Transposition of Intermediate Size under Immediate and Delayed Testing Conditions by Normal, Familially Retarded, and Down's Syndrome Children

Tohoku Psychologica Folia
1977, 36(1-4), 32-38

TRANSPOSITION OF INTERMEDIATE SIZE UNDER IMMEDIATE AND DELAYED TESTING CONDITIONS BY NORMAL, FAMILIALLY RETARDED, AND DOWN'S SYNDROME CHILDREN

By

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A comparison was made of the transposition of intermediate size under immediate and delayed testing conditions between normal and retarded groups, matched in mental age.

There was no significant difference in the choices of familially retarded Ss, elicited immediately or 3 hr. after training. They responded dominantly to the absolute stimulus. Relational responses did not necessarily depend upon the ability of S to verbalize the problem.

The results lent no support to the mediational deficiency hypothesis and could not be understood in terms of the traditional dichotomy of absolute and relative responses in transposition.

Introduction

Research on transposition behavior of children has indicated several factors that influence the probability that transpositional responses will be made (Reese, 1968). The hypothesis that children's ability to use verbal responses as mediators is a function of age level has been proposed by Kunne (1946), Kendler and Kendler (1962) and Reese (1962) to explain differences in performance between younger and older children in transposition. Reese (1962) in a review of the literature termed this assertion the "mediational deficiency hypothesis". Kunne, on the basis of post experimental interviews, inferred that the older children's far transposition was mediated by covert verbalization of the relevant stimulus attributes and yet did not transpose on the above chance in the far test. Stevenson and Iscore (1955) and Saito (1968) studied transposition in retardates as a function of size distance in the test. They reported a significant amount of transposition. Moreover, the incidence of transposition did not change as the test stimuli were more remote in absolute size from the training stimuli. Stevenson and Bitterman (1955) and Reese (1961, 1962) attributed the decreased transposition to the increased discriminability between training and testing stimuli. In transposition, a restriction of the extent of stimulus generalization should yield fewer relational and more absolute responses. Rudel (1957, 1958, 1959) indicated that absolute and relative properties of the discriminanda appear to emerge together in the course of

stimulus differentiation, and the absolute response is the one most likely to be elicited when the discriminanda are distinctly different from each other, and when testing immediately follows training.

The transposition studies which compare the difference in the choices between retardates and normals were reported by Rudel (1959, 1960), Martin and Blum (1961), Baumeister (1964), and Saito (1968). These workers found that each group transposed significantly but there were no differences between them. Studies by Rudel (1959, 1960) suggest that when the original discrimination is made easily and testing is carried out immediately, normals tend to respond to absolute properties of the stimuli, whereas Mongoloid, brain-injured *S*s tend to make the relational response, and when the original discrimination is more difficult or testing is delayed, normals also respond to the relational aspects of the stimuli.

There is general empirical support for the contention that transposition in the intermediate size problem is a decreasing function of the difference between training and testing stimuli when young children serve as *S*s (Stevenson and Bitterman, 1955; Reese, 1961, 1962; Zeiler, 1967). There have been considerable experimentations on the question of which subject variables are most likely to elicit the absolute response. Spiker, Gerjuoy, and Shepard (1956) suggested that children who lack a verbal concept of middle-sizedness can nevertheless solve the intermediate size problem on a verbal basis if they possess the concepts of big and little, by using some of such verbalizations as "not big and little" to control their choices.

The purpose of this experiment was to compare normal and retarded groups, matched in mental age, on tranposition of intermediate size under immediate and delayed testing conditions, and to examine mediational deficiency hypothesis.

Method

Subjects: Normal *S*s were 20 children (13 males, 7 females) enrolled in a nursery school where they spent the day from 8 a.m. to 5 p.m. Familially retarded *S*s of 18 children (8 males, 10 females) were selected from five residential institutions. The individuals were all of the familial type of mental deficiency except for a few *S*s classified as retarded with undetermined etiology. No individuals with gross motor or sensory disturbance were used. One subject was dropped because of position or alternation habits which could not be broken after an average of 150 trials. Of 16 Down's syndrome children, two *S*s were dropped from the experiment on account of failure in learning the initial discrimination, and therefore 14 retardates (8 males, 6 females) were able to make the initial discrimination. All were experimentally naive (see Table 1).

Apparatus: The apparatus consists of three 40-X 40-cm. plywood boxes set on wooden supports. By opening the front swinging window of a box, one gets at the floor of each box in which the reward (chocolate peanut) was placed. The front panel of each box was painted black and fitted with a white window which served as discrimination stimulus. The windows varied in size from 1.4 in. on the side to 11.3 in. on the

Table 1. Means and SDs of CA, MA, and IQ for the various subgroups included in the experiment.

Group	Testing Condition and Subgroup	N	CA		MA		IQ	
			Mean	SD	Mean	SD	Mean	SD
Normal	Immediate NI	m 7 f 4	47.27	5.642	50.73	5.259	107.82	6.685
	Delayed ND	m 6 f 3	49.89	4.254	52.22	3.675	105.00	5.292
Familially Retarded	Immediate FI	m 4 f 4	141.38	23.711	51.88	12.293	37.88	9.804
	Delayed FD	m 4 f 6	147.20	24.007	56.00	12.490	38.80	8.340
Down's Syndrome	Immediate DI	m 5 f 3	134.38	42.175	40.25	9.243	31.75	3.632
	Delayed DD	m 3 f 3	154.50	26.569	43.33	7.273	29.17	5.958

side; the ratio of the area of one window to the next was 1:2. The three boxes were placed in a straight line before *S*, who sat opposite *E*. Curtains were drawn down before each trial.

Procedure: Prior to training *S* was given demonstration trial.

Training trials. *S* was presented with three training stimuli (Nos. 1, 3, 5) until *S* reached the learning criterion of nine correct choices in ten consecutive trials. 50 trials were given each day. The *S* was told that this was a game, and then was told to sit down opposite *E*. Then *E* said to *S*, "Now look at these boxes. I'm going to hide a peanut into one of these boxes and I want to see if you can find it. You open the window behind which you think the peanut is hidden." No mention was made of the stimulus squares. The frameboard was removed behind the screen and the boxes and peanut arranged. The *E* placed the board in front of *S* saying, "Where's the peanut ?" The *S* was allowed to open only one window of three boxes at each trial. If *S* had not achieved criterion by 150 trials, training was discontinued, and *S* was excluded from the experiment.

Testing trials. The testing stimuli consisted of Nos. 3, 5, 7. For the test trials six groups were formed, and *S*s were assigned to eah at random. Immediately after *S* attained to the criterion, ten test trials were given without comment.

Verbalization. The prodedure of verbalization was the same as that which Rudel (1957) used. Immediately following the final test trial, *S*s who had not spontaneously verbalized the problem were asked the questions on seven differential stages. Verbalization scores were determined by the children's remarks and by their responses to post experimental questions in the following manner: statement of principle, spontaneously, prior to questioning, was counted as 4 points; statement of principle upon questioning, 3; verbal identification of "middle size," 2; appropriate selection of big,

little and middle-sized boxes, on command, 1; inability to do any of these, 0.

Results

Training. The data collected for the 74 *S*s are shown in Table 2. To learn to choose Stimulus 3 when it was presented with No. 1 and No. 5 (large-difference discrimination), NISs required a mean of 19.6 trials, while NDSs required 20.3 trials. DISs and DDSs required 56.5 and 51.5 trials. There are no significant differences between immediate testing and delayed testing condition in normal *S*s and Down's syndrome *S*s. FISs and FDSs had respectively required a mean of 51.3 and 36.9 trials to make this discrimination. However the difference is not significant (t=1.205, df=16, p>.2). The difference between NISs and FISs under immediate testing condition is significant at more than .001 level of confidence. Other comparisons are not significant.

Table 2. Mean number of trials and errors to reach the criterion of learning, and percentage of total responses to different testing stimuli after training in each group.

Group	Training				Testing stimulus		
	Trial		Error		Absolute (smallest)	Relative (middle)	Largest
	Mean	SD	Mean	SD			
NI	19.64	7.401	7.09	4.557	67.27	23.64	9.09
ND	20.33	8.907	6.78	4.661	35.56	32.22	32.22
FI	51.25	20.572	22.50	10.161	56.25	31.25	12.50
FD	36.90	26.006	15.10	13.987	55.00	34.00	11.00
DI	56.50	17.916	24.75	9.997	36.25	33.75	30.00
DD	51.50	14.009	22.50	7.522	28.33	56.67	15.00

Testing trials. Figure 1 gives these results for immediate and delayed testing in terms of the proportion of total responses made to absolute, relative, and the largest stimuli by normal group and two retarded groups. The significance of the difference between groups for three measures is given in terms of Chi-square values. When testing immediately followed training 10 out of 20 normal *S*s responded predominantly to the absolute stimulus. 11 to 18 familially retarded *S*s and 4 of 14 Down's syndrome *S*s made such absolute responses, i.e., chose the originally positive stimulus. 5 familially retarded *S*s and 7 Down's syndrome *S*s responded predominantly to the relational stimulus, while 4 normal *S*s made such responses. 2 Down's syndrome *S*s, one familially retarded *S* and 5 normal *S*s predominantly responded to the largest stimulus (No. 7). The difference in the choices between DISs and DDSs made immediately or 3 hr. after testing was highly significant (χ^2=7.980, df=2, .02>p>.01), and between FISs and FDSs was not significant. The absolute responses in NISs was significantly superior to those in the NDSs (χ^2=23.80, df=2, p<.01). There is no such difference in the choice of familially retarded *S*s who elicited immediately or 3 hr. after training.

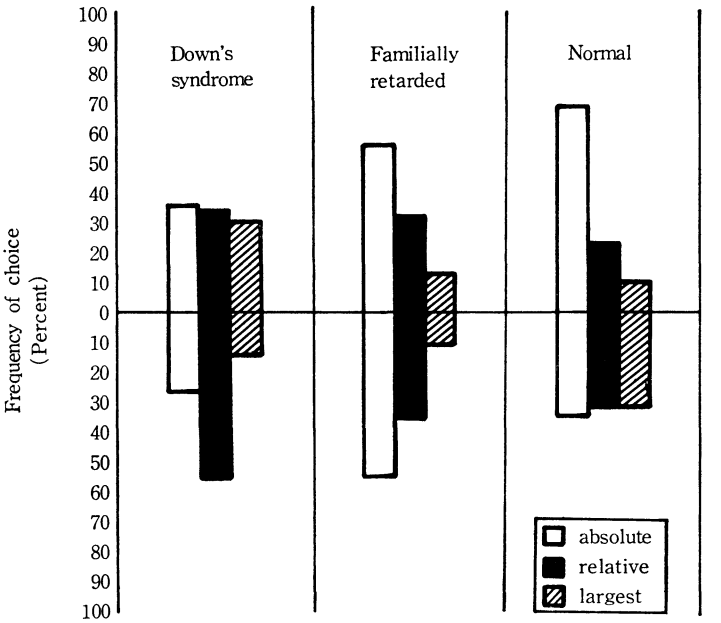

Fig. 1. Percentage of total responses to absolute, relative, and the largest stimuli by normal, familially retarded, and Down's syndrome *S*s, tested with large difference (ratio 1:2) between immediately after training (upper graph) and 3 hr. after training (lower graph).

Verbalization. Careful attention was paid to the questioning of *S*s concerning how they solved the problem. Only 4 of the 54 *S*s were able to verbalize the principle involved. 8 more *S*s mentioned something about the squares but could go no further in their explanation. The remainder could say nothing concerning their solution, nor insisted they did not know or just guessed. Thus the general assumption that responses were not mediated verbally in these *S*s seems a valid one. The rating of normal *S*s showed no relationship at any level with relative or absolute responses. None of Down's syndrome *S*s received a rating as above 1 (and only one was able to achieve that by appropriatedly identifying the stimuli). None could state the principle upon questioning (rating as 3); and of the 4 that received rating of 2 (verbal identification of the stimuli), 2 responded absolutely, 1 relationally, 1 to the largest stimulus. Of the 8 *S*s that were rated as 1 for appropriate selection of the stimuli on command, 4 responded in absolute and 4 in relative terms. It should be noted that of the 25 *S*s that responded in absolute terms, 6 were able to verbalize at some level of above 0 (24%), and likewise of the 16 *S*s that responded predominantly to the relative stimulus, only 6 achieved verbalization score of above 0 (37.5%).

Discussion

The hypothesis that retarded *S*s would make fewer absolute responses has not been confirmed. Familially retarded *S*s responded dominantly to the absolute

stimulus on both immediate and delayed testing condition. The results of familial *S*s and normal *S*s lend partly support to a conclusion drawn from Rudel's studies (1957, 1960) that optimal stimulus variables (conditions which make for the easist discrimination and the best recall) are those most likely to yield absolute responses. Normal *S*s responded dominantly to the absolute stimulus in the immediate testing but did not transpose on the above chance in the delayed testing. However, the same is not true of subjects with Down's syndrome. They responded on the chance level to absolute, relative, and the largest stimuli in the immediate testing, but yet did dominantly to the relative stimulus in the delayed testing.

Verbalization of the problem is not a necessary condition for relational responses. 5 of 7 *S*s who reponded to the relative stimulus in all 10 trials were not able to verbalize the task at all to the extent of naming or identifying the stimulus that was middle-sized. It was as if the concept of middle in our normal and retarded *S*s had not been clearly differentiated from that of middle-size.

These results do not correspond with Rudel's findings (1957) that in subsequent testing, responses were relational regardless of whether testing was immediate or delayed, and relational choice appears to have greater stability than absolute choice, and the lapse of time seems to have the same effect as decreasing stimulus differences. The results of our study cannot be understood in terms of the traditional dichotomy of absolute and relative responses in transposition. It would be furthermore desirable to investigate problems about subject variables (mental age, discrimination ability of the absolute aspects of the stimuli) and the effect of the lapse of time.

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(Received October 6, 1977)