

The Subjective Organization in Free Recall Learning by School Children

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THE SUBJECTIVE ORGANIZATION IN FREE RECALL LEARNING BY SCHOOL CHILDREN

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The developmental change in subjective organization (SO) in multitrial free recall learning was examined with school children at three grade levels. Both measures of recall performance (P) and SO increased over the course of 16 trials, and these increases were larger for the elder age group. Of the relationship between SO and P, it was considered that SO might be one of the factors contributing to the integrative function of recall and the degree of its contribution might be different at different age levels.

A problem which has received increasing study in recent years has been that of organization in free recall. Some of the studies have approached the problem from the developmental viewpoint (Bousfield, Esterson & Whitmarsh, 1958; Laurence, 1966; Vaughan, 1968; Nelson, 1969). The information on the developmental changes in the ability to organize stimulus input would be useful to study the development of memory function and the nature of the organization process itself. According to Shuell (1969), three paradigms have been developed for the study of organization in free recall, and these differ in the experimental situation used for inducing organization, and, thus, differ in findings and theoretical interpretations. Although research in comparing these different types of organization (e.g., Puff, 1970) is important, further investigation within each paradigm using different independent variables is also necessary.

The present paper is the report of an experiment on subjective organization in multitrial free recall verbal learning by school children. The experiment which was performed to investigate the developmental process of subjective organization, is a variation of Tulving's (1962).

METHOD

Subject: Three groups of 115 children in the 2nd and 5th grades of the Elementary School and the 2nd grade of the Middle School affiliated with Niigata University served as Ss. Each group consisted of all the attending members of a single class from each grade. Their mean age and intelligence level are shown in Table 1.

Materials: 16 words were selected as learning materials based on the norm of Sakamoto (1958) and on the results of an association test given to the pupils of a class from the 3rd grade of the same Middle School. The criteria of selection were as follows: 1) common nouns which consisted of 3 or 4 letters, 2) no two items beginning with the

Table 1. The table of subjects.

Group	Grade level	Number of Ss	Mean age	Intelligence sigma score
I	2nd grade of Primary School	35 { Boy 18 Girl 17	8 years, 1 month	Mean 58.7 SD 6.8
II	5th grade of Primary School	38 { Boy 18 Girl 20	11 years, 1 month	Mean 60.1 SD 5.9
III	2nd grade of Middle School	42 { Boy 22 Girl 20	14 years, 2 months	Mean 64.2 SD 6.1

same first letter, 3) words which are in the vocabulary lists from the 1st to the 3rd grades of elementary school and which are included in the most important 1000 words in the lists, 4) no homonyms, 5) no words of foreign origin, 6) no immediately associative relations between any two words, and 7) words with nearly the same number of associates.

The 16 items were the following: いしゃ [iʃa] (doctor), にわとり [niwatori] (hen), さかな [sakana] (fish), すいどう [suido:] (waterworks), こたつ [kotatsu] (fixed body warmer), ぶらんこ [buranko] (swing), ひこうき [hiko:ki] (airplane), はさみ [hasami] (scissors), くつした [kutsuʃita] (socks), とけい [tokei] (watch), ちゃわん [tʃawan] (rice-bowl), きもの [kimono] (Japanese robe), ほうき [ho:ki] (broom), べんとう [bento:] (lunch), かがみ [kagami] (mirror), でんわ [denwa] (telephone).

Each item was printed photographically in Japanese cursive syllabary on a slide film.

Procedure: Ss in the three age groups were each given 16 free recall trials on the set of 16 words. The order of presentation of the words was that each word appeared in each serial position just once and was preceded and followed in the series by each other word just once in the course of the 16 trials. This eliminated any built-in sequential dependencies in the material. All children in each age group were tested as a group in their own classroom where they take lessons everyday. The order in which the 16 ordered lists were presented to the Ss was the same for each of the three groups. The stimulus words were presented by means of a Kodak Carousel slide-projector connected with an electronic time-regulator at the rate of 1-sec. exposure time and 1-sec. inter-item interval. At the end of the trial Ss were allowed 90-sec. (=inter-trial interval) to write down their recall on a booklet of record sheets with 16 lines.

In the instructions Ss were told that their task was to remember the words which successively would appear on the screen, that, at E's signal, they were to write down in any order as many words which they could recall, and that there would be 16 trials with the same words.

RESULTS

The changes in the recall performance (P), defined as the number of correct recalls per trial, and the level of subjective organization (SO) over the course of 16 trials for

each three age groups were investigated. Extralist intrusions were ignored in computing both P and SO scores. Repetitions of list words within a given trial were included in the recall matrix and thus entered the SO score, but not the P score. The SO scores were computed in exact accordance with Tulving's (1962) method. In the case of the second-order sequential organization based on pairs of successive responses, in addition to a single SO score for the total block of 16 trials (SO-Lag0), the following three SO scores were computed for successive blocks of 6 trials each by dividing the whole experimental period into three blocks: the block of Trials 1 to 6 (SO-Lag0-1), Trials 6 to 11 (SO-Lag0-2), and Trials 11 to 16 (SO-Lag0-3). In the case of the third-order sequential organization based on pairs of responses separated by one response, the SO score was computed only for the total block of 16 trials (SO-Lag1). The SO score of the fourth-order sequential organization was also computed only for the total block of 16 trials (SO-Lag2).

In Fig. 1, the mean number of words recalled over 16 trials and the mean values of the second-order SO calculated for successive three blocks of 6 trials for each age group are shown. Here, it is seen that at the first trial the upper three performance curves all start from the neighborhood of "the magical number 7" (Miller, 1956) and then increase over the course of trials, but the rates of increase differ with age. The

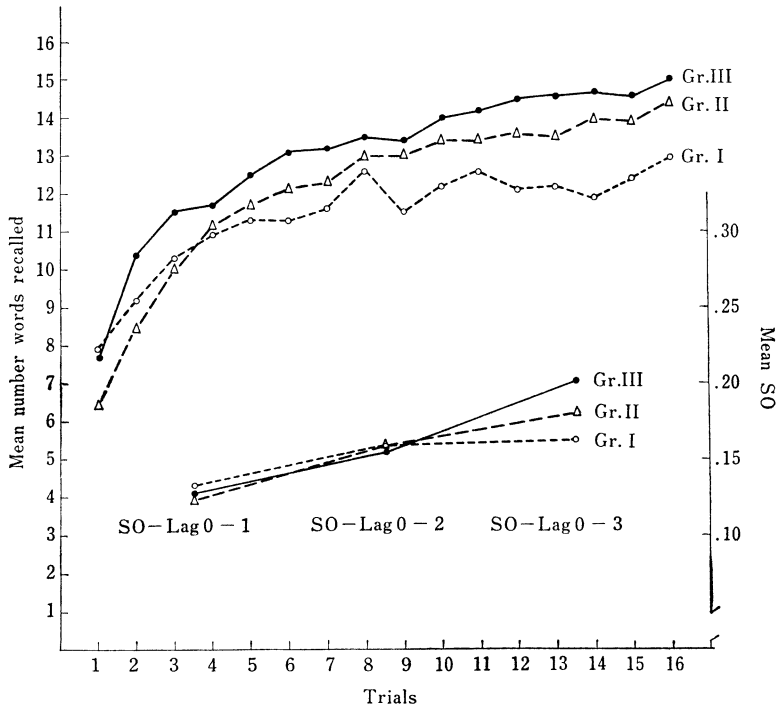


Fig. 1. Mean performance (upper three curves) and mean second-order SO (lower three curves) over the course of 16 trials by 3 age groups. (Values of performance are to be read from the left ordinate, SO from the right ordinate.)

Table 2. Means and standard deviations of SO.

Group	Lag Trials	Lag0				Lag1	Lag2
		1-6	6-11	11-16	1-16	1-16	1-16
I	Mean	.135	.159	.163	.216	.183	.183
	SD	.080	.053	.043	.034	.023	.024
II	Mean	.123	.158	.183	.226	.188	.169
	SD	.040	.061	.058	.040	.018	.019
III	Mean	.129	.155	.203	.228	.190	.185
	SD	.048	.047	.062	.036	.021	.024

differences among three groups in the performances of the last block of 6 trials, Trials 11 to 16, are significant by an analysis of variance ($F=23.31$, $df=2,112$, $p<.01$).

On the other hand, it is also shown that the changes of SO parallel those of recall performance. Namely, SO scores for three groups which are almost the same on the first and second blocks of trials become different in the same order of age as shown in the recall performance on the last block of 6 trials. The differences among SO scores for three groups on the last block (SO-Lag0-3) are shown to be significant by an H-test (Kruskal-Wallis Test) ($H_c=10.10$, $df=2$, $p<.01$).

The mean scores of the third- and fourth-order SO are also shown in Table 2, but no significant difference was found among the scores of these third- and fourth-order SO for the three groups.

DISCUSSION

It was found that there were increases in both measures of P and SO over the course of the 16 trials for each group, and the degree of increase ultimately attained was larger for the elder age group. These differences with age developed progressively through the process of the trials and became distinct in the later trials. From these results a causal relationship between SO and P is suggested. Laurence (1966) noted, however, on the basis of his data obtained on Ss of widely varying ages that any assumptions about the parallel nature of the phenomena which these measures might represent or about any causal relationship which might exist between them should be treated with caution.

About the relationship between P and SO, it seems appropriate to think that subjective organization is only one of many factors contributing to the integrative function of recall, and the degree of its contribution is different at each age level from young children to old people, as shown in Laurence's (1966) study.

It may be considered that within the range of age studied here, the degree of the contribution of subjective organization to recall performance is relatively constant; consequently, a parallel relationship is seen between SO and P.

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