The Effect of Verbal Coding in Preschool Children's Reproduction of Visual Sequences

Suzanne Salzinger, Jean Patenaude, Richard S. Feldman
Biometrics Research, N.Y. State Dept. of Mental Hygiene

Studies on the effect of verbalization on children's behavior in a number of different experimental paradigms, such as reversal, non-reversal learning (Kendler & Kendler, 1959), transposition (Kuenne, 1946), discrimination (Spiker, 1961), etc., have led some investigators such as Reese (1962) to suggest the possibility of two types of mediation deficiency, a production deficiency (Flavell, Beach, & Chinsky, 1966) and a mediational deficiency (Potts, 1968). Generally, the deficiency hypotheses are taken to be developmental (Luria, 1967) and not based upon learning, the age at which verbal mediation tends to be utilized being given as about 5 yrs. old.

Other studies such as Milgram's study (1967) of paired associate learning and Glucksberg & Krauss' study on referential communication have not found such deficiencies. Whether or not a deficiency is found may well vary as a function of the situation in which the verbalization is learned, the type of verbalization learned (Robinson & Creed, 1968) and the relevance of the child's past learning of the verbalization to the task he is required to perform (Salzinger, Salzinger, & Patenaude, in press).

We feel that before accepting a developmental deficiency hypothesis to account for the effect of verbal on non-verbal behavior in children, the interaction between the two classes of behavior must be described in much greater detail.

In the present study we are not concerned with production deficiency since we controlled the emission of verbal responses. Rather we will focus on two problems: 1) an examination and classification of the types of verbalizations 5 yr. old children used in describing visual sequences and 2) the relationship of the different types of verbalizations to their ability to reproduce the sequences.

Method

Subjects -- Ss consisted of 15 white middle class children 5 yrs. of age. A comparison sample of 19 medical students was also used.

Apparatus -- A green wooden puzzleboard 6 x 36 inches with spaces for six 5½ inch animals in a row (rabbit, monkey, deer, bear, lion, and elephant) was placed in front of the child on a table. Each space could be filled by either a red or a blue wooden animal. Twenty 8 x 28 inch green posterboard stimulus cards were used. Each card consisted of the same sequence of six animals as that displayed on the puzzleboard, with the pattern of red and blue animals changing for each card.
The 20 6-unit binary color sequences that were used as stimuli were selected so as to represent approximately evenly the total number of reds and blues displayed (58 reds and 62 blues) and to distribute the color runs as follows: 1 card with 1 run, 3 cards with 2 runs, 6 with 3 runs, 6 with 4 runs, 3 with 5 runs, and 1 with 6 runs. Since the sequences varied in difficulty the 20 stimulus cards were presented in different random orders in each of the three conditions of the experiment. A blank sheet of white posterboard was used to cover the puzzleboard while the child was viewing the stimulus cards.

Procedure -- Each child was subjected to three experimental conditions not less than 1½ weeks apart.

The first was a non-verbalizing condition where the S was instructed to look at each stimulus card without speaking, and then to reproduce it on the puzzleboard 5 seconds after its removal. The second condition was an interference condition where S was instructed to recite the poem "Jack and Jill" continuously while viewing each stimulus card and then to reproduce it 5 seconds after its removal. The third condition was a verbalizing condition where Ss were told to describe the stimulus and then reproduce it 5 seconds after its removal.

There was no time limit set for placing the puzzle pieces. All the verbalizations were tape recorded and transcribed. At the end of each session the children were given a bag of trinkets.

The adults were given only the last two conditions, both in one session; half were given in the order of the verbalizing condition first followed by the interference condition, and half in the reverse order. In addition the delay between the removal of the stimulus card and the S's reproduction was increased to 10-15 secs.

Results

For each S the number of correctly placed pieces was totaled for all 20 stimuli, as well as for the 10 easy and 10 difficult stimuli separately. These scores were used to measure non-verbal performance.

Each S was then classified as a non-coder or a coder based upon the verbalizations he emitted during the verbalizing condition of the experiment.

Non-coders consisted of three kinds. Some were those Ss who, for most of the stimuli (the exceptions were usually made on the simple stimuli), attempted to repeat the entire sequence, i.e., both animals and colors. The two other kinds consisted of Ss whose verbalizations were most often classified as incomplete responses, where the verbal description did not account for the whole stimulus, and incorrect responses, where the stimulus was incorrectly described.

 Coders, on the other hand, were those Ss who, for most of the stimuli, verbalized according to one or more of the following coding categories. The first was temporal coding, where the S verbalized the sequence of colors in a
distinctive rhythmic pattern which divided the sequence into distinct segments, e.g., "red red blue/ blue blue red". The second was reduction coding, where the S did not verbalize all the information displayed on the stimulus card, but applied only one label to each stimulus. Most often this meant verbalizing only the color names. If a rhythmic pattern was imposed on a reduction sequence, it was classified as temporal coding. The third was grouping coding, where the S attached one label to more than one stimulus, e.g., "a lot of blues," or "the rabbit and the monkey are red," i.e., where in fact only those two were red.

Among the children there were eight coders and seven non-coders. Only one of the adults was a non-coder.

A Mann-Whitney U test (Siegel, 1956) was applied to test for the significance of the difference between the coding and non-coding children for each of the three conditions of the experiment. For the first, silent viewing, the medians of the coding and non-coding groups were respectively 84.5 and 78 (.116<.p<.140). For the second, verbal interference, the medians were 73.5 and 77 (.478<p<.522). For the third, verbalizing, the medians were 100 and 87 (p = .02). These results indicate that for children whose verbalizations code the information in a sequence, recall and reproduction are aided; when such verbalizing is interfered with, the same children perform as poorly as the non-coding children.

The question of the relationship between coding and stimulus complexity was raised by testing whether or not the coding children performed better than the non-coding children primarily for the more difficult stimuli. The same analysis as above was performed separately on the 10 easy and 10 difficult stimuli for the interference and the verbalizing conditions. The results did not differentiate performance on the easy from that on the difficult stimuli. No significant difference was found between coders and non-coders for the interference condition, but for the verbalizing condition, the coders achieved a significantly superior performance not only on the difficult stimuli (p = .007) but also on the easy stimuli (p = .027).

A Wilcoxon paired replicates test (Wilcoxon, 1949) was performed to see whether preventing the coding children from utilizing verbal coding would affect their performance more than that of the non-coding children and particularly more on the difficult stimuli (where coding was presumably needed). Each child's performance on the interference condition was compared with his own performance on the verbalizing condition. The results showed that only for the performance of the coding children on the more difficult stimuli was the interference condition significantly poorer than the verbalizing condition (p = .01).

All but one of the 19 adults were coders and that S performed third lowest in the group on the verbalizing condition. The distributions for the adults' and children's performance were almost completely non-overlapping for the verbalizing condition, and completely non-overlapping for the interference condition. Like the children, however, they revealed significantly better performance for the verbalizing condition than for the interference condition (p < .01).

The types of coding utilized were different for adults and children. The
predominant type of coding among the adults was grouping coding, whereas for the
coding children, only 3 used grouping coding and the other 5 used either
reduction coding, temporal coding, or a combination of both.

Discussion

If we view the adults as a standard then it is quite clear that verbal coding
aids in recall and reproduction and that when an adult is deprived of the
opportunity to utilize such coding his performance deteriorates. Examples of
such verbal coding in adults have been found in other studies such as those done
by Glanzer and Clark (1963) in experiments on the verbal loop hypothesis. For
the children, when language is utilized in a similar manner, recall and repro-
duction are aided. When their own language is not utilized in this manner it
appears to hinder performance in the same way as experimentally induced verbal
interference.

However, the coding children's performance is not as good as the adults' and
this may well be, in part, a function of the fact that, although practically
every adult in this study coded in essentially the same way, only 3 of the
children manifested this kind of coding.

A useful framework for viewing these results is that of the production of
an observing response. For the silent viewing condition, no differences were
found between the coding and non-coding children and in fact we had no way of
determining whether a child was utilizing his subvocal verbalization to produce
observing responses relevant to the stimuli. For conditions where the verbal-
izations produced observing responses relevant to the stimuli, the children
performed better, as was the case with the adults.

We would therefore conclude that children who learn to utilize their language
in such a way as to produce observing responses relevant to the stimuli around
them thus enable themselves to perform various psychological functions (e.g., in
this case, recall and reproduction) more effectively.

The fact that some children used less useful verbalizations than others in
this setting does not necessarily mean that such children would be unable to
learn the more useful type of verbalization.

We would suggest, rather than ascribing a mediation deficiency to these
children, that a learning explanation not be bypassed. A test of such a
hypothesis would lie in an attempt to condition verbalizations which produce
relevant observing responses in the other children and then to test the children's
generalization of such verbalizations to similar stimulus situations.
References


Footnotes


2 Grateful acknowledgment is made of the cooperation of Mrs. Regina Gilbert and her staff of the Stephen Wise Free Synagogue Nursery School and Kindergarten.