ANN.BULL.RILP(1991)No.25, 147-159

Word Association in Aphasia : The Semantic Relationship between stimulus and response.

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Introduction

Regardless of the aphasic type or the severity of language inpairment, word finding difficulty is one of the most common disorders in aphasic patients. Among the therapy methods that have been advanced, it seems that the most effective comes from investigating the semantic fields of aphasic patients although details remain to be clarified [1)2)3)4)5)6)].

In order to develop an effective therapy method for word finding difficulties, it is necessary to investigate the structure of verbal associate networks and analyze the relationship between words for aphasic patients. Word association tests have been used by the authors for this purpose. Some of our findings are as follows :

1.The responses of aphasic patients show some differences from those of normal subjects.

2.The lexical categories of responses are apt to be the same as those of stimulus words in aphasic subjects.

3.The percentage of antonymous or contrast response words increases in the case of abstract stimuli [7)].

The purpose of this study is to make clear the semantic relationship between stimulus and response through two different methods; free word association and word selection.

Method

Subjects

Thirty chronic aphasic patients served as subjects in this study (17 males, 13 females; mean age±SD, 59.7±12.5 years; duration of aphasia, 20.1±13.0 months) all of whom had received speech therapy. On the basis of SLTA results, ten anomic, ten Broca's, and ten Wernicke's patients were selected. The etiology of the aphasia was a single, left hemisphere cerebrovascular accident for all patients. A control group consisted of 20 non-brain-damaged subjects (15 males, 5 females; mean age±SD 61.8±3.9 years). Subject data regarding age, total scores on the SLTA and total scores on Raven's Colored Progressive Matrices are presented in Table 1.

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Procedure

The following two experiments were conducted. The same 20 stimulus words were used in both experiments.

(Experiment 1)

The stimulus words were spoken simultaneously with presentation of a card containing written characters (either Kanji or Kana). Subjects were asked to respond with 4 single words as associations as soon as they were presented the stimulus words. Not only oral responses but also writing responses were accepted. Time was limited to 1 minute per stimulus. If the subject could give 4 words before one minute elapsed, the next stimulus word was presented.

(Experiment 2)

The list of words used in Experiment 1 was presented orally the subjects. For each word, the subjects were also shown cards with five responses on them. The subjects were asked to select one response which seemed to be the most related to the stimulus word. The 5 response words were 1)superordinate : name of the class of which the target is a member (e.g. "apple" -- "fruit"); 2)functional context : situation in which the target occurs or another situationally determined object (e.g. "apple" -- "knife"); 3)contrast coordinate : another member of the same superordinate class (e.g. "apple" -- "orange"); 4)clang : a sound-alike word (e.g. "ringo (apple)" -- "kinko"); or 5)unrelated :(e.g. "apple" -- "pencil")(see Table 2).

Each session was 30 minutes in duration. An average of two sessions was required to complete the above two experiments, which were conducted by the same experimenter, who was one of the authors.

Results and Discussion

The results of Experiment 1 are presented in Figure 1. If the subject responded with 4 words to every stimulus word, the total number of responses would be 80 words. Eighty words would be 100% in this figure. The graph represents the percentages of the total number of responses by the group. Whereas the average percentage of the normal subjects was 99.6%, that of the aphasic patients was only 66.1%.

This result indicates that it is difficult for aphasic patients to think of several responses to stimuli, and that they have a problem with word recall.

As for differences among the aphasic types, the percentage of the total number of

responses was highest in anomics, followed by Broca's aphasics and Wernicke's aphasics (see Fig.2).

In the scattergram of Figure 3, the total number of responses and scores on the naming test of the SLTA are plotted. Each symbol represents one subject: "Δ" represents the anomic patients, "□" Broca's, and "●" Wernicke's. The correlation coefficient between the total number of responses and the scores on the naming test was fairly high, 0.78. Nevertheless, the dots of the Broca's aphasics and the Wernicke's aphasics are more scattered in comparison with those of the anomics; statistical differences were not observed among the aphasic types.

It is obvious that the severity of the word finding difficulty is reflected in the ability at word association.

The responses in free word association were classified into 6 categories with regard to their semantic relation to the stimulus words, and the percentage in each category was analyzed within the subject groups (see Fig.4). The six categories are as follows. 1)functional context, 2)contrast coordinate, 3)superordinate, 4)syntagmatic : word of different grammatical class (e.g. "dog" -- "bite"), 5)subordinate : member of the target as a superordinate class (e.g. "dog" -- "bulldog"), and 6)others : this group includes clang, unrelated words, perseverations and so forth. In the normal control group, the percentage of functional context words was highest (57.7%), followed by syntagmatic responses (22.7%), and contrast coordinate words (10.4%). The percentages of superordinate words (4.0%), subordinate words (5.1%), and others (0.4%) were very low. In the aphasic group, a similar tendency was observed, that is; a high percentage of functional context words (40.0%), and a low percentage of superordinate words (4.6%) and subordinate words (5.2%). On the other hand, the aphasic group showed a fairly high percentage of other responses (15.8%) and was different in this sense from the normal subjects.

In general, the same tendency observed in the normal subjects was observed among the aphasic groups. The anomic group showed a similar tendency to the normal subjects in the percentage of each response category (see Fig.5). In the Broca's group, it was noticed that the pecentage of syntagmatic responses was low (16.9%) in comparison with the anomics (23.5%), and that the percentage of contrast coordinate words was much higher (20.7%) than in the anomics (12.6%). As for the Wernicke's group, the most outstanding point was the high percentage of other responses (28.3%) which were response types peculiar to aphasic patients.

Figure 6 presents the results of Experiment 2. These graphs indicate the average percentage of the word categories which the subjects selected. In the normal subjects, superordinate words were chosen with a high frequency (59.8%), followed by functional context words (25.8%), and contrast coordinate words (13%). The percentage of clang words was only 1.5%, and normal group did not choose unrelated words. On the other

hand, as described above, in word association, the percentage of superordinate words was low. These results show an obvious contrast. In the aphasic group, there was a similar tendency, namely, the percentages of superordinate words and functional context words were high (41.0%, 33.9%). In addition, the percentage of contrast coordinate words was relatively high (21.9%). Aphasic patients, too, seldom selected clang words and unrelated words (2.1%, 1.1%). This is a different pattern from that obtained in the word association test.

Among aphasic types, the percentage of superordinate words was high in both the anomic group (43.5%) and the Broca's group (48.6%), and the selection patterns of these groups were similar to the normal subjects (see Fig.7). On the other hand, as for the Wernicke's group, the percentage of superordinate words was the lowest (30%), and the percentage of contrast coordinate words was the highest (27.5%) among the aphasic patients. Their selection pattern was different from that of the other aphasic groups.

These differences among the aphasic groups seems to relate to the severity of language disorder, especially with regard to the disfuction of semantic processing in the Wernicke's patients. Compared to the anomic and the Broca's patients, the problems that the Wernicke's patients have are more complicated and are not restricted to language disorders.

Concluding Remarks

As mentioned above, there are differences between word association and word selection in both normal subjects and aphasic subjects. These results suggest that the processing of word association and that of word selection are different. In addition, aphasic patients show not only quantitative but also qualitative differences from normal subjects. These differences are the frequent appearence of peculiar responses and a low percentage of functional context responses in word association and a high percentage of contrast coordinate words in word selection. It was noticed that the semantic disorders of the Wernicke's patients were the most severe among the aphasic types.

References

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Table 1 Mean±SD, age, scores on SLTA and scores on Raven's Colored Progressive Matrices for the control group and three aphasic groups

	N	Age (years)	Scores on SLTA	Scores on Raven's Colored Progressive Matrices
Anomic	10	57±14	198±18	28±7
Broca's	10	59±15	171±45	28±7
Wernicke's	10	63±9	125±53	24±5
Control	20	62±4		

Table 2 Procedure of Experiment 1 and Experiment 2

	Stimuli	Responses
Experiment 1	20 nouns	give associate words orally or in writing
Experiment 2	20 nouns (each stimulus word with 5 related words*)	word selection

*Examples of Word List in Experiment 2
Target Word : apple
1)superordinate (fruit)
2)functional context (knife)
3)contrast coordinate (orange)
4)clang ("kinko")
5)unrelated (pencil)

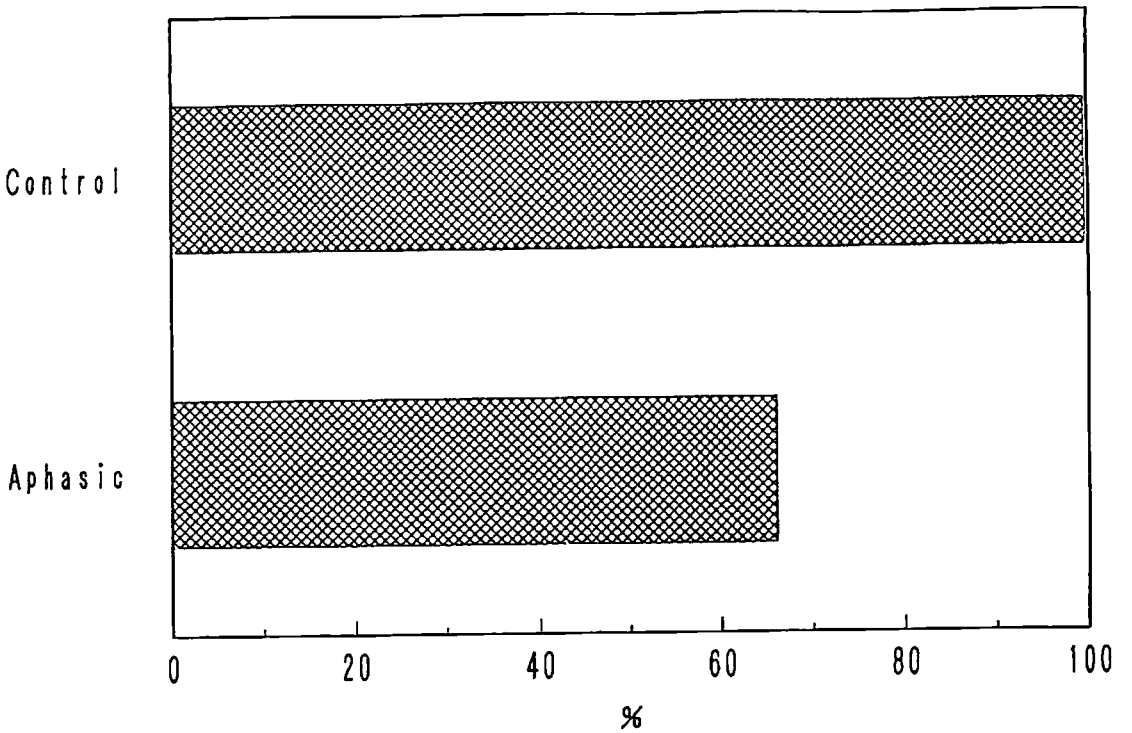

Fig.1 The percentage of word association responses by the control and aphasic subjects.

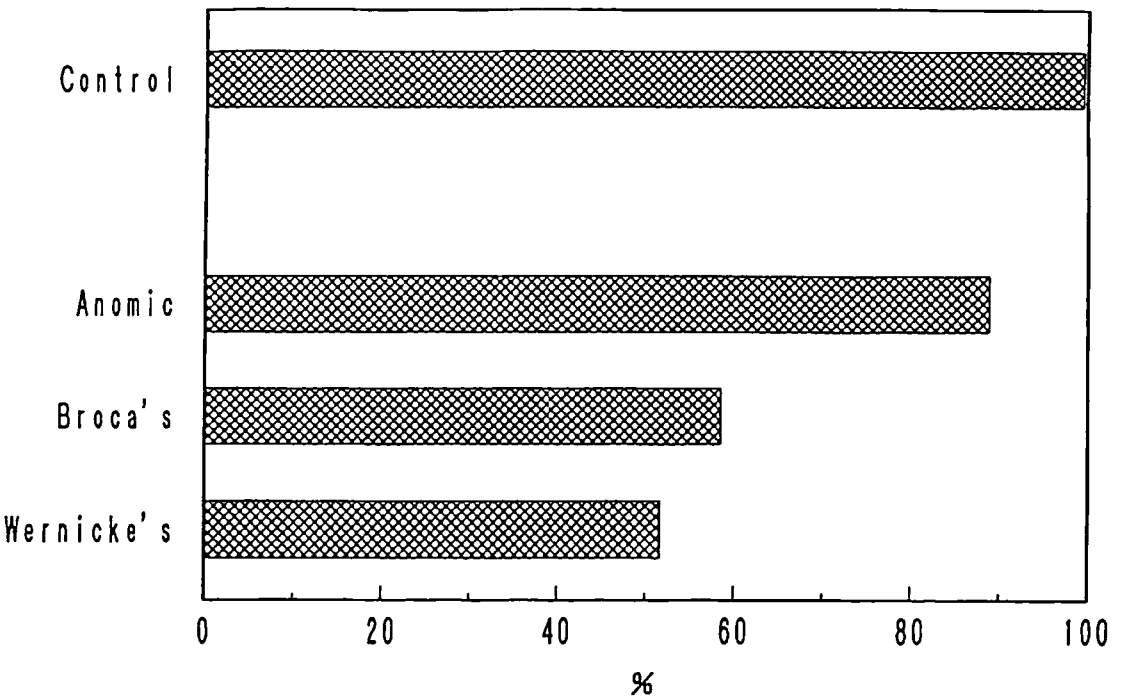

Fig.2 The percentage of word association responses in each type of aphasia.

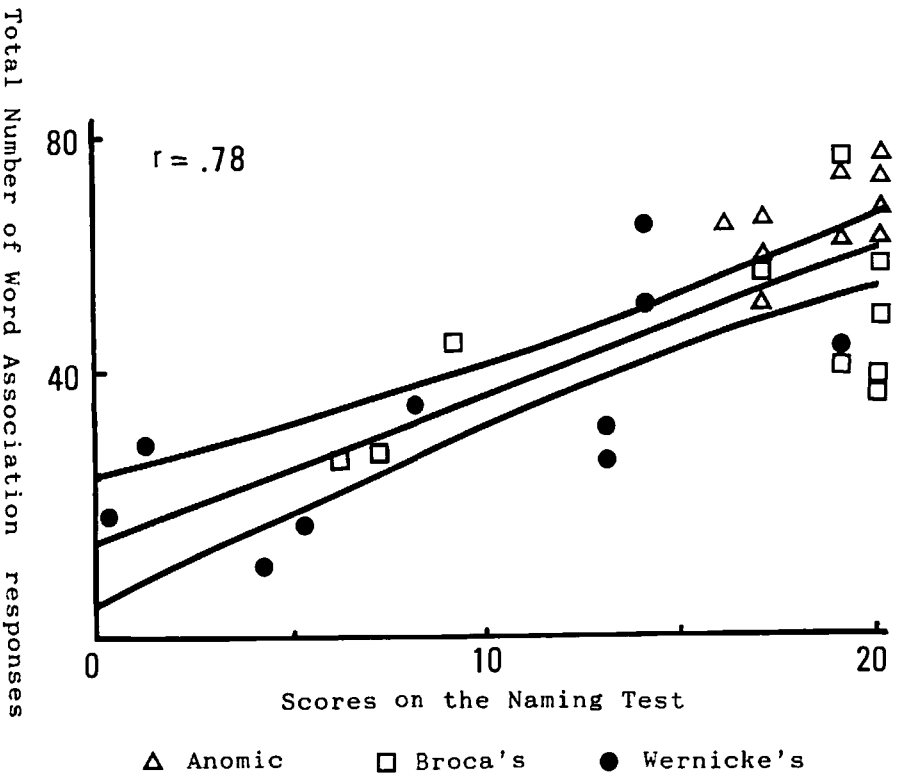

Fig.3 Relationship between total number of word association responses and scores on the naming test.

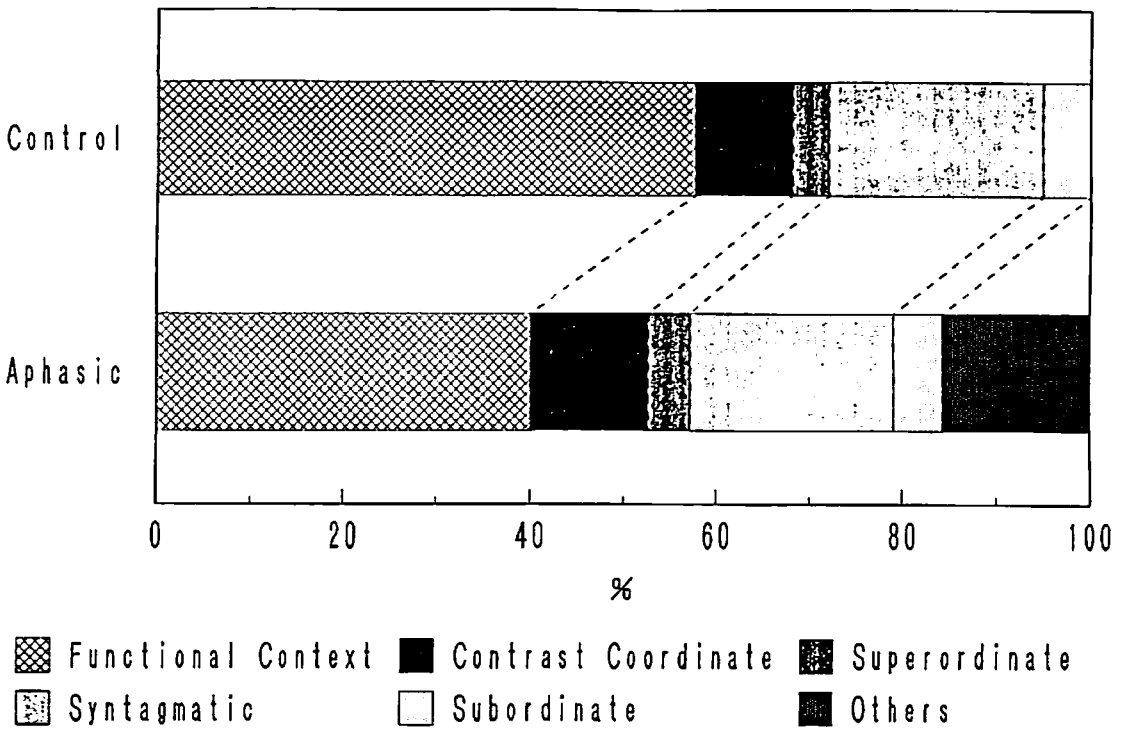

Fig.4 Categorical analysis of word association responses by the control and aphasic subjects.

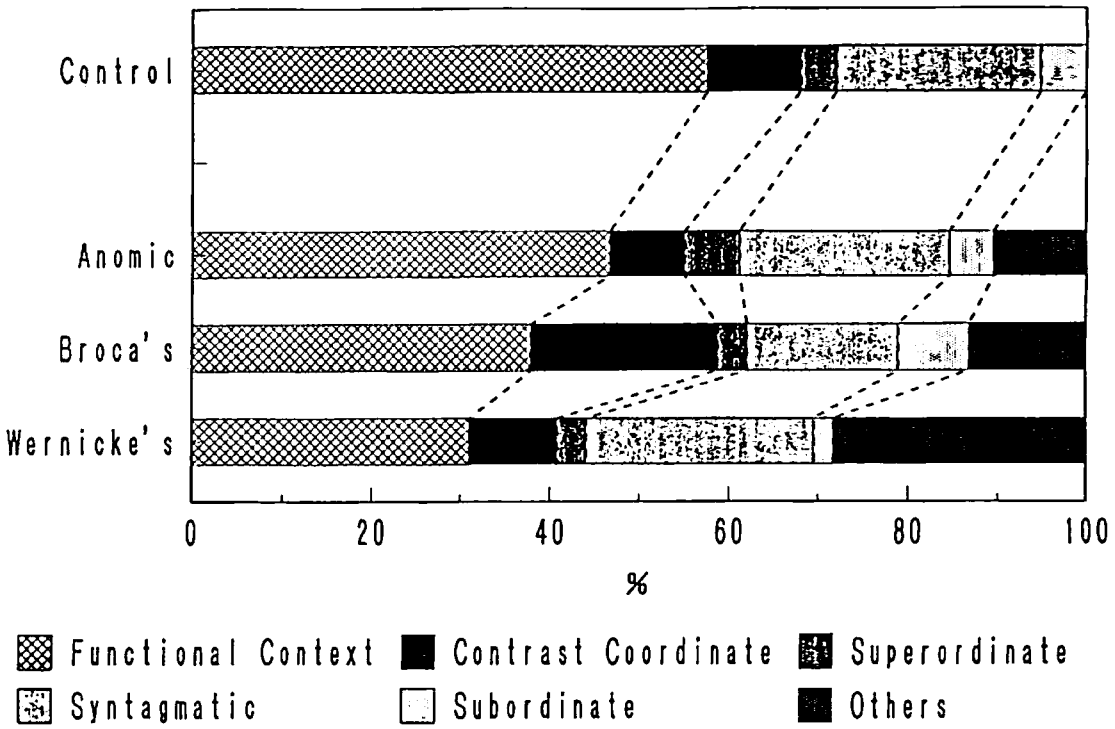

Fig.5 Categorical analysis of word association responses in each type of aphasia.

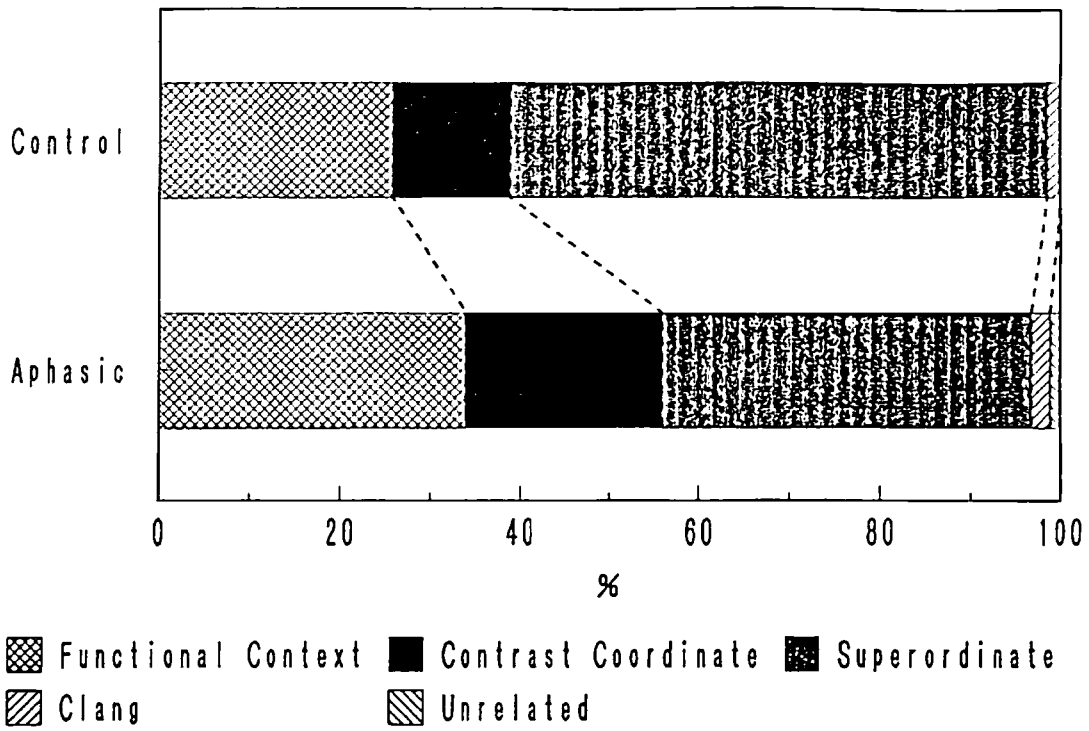

Fig.6 Categorical analysis of word selection responses by the control and aphasic subjects.

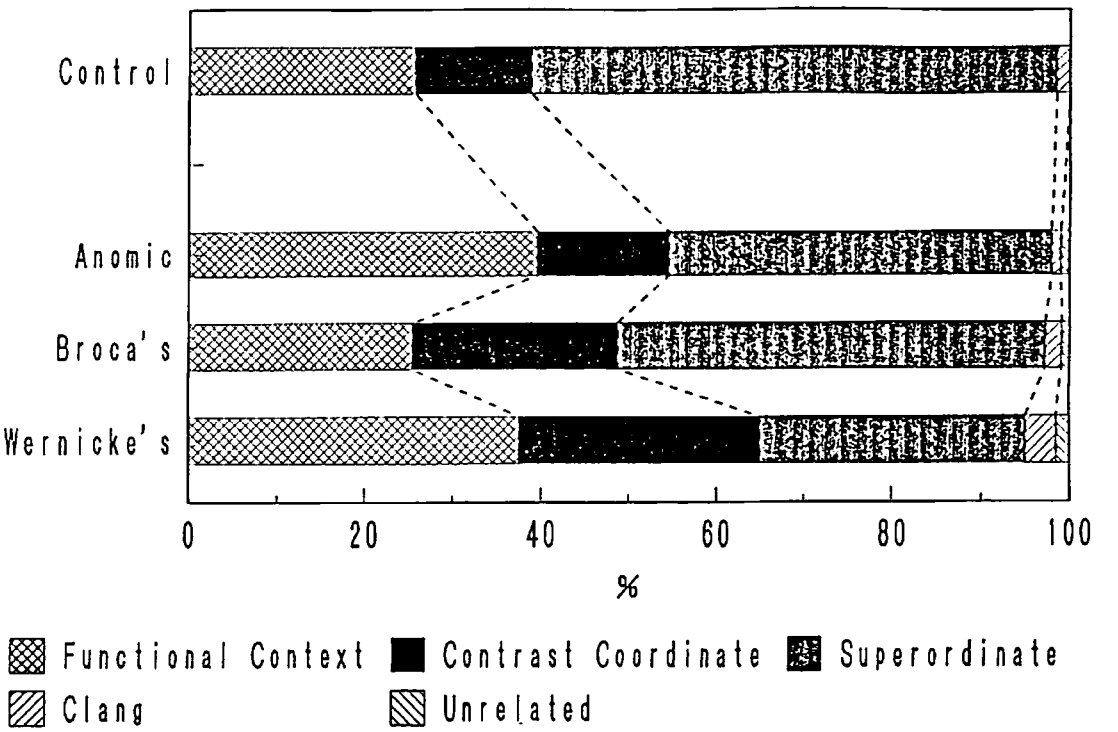

Fig.7 Categorical analysis of word selection responses in each type of aphasia.