

Effects of Indicating Categorical Names to Hearing Impaired Children on their Visual Memory

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The purpose of this study was designed to examine the effect of the indication of category names in visual memory in order to clarify the characteristic of serial visual memory of hearing impaired children. Exp. I was performed for the two kinds of groups, the clue recall conditioning and the free recall conditioning. In Exp. I, the recall condition was recognized to have main effect and the clue recall group could provide more recall of memory than the free recall group. Exp. II was performed to examine how the clue recall effect would change under the influence of frequency of trials while keeping the number of categories constant. In Exp. II, it was recognized that the clue recall condition provided more recall than the free recall condition in experimental trial and in both groups the more often the frequency of trials were given, the more number of recall was produced. These results showed the indication of category names had an influence on the recall of memory of hearing impaired children, however, the clue recall effect did not rely on the number of categories. From these results, it was suggested that the effect of indication category names on hearing impaired children depended on the factor of existence.

Tsuzuki (1981) made some experiments in order to clarify a modus of the visual memories of hearing impaired children. Developmentally examining the retrieval of information from the serial visual memory by a probe technique, Tsuzuki had the following findings: (a) Hearing impaired children were inferior to hearing children in using such strategy as utilizing the preceding items as clues and associating them with reaction items; no developmental changes were found as well: (b) also, they were not as well as hearing children when using serial position as clues: (c) besides, under the organization, they were inferior to hearing children when using both items and positions as clues. These findings suggest that it will be important to inquire into clues of meaning memory under the organization.

Therefore, Tsuzuki (1982) made the following experiments next. He tried to clarify the clues of the meaning memory under the organization by them. He intentionally controlled listed materials for memorizing and tested how

the amount of recall of the words which are classified into the materials for memorizing influenced on the visual memory. As a result, he suggested that the recall of the words would be functioning as an activater in the information processing.

The amount of the recall of the words will depend on the number of the categories. It has often pointed out and proved that hearing impaired children have poor vocabulary (Okada & Tsuzuki, 1978). Therefore, the activating functions under the organization differ according as hearing impaired are poor in the number of words which belongs to a category or they are poor in the number of categories itself.

Several studies on memory have been reported that the older the subjects get, the more they can recall in free recall using listed facts which are classified into several categories. According to one possible interpretation about this, the reason why younger children recall less is they can not efficiently recall the facts or items they

stored once (Eysenck & Baron, 1974). Eysenck and Baron (1974) think that even if the younger children stored as many facts as the elder ones they could not efficiently recall them using the category names as clues because they can not recall the category names as well as the other ones. Giving a category names as a clue to a recall (here after referred name as clue recall), in fact, promotes the recall and, therefore, they insist that the indication of category names promotes the recall of the category names and the facts which are classified into some category names (Eysenck & Baron, 1974). Further, there is a research which shows the effect of the clue recall depends on the number of categories. For instance, Tulving et. al. (1966), Earhard (1972) selected respectively high school students, college students as subjects for the experiments, and the results showed that the effect of the clue recall relied on the number of categories.

Tsuzuki (1982), imposing free recall of words which belonged to four kinds of category to subjects for a minute, examined whether the amount of recall would be influenced by the amount of this free recall or not. However, it will be predicated the modus of recall differs from that of the past if we give them different numbers of categories.

The present experiment was designed to examine the effect of the indication of category names in visual memory in order to clarify the characteristic of serial visual memory of hearing impaired children.

Experiment I

Method

Design. The experimental design was a 2×3 factorial design. The first factor was a recall condition which consisted of the clue recall condition and the free recall condition. The former was a condition under which category names was given as clue to memory. The latter was a condition under which no clues were given. The second factor was the number of

listed categories; 4, 6, 8 were the numbers. The first factor was a between-factor, and the second factor was a within-factors.

Subjects. Forty hearing impaired children who have succeeded in verbal learning to some degree were selected for subjects. They are in the fourth, fifth or six grade in elementary deaf school and each of them are pretty well coping with the learning requirements imposed on each of these grade students. The ages range from ten to twelve. T score of these students I.Q. ranges from 45 to 52 and the mean is 51. Their average hearing loss ranges 90 dB through 120 dB; the mean is 93 dB. These subjects were divided into the clue recall group and the free recall group. In dividing it, it was taken grade year, T score, the average hearing loss and memory span (nonsense syllables) into consideration. In any of these points no significant difference was found between the two groups.

Materials. Each list has 24 words. The number of categories is 4, 6, 8 and when it increases the number of words within a category decreases. That is, they are in inverse proportion to each other. For instance when the number of category is 4, the number of words within a category is 6, when the former is 6 the latter is 4 or when the former is 8 the latter is 3. Each material was shown in Tab. 1, Tab. 2, Tab. 3 respectively. As shown in Tab. 1, this four category conditioning has 4 categories such as *animals, flowers, fruits* and *stationeries* and each of them has 6 words. As shown in Tab. 2, this six category conditioning has 6 categories such as *animals, flowers, fruits, stationaries, musical instruments* and *vehicles* and each of them has 4 words. As shown in Tab. 3, this eight category conditioning has 8 categories such as *animals, flowers, fruits, stationeries, musical instruments, vehicles, birds* and *furniture* and each of them has 3 words. The words on the lists are randomly arranged to prevent the same category from being repeated when these words are indicated.

Table 1 Four category conditioning

category	item			
animals	bear	elephant	giraffe	
	tiger	dog	monkey	
flowers	chrysanthemum	chinese milk	vetch	sunflower
	rose	lily		violet
fruits	apple	grape	strawberry	
	water melon	pear	persimmon	
stationeries	writing brush	pencil	scale	
	paste	eraser	scissors	

Table 2 Six category conditioning

category	item			
animals	bear	dog	giraffe	tiger
flowers	rose	chrysanthemum	lily	violet
fruits	pear	water melon	apple	strawberry
musical instruments	bell	piano	drum	flute
stationeries	eraser	scale	scissors	paste
vehicles	airplane	ship	bus	train

Table 3 Eight category conditioning

category	item			
animals	bear	tiger	giraffe	
flowers	rose	chrysanthemum	violet	
fruits	apple	pear	strawberry	
musical instruments	bell	drum	flute	
stationeries	scale	eraser	scissors	
vehicles	airplane	bus	train	
birds	sparrow	pigeon	swallow	
furniture	chair	television	bureau	

However, "a bear, tiger and giraffe" in the animal category, "a rose, chrysanthemum and violet" in the flower category, "an apple, a pear and strawberry" in the fruit category and "a scale, eraser and scissors" in the stationery category are repeatedly used in the 3 conditioning lists. The words, "a bell, drum and flute" in the musical instrument category, "a airplane, bus and train" in the vehicle category are repeatedly used in the 6 category conditioning list and 8 category conditioning list. These words are the same words as Fujita et. al (1977) used. These words were already checked them

to determine if hearing impaired children were familiar with them or not and confirmed that they were; these words have 2 or 3 syllables.

Procedure. All the experiments were made always between the two kinds of groups. The stimulus was written on a card (15×25 cm) and taped into an audio-video cassette recorder. Each word was indicated for 2 seconds at an interval of 4 seconds. Subjects were forced to recall the words immediately after indication and to write them down on the recall sheets. The following instruction was given as a clue recall conditioning before indication of the listed stimuli; that is, "think about what kind of things are included in the following group and memorize them". This instruction was written on the recall sheets, too. Below this instruction on the sheet, category names were mentioned according to the number of categories. The free recall conditioning was given by the following instruction; "what did you find in the card you just saw? write them down in the order of your recalling." This instruction was given on the recall sheets as well. These sheets consist of 3 pages and answers for the former questions are devised not to be seen. Dividing each conditioning group into two, each was made "4 → 6 → 8" group and "8 → 6 → 4" group. Obtained data were treated in the following manner; any recall is considered as a correct answer as long as it is the same word indicated in the list. The analytical point is with clues or without clues to check the relation between the recall condition and the number of listed categories (e.g. 4, 6, 8).

Results

Tab. 4 shows the number of correct recall in terms of the relation between the recall condition and the number of categories. By analysis of variance where the recall condition and the number of the listed categories were treated as main factors, the recall condition was recognized to have the main effect ($F=45.81$, $df=1/114$, $P<0.001$). However, any significant difference was not found with the number of the category

ries and in the interaction ($F=2.94$, $df=2/114$, $P>0.05$; $F=1.01$, $df=2/114$, $P>0.05$). That is, this experiment shows that the recall condition, i.e., category name are indicated or not has a decisive influence on memory and, therefore, the clue recall group can provide more recall of memory than the free recall condition group. By the t-test given to the number of categories between the two conditions, a significant difference was found with each category (4; $t=4.50$, $df=38$, $P<0.01$, 5; $t=2.98$, $df=38$, $P<0.05$, 6; $t=4.09$, $df=38$, $P<0.001$). Tab. 5 shows the number of recall categories, which was based on any category where at least one item was recalled. When the number of recalled catego-

Table 4 The number of correct recall in four categories conditioning

	4	6	8
clue	14.1 (3.47)	14.3 (3.10)	15.5 (2.62)
free	8.7 (3.86)	11.2 (3.29)	11.0 (4.02)

(): S. D

Table 5 The number of recall category in four categories conditioning

	4	6	8
clue	3.9 (0.30)	5.8 (0.54)	7.3 (0.62)
free	3.5 (0.74)	5.2 (1.03)	6.2 (1.50)

(): S. D

Table 6 The average number of recall within a category

	4	6	8
clue	3.5 (0.87)	2.4 (0.52)	1.9 (0.34)
free	2.2 (0.97)	1.9 (0.56)	1.4 (0.51)

(): S.D

ries is computed in terms of the recall rate of listed categories, each of the clue recall groups can get more than 90 % of recall rate. By the t-test given to each category between the two conditions, each category was found to have significant difference (4; $t=2.28$, $df=38$, $P<0.05$, 6; $t=2.25$, $df=38$, $P<0.05$, 8; $t=2.97$, $df=38$, $P<0.01$). Tab. 6 shows the average number of recall within a category. This means how many words which belong to the same category are recalled. By the t-test given to each category, significant difference was found between the two conditions (4; $t=4.73$, $df=38$, $P<0.001$, 6; $t=2.91$, $df=38$, $P<0.01$, 8; $t=3.63$, $df=38$, $P<0.01$). As shown in the above results, it is obvious that the recall condition has an influence on the memory. In experiment I, some of the listed words are repeatedly listed on the 4, 6 and 8 category lists. Therefore, the repetition effect of the indication of listed words, too, might be reflected. This point should be examined. But it is recognized to a high degree that the clue recall promotes the recall of hearing impaired children's memory.

Experiment II

In experiment I, the relation between a recall condition (e.g. with clues or not) and the number of categories (e.g. 4, 6, 8) was examined. As a result of that, the recall condition was proved to have more influence on a memory than the factor of the number of categories. Experiment II was designed to examine how the clue recall effect will change under the influence of frequency of trials while keeping the number of categories constant.

Method

Design. The experimental design was a 2×4 factorial design. The first factor was a recall condition which consisted of the clue recall condition and the free recall condition. The second factor was the frequency of trials; 4 times are given. The factor of the frequency of the trials was a within-factors. Tab. 7 shows a breakdown of trials. The first trial and the

sixth trial are control trial using the same list where the arrangement order is the same. Any trial from the second trial to the fifth control is an experimental trial.

Subjects. The same as in Experiment I.

Materials. Used the same list which has 4 categories as Experiment I. But the items are randomly arranged. The arrangement order of the first trial is the same as that of the sixth trial. From the second trial to the fifth one they are different from each other.

Procedure. Indication time, interval, the way of recall and the instruction for recalling are all the same as Experiment I. Treatment of the result is, too, the same as in Experiment I. The difference of the number of recall between the said two kinds of groups observed when recall condition is changed, and the relation between the frequency of trials and clues existence (in other words, whether clues are given or not) are examined.

Results

Tab. 8 shows the number of correct recall in each trial observed in the two groups. In the first trial, any significant difference between the two groups was not found ($t=1.05$, $df=38$, $P>0.05$). From this, it is founded there is no difference in recall ability between the two. The analysis of variance in which the recall condition and the frequency of trials were treated as the main factors was completed in four trials from the second trial to fifth trial. And this analysis showed that in each factor the main effect was observed ($F=54.3$, $df=1/152$, $P<0.01$; $F=3.62$, $df=3/153$, $P<0.01$). From this fact, it was recognized that in experimental trial, the clue recall condition provided more recall than the free recall condition and, furthermore, in both groups the more often the frequency of trials are given, the more number of recall was produced. In the sixth trials which was a control trial any significant difference was not observed between the two ($t=0.98$, $df=38$, $P>0.05$). In the clue recall group the clues are given to both the first trial and the second

trial. It was founded a significant difference between the first trial and the second trial ($t=3.08$, $df=19$, $P<0.01$). In the free recall group, clues are given to the first trial but not to the second trial. A significant difference was observed between the first trial and the second trial ($t=3.27$, $df=19$, $P<0.01$). From this observation, it was recognized that a factor of the existence of clues, in other words, whether clues are given or not. Meanwhile, in the fifth trial and the six trial no significant difference was found in the clue recall group ($t=1.25$, $df=19$, $P>0.05$), while a significant difference was found in the free recall group ($t=3.36$, $df=19$, $P<0.01$). Therefore, the transition from non-existence of clues to existence of clues definitely influences on the recall of memory. As shown on Tab. 7, in the free recall group the number of recall of the second, third and fourth trials is almost the same. That of the fifth trial, for the first time, comes to be almost the same as that of the first trial which is an experimental trial. From the above results, it is suggested that in the clue recall group the more the frequency of trials are given, the more the number of recall is increased, and the way of transition of clues existence is considered to be a more influential in the frequency of trials.

Table 7 The breakdown of trials (Exp. II)

	1	2	3	4	5	6
clue recall	○	○	○	○	○	○
free recall	○	×	×	×	×	○

○ : clue × : free

Table 8 The number of correct recall in each trial

	1	2	3	4	5	6
free recall	14.3 (3.24)	11.1 (3.98)	11.6 (3.51)	11.8 (3.22)	14.0 (5.74)	18.3 (3.87)
clue recall	13.6 (3.25)	15.6 (4.26)	16.8 (4.69)	17.9 (4.61)	19.1 (4.49)	19.6 (4.25)

() : S. D

Discussion

The purpose of the present study was designed to examine whether or not the indication of category name has an influence on the recall of memory of hearing impaired children. The analysis about 2 experiments showed that ; (1) more recall was obtained in the clue recall group than in the free recall group ; the recall effect does not depend upon the number of categories ; (2) the clue recall effect is observed much more clearly when the frequency of trials is increased ; the way of transition of existence is considered to be an important factor of the effect.

These results are same as Tulving et.al (1966), Eysenck (1974) or Fujita et.al (1977) as far as they demonstrated the clue recall effect. However, they are different from Tulving's results as far as they (Tulving's results) showed that effect of clue indication depended upon the number of categories which compose a list. While, this research shows that the clue recall effect does not rely on the number of categories. As show on Tab. 5, in the clue recall group, there is no difference in the number of recall among 4 category conditioning, 6 category conditioning and 8 category conditioning. In the free recall group, too, there is no difference in the number of recall between 6 category conditioning and 8 category conditioning. The following would be interpretation about this result ; the effect of indicating category names on hearing impaired children heavily depends upon the factor of existence of clues. It is difficult for them to recall category names because the number of categories such as four, six or eight is too many for them. This is based on the fact that the average of number of correct recall per category decreases as the number of categories increases in shown Tab. 6. Also, as shown in Experiment II, in the free recall group there was no change in the number of recall even after indicating the same item 3 times in a random order. On the other hand, in the clue recall group, the recall of category

names becomes comparatively easier as the frequency of trials increases, and this effect is reflected. The result of this research is different from the suggestion by Earhard (1976) or Fujita et.al (1977) who point out that the effect of indicating clues depends on the number of clues used the number of categories and the number of words within a clue category. Also, Tulving (1966) and Eysenck et.al (1974) selected high school students and college students for the subjects while the present study as well as Fujita (1977) selected children for the subjects. Such a developmental gap can be related to the different results between this study and theirs to a high degree. It is pointed out that younger children are under the retrieval deficiency that even if younger children save up words by categories they can not use the categories as clues when they have to recall them (Eysenck, 1974). The hearing impaired might be reduced in the efficiency of recall because their experience to recall voluntarily using the category names as clues is limited. As pointed out by Tsuzuki (1980), forming an association which accords with the cognition or way of thinking peculiar to each learner, or such a promotion of motivation as a positive attitude toward learning comes to be very important.

It will be a topic for the future to make hearing impaired children's form a certain attitude toward learning subjects and to inquire into the relation between the clues used in that occasion and the subject factors.

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