The facilitating effects of various training methods on the development of verbal control of nonverbal behavior in four-year-old children

H. JOHN VAN DUYNE
Northern Illinois University, DeKalb, Ill. 60115

This study investigated the effects of passive movement and imitation training with verbal instructions on the learning of a perceptual-motor task and the effects of these training procedures on the children's behavior when the perceptual-motor associations formed in the initial learning are reversed under adult verbal instructions. The four treatments were passive movements and imitation with and without verbal instructions. The conditions were a two-association (colors-forms) motor-perceptual task and the reversal of the associations by means of verbal instructions. The results indicated that 4-year-olds performed significantly better on both task conditions when training was accompanied by verbal instructions. The results indicated that the development of verbal control of nonverbal behavior may be manipulated and developed artificially.

Luria (1961a, b) has shown that 4-year-olds may control their nonverbal behavior on simple perceptual-motor tasks by means of the excitatory and inhibitory functions of speech. Under verbal instructions the 4-year-olds were able to press a lever to a red light and not to a green light. On complicated tasks requiring mobility and flexibility in controlling nonverbal behavior such as pressing a lever twice to a red light and not pressing to a green light, 4-year-olds could not perform the task when given verbal instructions without further training.

Birch (1966) and Joynt & Cambourne (1968) have essentially replicated Luria's findings. Van Duyne (in press) found that 4-year-olds, when given verbal instructions, could not perform a two-association perceptual-motor task (pressing a square block to a blue light and a round block to a yellow light). Five-year-olds function at the elective significant level of language (Luria, 1961a, b), thus performing the task when given verbal instructions.

Zaporozhets (1961) has suggested and shown in his research that 4-year-olds learn motor-perceptual skills more readily by means of passive movements (tactical-kinesthetic) training than by imitation (visual) training.

This study examined (1) the effects of combining passive movement and imitation training with verbal instructions on the learning of a complex perceptual-motor task in 4-year-olds and (2) examined the effects of these training procedures on the childrens' perceptual-motor behavior when the perceptual-motor associations formed in the initial

training were reversed under adult verbal instructions.

SUBJECTS

The sample consisted of 16 4-year-olds (mean age, 54 months). All the children were currently enrolled in Northern Illinois University School.

EQUIPMENT

The equipment was a gray vertical panel with an aperture through which a yellow and blue light was shown in random sequence. In front of the vertical panel was a gray horizontal panel with two leverpress mechanisms. Mounted on one of the levers was a square block, 1 in. on a side and $\frac{1}{2}$ in. thick, and on the other a round block, 1 in. in diam and $\frac{1}{2}$ in. thick. The stimulus interval was 1.96 sec, and the interstimulus interval was 2.04 sec.

PROCEDURE

The children were assigned randomly to each of four treatment groups. All the children had previously learned color and geometric form discriminations as part of their nursery school experience. The children were tested for their ability to discriminate blue, yellow, square, and circle (criterion of four correct discriminations) prior to the experimental procedures. The children were rated on four factors (general intelligence, verbal ability, psychomotor skill, attention span, and emotional maturity) by the two nursery school teachers and 10 senior student teachers who worked with the children. The treatment groups were found to be equivalent on all factors.

The E participated in the nursery school activities for 2 weeks prior to the study in order to minimize emotional factors involved in meeting a stranger.

The initial task condition was to press the square to a blue (or yellow) light and the circle to a yellow (or blue) light. The task consisted of 38 stimulus events; 19 blue and 19 yellow lights in random sequence. Within the treatment cells the color-form associations were randomized to control for preferential associations.

The second task condition was a reversal of the color-form associations required on the initial task condition.

Treatment 1 was passive movements without verbal instructions. The E told the child, "Here is how we play the game. I will show you. Let me have your hand." He then moved the child's hand and pressed the correct geometric form to the blue and yellow lights for 38 stimulus events. No other verbal instructions were given. The child was then asked to do the task himself.

Treatment 2 was passive movements with verbal instructions. The instructions were exactly like Treatment 1, except that when the E moved the child's hand he said, "Blue (yellow), press the square. Yellow (blue), press the circle (round block)."

Treatment 3 was imitation without verbal instructions. The E said, "Here is how we play the game. Watch me. See how I do it." The E proceeded to do the task for 38 events without verbal instructions. The child was then asked to do the task.

Treatment 4 was imitation with verbal instructions. Instructions followed the same procedure as Treatment 3, except as the E did the task he said, "Blue (yellow), press the square. Yellow (blue), press the circle."

The reversal condition followed the initial task condition. Under the reversal condition the color-form associations were reversed by means of adult verbal instructions for all treatment groups. No other training was given. The instructions were as follows: "Now we are going to change the rules of the game. When the yellow (blue) light comes on, press the square (circle). What do you do when the yellow (blue) light comes on?" The statements and questions were repeated until the child could give four consecutive correct verbal responses for each stimulus. Once the child reached the above-mentioned criteria, he was asked to do the task.

RESULTS AND DISCUSSION

The scoring for both the initial and reversal conditions of the task was the number of correct responses out of 38 events. The criterion mean scores are given in Table 1.

The theoretical chance mean for correct responses on the basic task was calculated to ascertain whether or not the children were responding at a chance level ($p < .05$). The chance

Table 1
Mean Criterion Scores

Treatments	Task Conditions	
	Initial	Reversal
1	14.00	15.00
2	32.33	34.67
3	14.33	11.33
4	28.00	31.00

mean would be 19 and the confidence band would be 12.84 to 25.16. On the initial task, Treatment Groups 2 and 4 were responding correctly significantly better than chance (.05 level) and Treatment Groups 1 and 3 were responding correctly within the chance range. On the reversal task, Treatment Groups 2 and 4 were responding correctly significantly better than chance (.05 level); Treatment Group 1 was responding within the chance range; and Treatment Group 3 was responding correctly significantly below chance (.05 level).

A two-way analysis of variance for repeated measures was performed. A significant difference was found between treatment groups, $F(3,24) = 4.299$, $p < .05$. There were no significant differences between initial and reversal conditions, nor was there a significant interaction.

The Scheffé test following a significant F-ratio was used. It was determined that significant differences at the .01 level were found between Treatment 1 (passive movements) and Treatment 2 (passive movements with verbal instructions); between Treatment 2 (passive movements with verbal instructions) and Treatment 3 (imitation); between Treatment 4 (imitation with verbal instructions) and Treatment 3 (imitation); and between Treatment 4 (imitation with verbal instructions) and Treatment 1 (passive movements). No significant differences were found between Treatment 1 (passive movements) and Treatment 3 (imitation); and between Treatment 2 (passive movements with verbal instructions) and Treatment 4 (imitation with verbal instructions).

The results indicated that 4-year-olds performed significantly better on the two-association perceptual-motor task, under both the initial and reversal conditions, when the initial training was accompanied by verbal instructions than when verbal instructions were omitted. The reversal condition was the test of the development of verbal control of nonverbal behavior. It was postulated that if 4-year-olds had developed verbal control of perceptual-motor skills rather than perceptual-motor habits, no negative transfer (decrement in performance) would be observed between the reversal and initial conditions of the task—a reversal of perceptual-motor associations by means of verbal instruction alone.

The results indicated that 4-year-olds trained by means of passive movements or imitation accompanied by verbal instructions maintained a high level of performance on the reversal condition. Four-year-olds who received passive movements or imitation without verbal instructions performed poorly on the initial task condition, and their low level of performance continued under adult instructions on the reversal condition. Because of poor performance on both tasks, no negative transfer could be observed. Treatment Group 3, which responded correctly significantly below theoretical chance on the reversal task, may indicate some negative transfer between imitation training on the initial task and verbal instructions on the reversal task. It was concluded that 4-year-olds who received training accompanied by verbal instructions had developed verbal control of a complex perceptual-motor skill exhibited by their ability to reverse the task under verbal instructions.

According to Anokhin (1969) and Zaporozhets (1961), the high level of performance on both initial and reversal task conditions by the 4-year-olds who received passive movements or imitation training may be attributed to two mechanisms. First

is the directive function of speech, where the verbal instructions orient the child's investigatory activity to the salient stimuli and responses required in the performance of the task. The second is the development of the second signal system where, as the child performs the task, the verbal instructions become associated not only with the stimuli but more importantly with the perceptual-motor responses. The system of perceptual-motor connections created and associated with speech signals can be reproduced or changed (reversed) in the absence of direct training by means of verbal instructions.

Zaporozhets's conclusion that passive movement training is more effective than imitation training for 4-year-olds is not supported by the results of this study. The results indicated that 4-year-olds performed poorly under both training procedures, but they performed at a high level of proficiency when either procedure was accompanied by verbal instructions.

REFERENCES

- ANOKHIN, P. K. Cybernetics and the integrative activity of the brain. In M. Cole and I. Maltzman (Eds.), *A handbook of contemporary Soviet psychology*. New York: Basic Books, 1969.
- BIRCH, D. Verbal control of nonverbal behavior. *Journal of Experimental Child Psychology*, 1966, 4, 266-275.
- JOYNT, D., & CAMBOURNE, B. Psycholinguistic development and the control of behavior. *British Journal of Educational Psychology*, 1968, 38, 249-260.
- LURIA, A. R. *The role of speech in the regulation of normal and abnormal behavior*. New York: Liveright, 1961a.
- LURIA, A. R. The genesis of voluntary movements. In N. O'Connor (Ed.), *Recent Soviet psychology*. New York: Liveright, 1961b. Pp. 165-185.
- VAN DUYNE, H. J. The development of the control of adult instructions over nonverbal behavior. *Journal of Genetic Psychology*, in press.
- ZAPOROZHETS, A. V. The origins and development of the conscious control of movements in man. In N. O'Connor (Ed.), *Recent Soviet psychology*. New York: Liveright, 1961. Pp. 273-389.