the responses are other formats, which include the linguistically incorrect sentences. The differences of correct responses among sentence comprehension strategy in the sentence production tasks resulted from the differences of the sentence formats, which each sentence comprehen-

sion strategy group acquires.

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