Encoding activities by preschool children under orienting versus learning instructions: Are onomatopoeias associated with more concrete images?

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Two experiments were conducted to investigate the mnemonic activity of young children and its relationships to the materials to be memorized. Thirty preschoolers were asked to remember one of the two kinds of 10-word list. The subjects who heard the 10 words in the form of onomatopoeias performed better in both free recall and recognition tasks than those who heard them in the form of ordinary common nouns, which was interpreted to indicate that an onomatopoeia might be associated with the more concrete image compared with an ordinary common noun. Another 30 children of the same age were required to arouse either an auditory or visual image of a particular referent as each word of the same 10-word list was presented, instead of being told to remember. These incidental learning conditions turned out to be superior to the intentional memory condition, suggesting that it was more effective for young children to develop some kinds of imagery of each referent than to be asked just to remember individual words.

Key words: children, imagery, onomatopoeias, memory, incidental learning, recall, recognition.

This paper describes an exploratory study of the mnemonic activity of young children and its relationships to the materials to be memorized. We are often surprised to discover that young children so easily remember new things and events in everyday situations, whereas their memory performances, as found in experimental studies, are not so good as those of adults or older children. One reason for this is that young children are not good at using effective mnemonic strategies. A recent review of Kail and Strauss (1984) indicated that children younger than seven or eight years rarely use any kind of rehearsal which is a potentially helpful memory strategy. They also suggested that preschool children do have rudimentary understanding

of such terms as "remember" or "forget", which renders their intentional learning difficult.

Although spontaneous use of mnemonic strategies seems possible only after children reach the age of eight or nine years, it seems that younger children might benefit from such strategies if they are induced to employ them. Shimizu and Inoue (1987) investigated the role of overt rehearsal in preschoolers' recognition using a false recognition paradigm. In this experiment, half of the subjects were asked to repeat aloud the presented words. The results suggested that overt rehearsal facilitated not only phonological, but also semantic coding. More specifically, it was shown that overt rehearsal enhanced the subjects' performance for the lists including phonologically similar distractors in the immediate recognition task. Further, in a delayed test which was conducted two days later, the subjects who had been required to rehearse overtly could not adequately reject semantically related

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distractors although they did reasonably well with unrelated new items. These results suggested that semantic encoding was facilitated in this group more than in the group which had not rehearsed overtly.

In short, it was demonstrated that a particular mnemonic strategy had some effect, although it was difficult for young children to use it spontaneously. But such a strategy, namely overt rehearsal, is not considered conspicuously effective compared with other strategies. One of the purposes of the present study is to search for more effective mnemonic strategies and, if possible, also for the circumstances in which children may easily employ such strategies.

In Experiment I, two types of stimulus materials were used. One of them was a ten-word list of ordinary common nouns, and the other was a list of corresponding ten onomatopoeias. One of the purposes of this study was to investigate the relationships between the materials to be memorized and the mnemonic strategies spontaneously employed by young children. Two conditions providing preschool children with superficially different stimuli may give us a clue concerning that interest.

Older preschool children were recruited as subjects because the previous studies showed that they were more or less easily influenced by the instructions or requirements in the memory experiments (for instance, Shimizu and Inoue, 1987).

Experiment I

Method

Subjects. Thirty preschool children (mean chronological age=6 years, 4 months) served as subjects. Although some additional children participated in the experiment, those who did not have memory capacity of more than three-digit span, or those who could not follow the

Table 1
Stimuli of the present study

Nominal	Onomatopoeic	(meaning)
inu	wan-wan	(dog)
ame	zah-zah	(raindrop)
kaeru	guero-guero	(frog)
hasami	choki-choki	(scissors)
yagi	meh-meh	(goat)
kyukyusha	peepoh-peepoh	(ambulance)
ushi	moh-moh	(cow)
tokei	kachi-kochi	(clock)
niwatori	kokekokko	(rooster)
taiko	don-don	(drum)

experimenter's instructions were excluded from data analysis. The children were randomly assigned in equal numbers to two conditions with an effort being made to keep the groups balanced for sex.

Design and materials. Two kinds of ten-word lists were used. The stimuli presented in the experiment are shown in Table 1, which also shows ten pairs of common nouns and their corresponding onomatopoeias line by line, with their meanings. Half the subjects (Nominal Group) received a Nominal List (shown in the first column of the table), and the remaining subjects (Onomatopoeic Group) did an Onomatopoeic List (the second column). A pilot study (Terada & Narusawa, 1988) confirmed that the associative relatedness between each pair of the two semantically correspondent items was very high. That research also showed that the stimulus materials used in the present experiment were familiar to children from five to seven years old.

In addition to the ten concepts mentioned above, which were selected for to-be-remembered items, six concepts were selected for distractors in the recognition task. They were: cat, snow, saw, fire engine, telephone, and duck, each of which was a concept assumed to be semantically similar to one of the orally presented items. (The counterparts in the

study list were: dog, raindrop, scissors, ambulance, clock, and rooster in that order.) For that task, sixteen pictures were prepared depicting both to-be-remembered items and distractors. The pictures were solidly colored line drawings, approximately 7.5×10.0 cm in size.

Procedure. The overall experimental procedure was diagrammed in Fig. 1. The subjects were tested individually in a small private room within the kindergarten building. The child was seated in front of the experimenter, and informed of the memory tasks to follow. It was emphasized that when the last word had been presented, the child would be asked to recall as many presented words as possible. Each child was presented with either the Nominal or Onomatopoeic List in a randomized order. Each of the 10 words was spoken twice by the experimenter at a rate of one every 5 s.

The recall task was terminated when each child could not recall any more, subject to a limit of two minutes since the end of the presentation. Following the recall test, the subjects were tested on their performance on digit memory span (from 3 to 5 digits). Finally, all sixteen picture cards were arranged in front of the child simultaneously, and the child was required to pick up the ones which had been presented, distinguishing old items from semantically similar new ones. Time was not restricted in this recognition task.

Table 2
Mean recall and recognition scores
for Experiment I

	Nominal	Onomatopoeic
correct recall	3.7 (1.58)	3.6 (2.75) ^{a)}
recognition	0.29 (0.267)	0.49 (0.188)
(proportion of hit)	0.61 (0.205)	0.68 (0.180)

^{a)} The modified values indicate 4.8 and (1.17).

Results and Discussion

The recall protocols were first scored to determine the number of items recalled correctly. Duplicates of list items and intrusions of nonlist items were not counted as correct. Mean correct recall scores for the Nominal Group and Onomatopoeic Group are presented in the first line of Table 2. The values in parentheses show standard deviations. Comparison of the two conditions revealed that there was no significant difference between them ($t=.118$, $df=28$, ns). Investigation of the recall protocols in more detail, however, showed that four out of 15 subjects of the Onomatopoeic Group "recalled" the items in their common noun forms. That is, they reported "inu" or "tokei", instead of "wan-wan" or "kachi-kochi" for example. If these "translated" items are counted as correct, the performance of Onomatopoeic Group is enhanced to a mean of 4.8 items, showing a marginal superiority

Fig. 1. The diagram of experimental procedures in the present study. In Experiment I, 30 subjects were required to remember auditorily presented 10 words, whereas in Experiment II, another 30 subjects were asked a question instead as each word was presented. All of them were tested in both free recall and recognition tasks with a digit span test interpolated between them.

compared with that of the Nominal Group ($t=1.762$, $df=28$, $.05 < p < .10$).

This tendency was confirmed by the results of the recognition task, which are also shown in Table 2. Comparison of the conditions revealed that the proportion of correct recognition for the Onomatopoeic Group was significantly superior to that for the Nominal Group ($t=2.292$, $df=28$, $p < .05$). Together with the modified results of recall performances mentioned above, it was apparent that the preschoolers did benefit from being presented with to-be-remembered items in the form of onomatopoeias. Why should this be so?

One may hypothesize that Onomatopoeias are more easily remembered because young children are more familiar with them compared to ordinary words. The words children produce in their early stages of language acquisition are somewhat different from those spoken by adults, and include not only simplified versions of adult words, but also some repetitive and rhythmic words (Clark & Clark, 1977) just like onomatopoeias, such as "wan-wan" (which means bow-wow in Japanese) or "nyan-nyan" (meaning meow). The subjects in the present experiment, however, were preschoolers of more than five years of age, and they do not use such "baby talk" in their everyday conversation. It is not plausible, therefore, that the benefit for Onomatopoeic Group was simply due to familiarity of the stimuli or accessibility to a concept by its corresponding onomatopoeia.

Another possibility is that the Onomatopoeic Group benefited because of their encoding richness. For example, the sound "peepoh-peepoh" (like the siren of an ambulance) conveys the image of a white station wagon with a red line (presumably in Japan). Thus, an onomatopoeia may be associated with the more concrete image, compared with an ordinary common noun. Thus it may be

easier for the Onomatopoeic Group to use both auditory and visual imagery for each referent.

In addition, it is plausible that one can easily "translate" an onomatopoeia into a common noun form, because the latter is an ordinary label of each referent and is more often used in everyday conversation. The analysis of the protocols supports this possibility; four out of 15 subjects in the Onomatopoeic Group did "translate" in the phase of presentation, whereas none of the Nominal Group did so, at least in terms of overt behavior. There have been some researches which indicate that translation is considered to be one of the most effective encoding strategies. Durgunoglu and Roediger (1987), for example, conducted a memory experiment using Spanish-English bilinguals as their subjects. They showed that those who were required to translate the Spanish words into English performed much better than the same type of bilingual subjects who only read the verbal stimuli. In the present experiment, a "quasi-translation" strategy seemed to be employed by at least some of the subjects in the Onomatopoeic Group, and that might lead them to the better performances.

Experiment II

One problem in interpreting the results of Experiment I is that it is unclear what the subjects of both groups really did when they heard the presented words. Thus, it is not possible, in Experiment I, to determine whether the Onomatopoeic Group performed better because the materials were easy to process, or because they tended to employ effective mnemonic strategies (automatically or not). Although the above discussion in Experiment I favors the latter possibility, it is not known what kinds of encoding strategies (for example, phonological or visual encoding) are really effective for young

children.

To clarify this point, another experiment was designed to test the influence of two types of orienting activities on children's memory. In this second experiment, unlike the procedure of Experiment I, an incidental memory paradigm was used to control the subjects' encoding operations.

Because orienting tasks force the subjects to do what the experimenter want them to do, it will become easier to reveal what kinds of mnemonic strategies are more effective for these young children. The subjects of Onomatopoeic Group in the previous experiment heard ten onomatopoeias while their counterparts in the Nominal Group heard the same number of common nouns. What would happen if children were asked to generate each onomatopoeia under the same condition as for the Nominal Group? Furthermore, even if such performances are good enough to compare with the results of the Onomatopoeic Group, it is still interesting to know whether such auditory coding is superior to visual coding which require subjects to generate the visual image of each referent.

Method

Subjects. The subjects were thirty kindergarteners (mean chronological age=6 years, 5 months), who had not participated in the previous experiment, following exclusion of those children who did not meet the criteria employed in Experiment I. Each child was randomly assigned to two groups. There were approximately equal numbers of boys and girls in each group.

Design and materials. The ten-word list for the Nominal Group in Experiment I was also used in this second experiment. The instructions given to the subjects, however, were different from those of the intentional memory tasks. In this experiment, two kinds of orienting tasks were employed, which provided two con-

ditions of incidental memory tasks. The stimulus materials used in the unexpected recognition task were the same picture cards as used in Experiment I.

Procedure. The procedure in this experiment was almost identical to that described in Experiment I, except that the subjects were not informed of any memory task that followed. Instead, they were required to respond to the experimenter's question as each of the ten words was presented. Half the subjects (Auditory Group) were asked to say what kind of a sound each referent they would think emits. The others (Visual Group) were required to show the size of each referent with their hands. The name of each referent (shown in the left column of Table 1) was mentioned only once for each child of both groups. Such orienting task sessions were followed by unexpected tasks of recall and recognition, with a digit span test interpolated between them. All verbal responses were taperecorded throughout the experiment.

Results and Discussion

Children's responses to the orienting questions were all judged appropriate, although the verbal responses for the Auditory Group did not always coincide with the onomatopoeias expected by the experimenter as shown in Table 1.

As in the previous experiment, the recall protocols were scored to determine the number of items recalled correctly. Mean correct recall scores for the Auditory Group and the Visual Group are presented in the first line of Table 3, together with the score for the Nominal Group of Experiment I as a baseline for comparison. Both of the incidental conditions are superior to the intentional condition ($t=3.733$, $df=28$, $p<.001$, and $t=2.093$, $df=28$, $p<.05$, respectively). Comparison of the two incidental conditions, however, revealed that there was no significant difference between them ($t=.023$, $df=28$, ns).

Table 3
Mean recall and recognition scores for Experiment II

	Intentional (Baseline)	Incidental	
		Auditory	Visual
correct recall	3.7 (1.58)	4.7 (1.12)	4.8 (1.17)
recognition	0.29 (0.267)	0.84 (0.139)	0.69 (0.206)
(hit)	0.61 (0.205)	0.91 (0.072)	0.83 (0.173)

The results of the recognition task also confirmed that the incidental condition was superior to the intentional ($t=6.837$, $df=28$, $p<.001$, and $t=4.438$, $df=28$, $p<.001$, respectively). Moreover, comparison of the two incidental conditions in this task showed a different pattern from that of the recall task, revealing that the Auditory Group performed significantly better than the Visual Group ($t=2.258$, $df=28$, $p<.05$).

It is difficult to find the reason why the Auditory Group did better than the other group. But one of the possibilities is that the orienting task of that group might require the subjects to develop a more effortful and elaborate image of each referent. Of course, the modalities are different; one is auditory and the other is visual. Although it is safer to refrain from comparing auditory images with visual ones on a certain level, it is plausible that the subjects who were required more effort and developed a more elaborate image should remember the presented words better than those who did not do so.

A major aim of this study was to compare performances under explicit instructions to remember and incidental learning instructions. Both the dependent measures employed in recall and recognition tasks showed that the latter was better than the former, and that the difference between them was generally large. Presumably the results largely depend on the characteristics of orienting tasks which are used in incidental memory tasks (Puff, Tyrrell, Heibeck, & Van

Slyke, 1984). In the present experiment, both the Auditory and Visual Groups were required to develop some kinds of imagery as each question was given. So they had to process the presented word to a level of semantic encoding, which makes memory more durable than any other level (Craik & Lockhart, 1972).

Further, the subjects in the Nominal Group were too young to employ appropriate and effective encoding strategies spontaneously (see Shimizu & Inoue, 1987), even if they were explicitly instructed to remember. In case of adults, it seldom happens that incidental conditions exceed intentional ones in memory performance. This is consistent with our intuition, although some researchers report such data in a certain exceptional situation where intentional subjects could not employ good mnemonic strategies (Anderson, 1985). Thus, the phenomenon of "the incidental being superior to the intentional" is mostly unique to younger children who are only helped by the explicit instruction of an orienting task, which involves consequent employment of effective strategies.

In a review on the studies of central-incidental learning, Hagen and Hale (1973) concluded that children's ability in selective attention improves with age, and that they become able to concentrate on task-relevant stimuli and to ignore extraneous information. Thus, in experiments on central-incidental learning, the central memory task scores increase as a function of age, but the incidental scores do not. Since central-incidental tasks

differ from our incidental memory paradigm using orienting tasks, in which a orienting task itself makes the subjects attend to what they are to remember, we should not confuse the outcome of these two types of experiments. But the developmental trend in efficiency of attention deployment mentioned above holds true for our incidental memory paradigm.

Conclusion

The results of the two experiments showed that preschool children remembered the auditorily presented words comparatively well when they were required to develop some kinds of imagery. It was also indicated that an onomatopoeia might be associated with the more concrete image compared with an ordinary common noun, which helped young children memorize individual concepts more easily when presented in the form of onomatopoeias. Since explicit instructions to remember did not always work for the young children, it was implicated that it might be more effective for them to be required to arouse some kinds of imagery of each referent than to be asked just to remember that word.

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