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THE EFFECT OF WORD ASSOCIATION AS A RETRIEVAL CUE UPON THE RECALL

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This experiment was carried out to examine the effect of word association on the recall. First, each subject was required to recall as many items as possible freely, immediately after the presentation of 20 learning items. Next, the subject was given an association task, in which he had to generate some nouns as response words to stimulus words. The half of stimulus words were the words whose most frequent response words were the learning items. Finally, each subject was asked to recognize the learning items from among the response words produced by word association. In control condition, each subject was given an irrelevant task (computation task) in place of the association task after the immediate free recall, and then asked to recall freely all the learning items previously presented. The results were as follows: the learning items not recalled in the immediate free recall were significantly more recalled with the aid of word association, than in the case of the lack of the aid of word association. It follows from this that word association as a cue has a facilitating effect on the recall. Further, it was in the early and the middle parts of serial position, that the learning items were more recalled with aid of word association as a cue. This indicates that word association as a retrieval cue mostly affects the recall of the learning items from the long-term store.

All the learning items that have been stored can not always be recalled in a free recall. In this case, we give subjects some kinds of cue (category, associate, some aspects of stimulus, etc.) to see whether there are still items stored. It has been argued that whether a cue is available or not depends upon how subjects encode the learning materials (e.g., Tulving & Thomson, 1973). In general, the way of encoding is determined by the nature of materials as well as the strategy of processing the learning materials. Here we arranged the to-be-learned words in such a way that words were meaningful, but irrelevant to one another with regard to an association within a list. This aimed at the use of word association as a dominant cue. We arranged the stimulus words in word association in such a way that they were closely relevant to the to-be-learned words with regard to the association. First, we had an attempt to examine how word association affected the recall of learning items. In one condition, subjects were asked to produce associates to stimulus words after the immediate free recall of the learning items, and then to recognize the learning items from among the associated words. In the other condition, subjects were given a task irrelevant to the learning items after the immediate free recall of the learning items, and then they were asked for the final free recall of learning items. Two conditions were compared concerning the number of the learning items which were not recalled in the immediate

free recall. Secondly, we were concerned with the problem as to how word association as a retrieval cue affects the input order of the learning items. Namely, it was examined how the early items, the middle items, and the last items in the serial position of learning list, all of which had not been recalled in the immediate recall, were recalled with the aid of word association.

METHOD

Basic procedure: Subjects were presented with 20 words. Each word was shown them in the window of the memory drum, one at a time, for two seconds. Immediately after the presentation of 20 words, subjects were required to recall all the words presented, regardless of the order of the presentation. Each subject was given five trials with this procedure. The following experimental condition was added during the intertrial interval.

Experimental condition: Either an association task or an irrelevant task was given each subject after a given trial. In an association task subjects had to produce associates to stimulus words and write them down beside those stimulus words on a sheet of task paper (Association). 1 to 3 associates to each stimulus word were supposed to be nouns. 40 stimulus words were composed of 20 stimulus words whose most frequent associated responses were 20 words as the learning items, and 20 stimulus words which were irrelevant to the learning items with regard to an association. After writing down the associated words to all the stimulus words, subjects were told to enclose those words with circles, if they found the learning items previously presented among the associated words (Recognition). In an irrelevant task subjects were given the Uchida-Kraepelin Psychodiagnostic Test after a given trial. After the Test, they were required to recall all the learning items freely again (Final Recall). Each task lasted for 20 min. after the 1st trial, and for 15 min. after the 2nd to 5th trial.

Learning materials: Learning items and stimulus words of word association were selected from a table of the word association norm (Umemoto, 1969). 20 words of 40 stimulus words were words whose most frequent associated responses were the learning items (e.g., INVENTION as a stimulus word — EDISON as a learning item). The remaining 20 stimulus words were words irrelevant to the learning items with regard to an association. The same stimulus words were used in the association task after a given trial in a random order.

Subjects: 18 subjects served in this experiment for partial fulfillment of a requirement for the introductory psychology course. Each subject was given either an association task or an irrelevant task over the task periods after the 1st to 5th trial more than once respectively.

RESULTS AND DISCUSSION

As the learning items were very meaningful, a good performance of the immediate free recall can be expected. Figure 1 shows the proportion of the immediate free

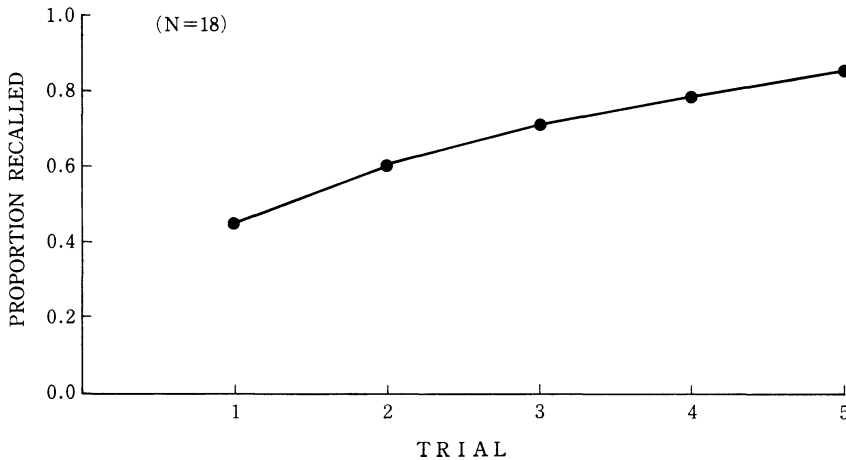


Fig. 1 The proportion of the learning items recalled in the immediate recall as a function of number of trials.

recall. Because of the rapid rate of the learning, the role of word association is considered to be played especially in the early learning trials. Therefore, an analysis will be made of the early part of the learning curve. The learning items were included among the response words produced by word association. We can not say, however, that the subject can identify all the learning items included among the response words with the to-be-recalled items. It is likely that the subject merely generated the learning items as the response words to stimulus words. What is needed is to make the subject recognize which of the written words as the response words to stimulus words were the items presented during the learning trials. The recognized items contained both the items recalled and the items not recalled in the immediate recall. Figure 2 shows the results of Association and Recognition in the tasks after the 1st trial (T1) and after the 3rd trial (T3). With regard to the ratio of the number of the recognition to the number of the association in T1, there was a marked difference between the items recalled and the items not recalled in the immediate recall. This suggests that subjects mostly produced the response words, not as the learning items, but as the mere response words to stimulus words, concerning the items not recalled in the immediate recall. On the other hand, however, a high degree of cue dependence for the recognition is found in T1. Figure 3 shows the percentage of the recall about the items not recalled in the immediate recall with word association or without word association. In Recognition, subjects had to generate the response words to stimulus words and recognize some of those words as the learning items previously presented. In Final Recall, subjects had to recall all the learning items freely again after the irrelevant task. Table 1 shows mean number of the recall with word association or without word association about the items not recalled in the immediate recall. For the summed data of T1 and T3, a test for the difference between Recognition and Final Recall about the items not recalled

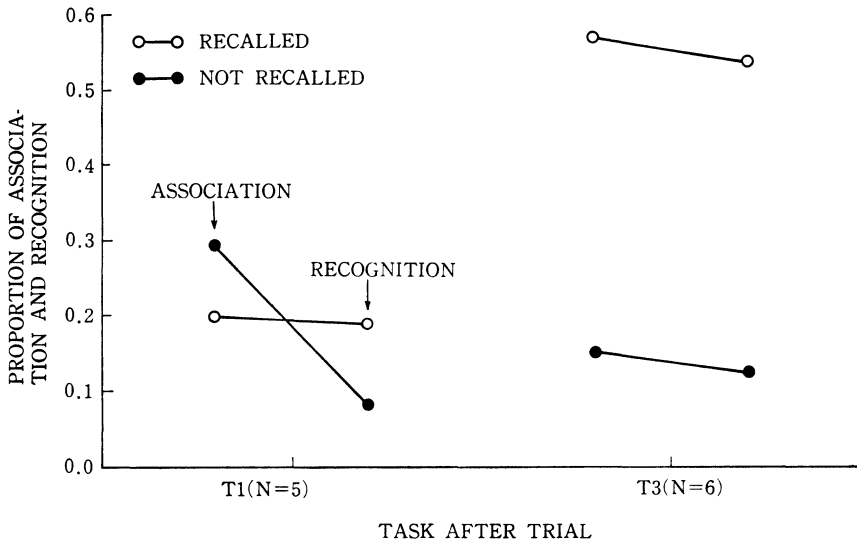


Fig. 2 The proportion of association and recognition concerning the items recalled and the items not recalled in the immediate recall.

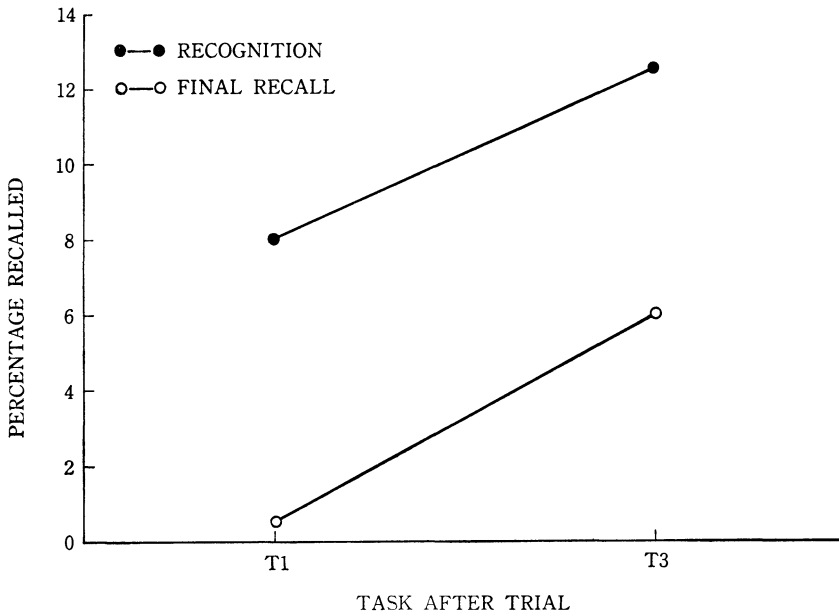


Fig. 3 The percentage of the items recalled with cue or without cue.

in the immediate recall was significant ($t'=3.16$, $df=10$, $p<.02$, Cochran-Cox method). This indicates that word association as a retrieval cue facilitates more the recall of the items not recalled in the immediate recall than in case of the usual free recall. We

Table 1. Mean number of the learning items recalled with cue or without cue

Condition	Task 1	Task 3	Task 1+3
Recognition	1.6(N=5)	2.5(N=6)	2.1(N=11)
Final Recall	0.1(N=7)	1.2(N=5)	0.6(N=12)

Table 2. Mean number of associated words and recognized items about the items not recalled in the immediate recall

Condition	Serial position	T1 (N=11)	T2 (N=7)	T3 (N=6)	T1~T3
Association	Early (1~7)	1.6	1.6	1.2	1.5
	Middle (8~13)	2.2	2.3	1.2	2.0
	Last (14~20)	1.7	0.6	0.7	1.1
Recognition	Early (1~7)	0.8	1.0	1.0	0.9
	Middle (8~13)	0.7	1.1	1.0	0.9
	Last (14~20)	0.3	0.3	0.5	0.3

find here the effectiveness of the extralist cue, not by the method of association, but by the method of association followed by recognition. Figure 4 and Table 2 show the relationship between the serial position of the learning items and word association. Table 2 shows the mean number of the association and the recognition about the items not recalled in the immediate recall, in the serial position of the learning list. Figure 4 shows the ratio of the recognition to the association concerning the items not recalled in the immediate recall, in the three parts of the serial position of the learning list. The result suggests that the effect of word association as a retrieval cue depends upon the serial position of the learning list. The summed data of T1, T2, and T3 in Recognition, were statistically tested. The difference between the performance in the early part and that in the last part in the serial position was significant ($t=2.70$, $df=23$, $p<.02$). The difference between the performance in the middle part and that in the last part in the serial position was also significant ($t=3.08$, $df=23$, $p<.01$). The difference between the performance in the early part and that in the middle part in the serial position was not significant. This indicates that the parts where the learning items are more recalled with the aid of word association, are the early and the middle parts but not the last part. Further, the result suggests that the difference of performance in the different parts of the serial position gradually decreased, as trials proceeded. If we consider the performance in the early and middle parts of the serial position as

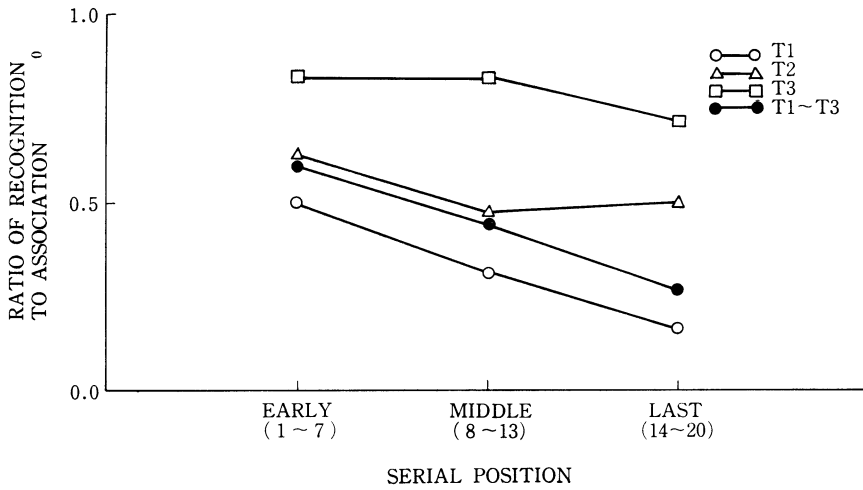


Fig. 4 The ratio of recognition to association about the items not recalled in the immediate recall.

the output from the long-term store and the performance in the last part as the output from the short-term store, it follows from the result that word association as a retrieval cue mainly affects the recall from the long-term store.

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