The Effects of Non-Solution Hypotheses on Concept Learning

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SYNOPSIS. Forty-five preschool children were given 18 uncorrected trials before solving a size discrimination problem. Non-solution response choices for a particular stimulus size or position were evidenced by 71% of the subjects. Subjects who made non-solution hypothesis behaviors on the trials before concept learning did not require significantly more blocks of trials to learn the discrimination problem than those subjects who had responded randomly. A trend was noted such that subjects who had demonstrated the most consistency in their non-solution hypothesis behavior required fewer trials to learn the discrimination problem.

Perseverative responses or response sequences given before concept learning have been described by Levine (1963) as mediating responses, which are hypothesis predictions of what constitutes solution behavior to a problem. Levine (1964, 1966) using a two-choice discrimination model demonstrated that the particular hypothesis held by a subject during a learning problem may be inferred if outcomes (information as to correctness of response) are withheld for a few trials. Over consecutive blank trials (i.e., nonoutcome) only one hypothesis is maintained. The S responds consistently to the aspect of the stimulus corresponding to the hypothesis he has adopted as if E were saying "right" following each choice.

The relationship of these systematic response patterns to the learning process is not clearly established. Perseverative non-solution response choices for stimulus size, position, or color before concept learning have been explained as generalizations of response strength from previous learning. This generalization of non-solution behaviors is described as negative transfer, hindering new learning. Levine (1966) and Restle (1962) however held that it was the hypothesis-prediction on a particular trial that was the unit of behavior affected by reinforcement rather than a particular response. Therefore, Ss evidencing a significant-level pattern would NOT be expected to take longer to learn the concept.

The present study investigated the relationship of the type and number of repetitions of a non-solution hypothesis, evidenced on a pre-problem non-outcome trials measure to the number of sessions required to learn the concept "middle-size" under three informational conditions. It was predicted that the systematic response pattern would be affected as a total approach-to-the-problem.

METHOD

SUBJECTS: The subjects were 45 Madison Wisconsin nursery school children of ages 35 to 64 months. Children who already possessed the concept middle-size (as indicated by 10 or more correct discriminations on the 18 blank trials measure, $P < .05$) were not included. The subjects were divided into three treatment groups of ten children each and a control group of 15 children who received no training. The groups were matched for nursery school source and were not significantly different in mean chronological or mean correct score on the blank trials measure.

APPARATUS: The blank trials measure consisted of three yellow panels with six horizontal rows of objects of varying size on each pane. The apparatus and procedure has been described in detail previously (McManus, 1970). The discrimination problem stimuli were circles, hexagons and kegs manufactured by the Arthur Plastic Corporation. Blocks of trials were set up to consist of three trials for each class of objects, the circles, hexagons and kegs, for a total of nine trials in each learning session. The order of presentation was the same for each subject.

PROCEDURE:

Blank trials measure. Each S was presented with a series of 18 unreinforced trials in which he was instructed to choose the middle-sized object. No feed-back followed a response. A response was followed only by the next trial. The S's pattern of response was recorded as well as his total correct choices. This was evaluated to determine if he had demonstrated a hypothesis—i.e., a consistent choice of objects of a particular size (small or large) or a particular position (center or side) or had alternated choices in a systematic manner. Following the concept learning problem and an equivalent time for the control group, the blank trials were again administered.

Discrimination problem. The information conditions for the three groups were as follows: Group I received a token reward for a correct response to the directions, "Pick up the middle-size one." Group II received a token following a correct response and correction following an error, "No, that is not the middle-size one; this is the middle-size one." Group III received reinforcement and correction as Group II. In addition they were preinstructed with the concept before the trials each day and after responding with an error. The reinforcements were paper stars manufactured by the Dennison Company. The criterion for a perfect performance was nine correct trials in a learning session.

RESULTS

Children who do not possess the concept "middle-size" when asked to respond in terms of the concept and given no feedback on the correctness of their choice do not respond randomly. Table 1 shows that 71.1% demonstrated a tendency to respond with a significant level hypothesis before any discrimination training. The significant incidence of a hypothesis was taken to be 12 or more choices of 1 particular quality of the stimuli on the 18 blank trials. This is below the .01 level of significance as computed by the expansion of the binomial equation. The probability of re-

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sponding to a quality of size, such as smallest or largest, or to a specific position was figured separately. No consistent hypothesis of alternation (as LMR or RML) was observed. If children had adopted some searching strategy without alternation or observable systematic patterning their response was classified as random.

TABLE 1. PERCENTAGE OF SUBJECTS SHOWING HYPOTHESIS RESPONSE PATTERNS AMONG THE TREATMENT AND CONTROL Ss. (N=45)

Response Bias	%	N
Size	48.9	22
Smallest	24.4	11
Largest	24.4	11
Position	22.2	10
Center	13.3	6
Side	8.9	4
Total	71.1	32

Note—Significant incidence criterion was 12 or more choices of a particular stimulus quality on 18 nonoutcome trials of a 3-choice discrimination task ($P < .01$).

The mean ages of children choosing the various categories of hypotheses did not differ significantly. Nor were the ages of children who responded randomly different from those who evidenced a significant level hypothesis. ($F = 1.47$). Among the Ss who demonstrated a significant level hypothesis (12-18 choices of the same quality) the older children persisted more. The correlation of age and consistency of the hypothesis approached ($r = +.33$, $P < .07$) but did not reach significance.

Table 2 shows the means and sigmas for the number of sessions to score nine trials correct for subjects in the different response pattern groups. Treatment conditions have been collapsed. An overall analysis of variance indicated that the hypothesis groups did not differ significantly in days required to reach a criterion performance ($F = 1.63$). Those who demonstrated a non-solution hypothesis as size or position did not take significantly longer to learn the problem than those who had shown no such consistent behavior.

TABLE 2. COMPARISON OF THE HYPOTHESIS GROUPS ON SESSIONS TO FIRST PERFECT PERFORMANCE

Pattern	Smallest N=7	Random N=10	Position N=6	Largest N=7
Mean	2.57	3.60	3.66	5.28
Sigma	1.29	2.25	2.29	2.53

There is a trend for Ss evidencing the most consistency in their hypothesis to take the least time to learn ($r = -.34$, $P < .08$). Correlations computed separately for the treatment groups of minimum, intermediate and maximum information between number of consistent choices in the significant level hypotheses and days to learn the discrimination problem were insignificant. Subjects evidencing the most consistent hypothesis behavior appeared to take the least time to learn under the condition of being preinstructed with the concept.

An analysis of the hypothesis groups performance on the post-problem administration of the blank trials measure found that the difference between the hypothesis groups was not significant ($F = .43$). The groups were equally improved. Subjects who had received discrimination training performed significantly better than the control group that received no training. ($F = 30.83$, $P < .001$).

DISCUSSION

The percentage of children evidencing hypotheses in this study (71%) was higher than those reported by Rieber (1969). He reported 62.5% of the responses of kindergarten children were considered random, 25% based on color and size and 12.5% positional. The results were more consistent with those of Weir (1964) that showed children in the 3-5 age group used the searching strategy rarely and more often chose a simple win-stay, lose-shift strategy. They also resemble those of Ingalls and Dickerson (1969) who found their blank trial sets. This study supported Levine's (1964) 5th grade Ss evidenced consistent hypotheses on 81% of position on the equivalence of reinforcement and non reinforcement. The children behaved on the blank trials as if E said "Right" to their responses.

Kendler and Kendler (1962) suggest that below age 5 children behave predominantly in a single unit S-R basis. With increasing age, children made a transition to behaving in a mediated manner. The three choice middle-size discrimination problem with blank trials preceding outcome trials may be a sufficiently different situation from the two choice learning problem that strategies that children employ cannot be equated. However, in this study, the presence of a systematic response bias or hypothesis previous to concept learning did not inhibit speed of learning. Children who demonstrated a significant level hypothesis did not learn the discrimination problem at a different rate from those who had responded randomly. It was noted that children demonstrating the most consistency in their hypothesis tended to learn more rapidly rather than less rapidly. The hypothesis seemed to extinguish as a unit.

The results of this study suggest that hypothesis and strategy models that have proved useful in the description of adult behavior may hold promise in the analysis of response bias data with younger children.

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