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ABSTRACT

The present experiment compared direct and vicarious transfer in the attainment of affirmative and relational concepts. Second and third grade children were randomly paired as model and observer. The latter observed his yoked model solve the initial two-dimensional problem before solving the intrarule transfer task himself. No differences in solution difficulty were apparent in the affirmative (color) versus relational (size) comparison. Children of this age may have equal facility with these concepts even though relational values are learned later than affirmative ones. Models showed significant positive transfer for relational and affirmative concepts; however, observers did not. (Author)

Vicarious Transfer of Affirmative and Relational Concepts

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The present experiment compared direct and vicarious transfer in the attainment of affirmative (color) and relational (size) concepts. Second and third grade children were randomly paired as model and observer. The latter observed his yoked model solve the initial two dimensional problem before solving the intrarule transfer task himself. Models showed significant positive transfer for relational and affirmative concepts combined; however, observers did not. Greatest positive transfer occurred for models attaining the relational concept. Although relational values are learned later than affirmative ones, the limited dimensions available for the former make it similar to the reversal shift rather than the nonreversal. The results are discussed in terms of the calculus of propositions for bidimensional rules.

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Sizable general intrarule transfer in the learning and using of concepts has been demonstrated in various contexts. Bourne (1970) proposes that such facility within, as well as between, combination rules can be traced to a problem solving strategy based on a bidimensional logical truth table. There is general agreement that, although learning sets acquired through inter- and intra-rule nonspecific transfer lead to efficient solution over an extended problem series, initial differences exist in rule difficulty. That is, some concept rules (e.g., conjunctive red $\cap$ square) are more easily attained early in the problem series than others (e.g., disjunctive, red $\cup$ square) (Di Vesta & Walls, 1969).

Carroll (1964) proposes that concepts dealing with relationships among and within dimensions (e.g., $A > B$) may be more important than concepts dealing with combined presence or absence of dimensions and their attributes. Many of the concepts learned by children are of the former type.

Conflicting evidence exists with regard to the relative difficulty of attaining a relational (e.g , cup a > cup b) concept rule as compared to the conjunctive or disjunctive (Bourne & Guy, 1968; Hunt & Hovland, 1960; Laughlin & Jordan, 1967; Securro & Walls, 1971). However, for young children, the relational concept, (e.g., larger) should be more difficult than the simple affirmative (e.g., red). Piaget holds that such relational or seriation values are acquired at approximately 5 to 6 years of age. Children who have a grasp of the nature of both of these class concept types may be able to deal equally well with them. This proposition may be tested reasonably since, unlike most other rule pairs, comparable truth table relations can be constructed for each.

In the calculus of propositions formed by bidimensional partitions of a stimulus population, the simple affirmative rule can be represented as two positive and two negative instances as illustrated in Table 1. Similarly, it will be noted that response categories for the relational rule are also two positive and two negative in the truth table. The present experiment involved combinations of the attributes within each of two dimensions in a two-choice reception-selection combination paradigm. Although the relational and affirmative concepts are not primary bidimensional rules (Bourne, 1970), the systematic variation of two dimensions as utilized herein allow such representation.

Teachers often use demonstrations, films, attribute naming, or other vicarious processes to teach concepts in the classroom. Bandura and Walters (1963) indicate that when solution requires the use of complex strategies or rules by the model, the modeling cues apprehended by the observer may not constitute a sufficient sample to permit complete attainment. Walls and Rude (1972) found an interaction between low (conjunctive) and high (conditional) level concepts for adult observers and their adult models. Performance was similar for models and observers in the easy task; but while models showed large positive transfer effects for the more difficult conditional problem, observers did not. The purpose of the present investigation was to examine such possible relationships with second and third grade children learning affirmative and relational rules.

Children of this age should have some facility with collpasing the stimulus population at the class level (Bourne, 1967) but may identify one rule more readily than another as has been indicated for conjunctive (TT) versus disjunctive rules (TT, TF, FT). It is assumed that models should exhibit greater positive transfer than their observers.

Insert Table 1 about here

Method

Subjects and Design

The subjects were 40 (23 male and 17 female) second and third grade children. The children were enrolled in a rural public school in West Virginia; fewer than five percent of the children were Black.

By reference to a table of random numbers, these children were randomly paired (within their own grade) in the Learner condition as model and observer. These pairs were randomly assigned to one of the two Concept conditions (affirmative or relational) with the restriction that n in all cells was the same. The original and intrarule transfer Problems constituted a within subjects factor in the 2 x 2 x 2 mixed design. However, subjects serving as observers were yoked to their respective models. That is, observers were assigned the same original or first problem learning scores as their models for computation of transfer effects.

Apparatus and Stimulus Materials

The apparatus was basically a large wooden box (70 cm long x 32.5 cm wide x 58.5 cm high) the bottom of which was 45 cm from the floor. The top half of the apparatus was the experimenter's storage shelf and was obscured from the subject's view. The bottom half was open, front and back, and resembled a puppet show theatre. The experimenter controlled a curtain that blocked the subject's view between trials.

The stimulus materials for the first problem were six plastic cups of the same shape but varying in size (small, medium, large; 3 cm, 6.5 cm, and 9.5 cm high, respectively) and in color (blue, black). For the second or transfer problem, the six cups represented the same dimensions of size (small, medium, large) and color (yellow, white).

Procedure

The observer was seated to the model's right at the apparatus; after giving initial instructions, the experimenter sat behind the apparatus so that his head and upper body were not visible to subjects. They were told that the object of the game was to find as many "silver tokens" under the cups as possible so that they might trade them for a toy from the display of inexpensive toys at the side of the experimental room. The observer was instructed to, "Watch what name of model does. You watch which cups win so you can win when it is your turn to play." Simple two-choice discrimination instructions were given to the model. The subject responded by looking under one of the two cups presented on each trial.

In the first problem a blue and a black cup were presented on each trial, with approximately 15 cm from cup-center to center and left-right position determined randomly. Two cups of the same size were never presented on a given trial. Thus, in the six possible combinations, the affirmative concept "blue" always had one positive and one negative instance on each trial, as did the relational concept "larger." The experimenter closed the curtain of the apparatus before preparing the randomly determined presentation. The transfer problem was solved by one half of the models immediately following solution of the first; the other half was counterbalanced so that their observers solved the transfer problem first. Attention to and play with the array of toys served as filler activity for those subjects not solving the transfer task immediately.

Results

Criterion for learning was five consecutive correct selections. Data were recorded as trials and errors to criterion; these means are reported in Table 2. A t test for independent means indicated no significant difference in performance errors between the subjects who solved the transfer problem immediately and the counterbalanced delay subjects ($t=0.33$, $p>.05$). This factor was thus collapsed for subsequent analyses. Analyses for related measures yielded significant positive transfer for models ($t=2.52$, $p<.05$ two-tail for errors to criterion; $t=2.51$, $p<.05$ for trials to criterion). Similar transfer analyses for yoked observers yielded nonsignificant transfer effects ($p>.05$ for errors and $p>.05$ for trials). Testing possible transfer effects for affirmative and relational concepts separately revealed significant positive transfer only for models solving the relational problems ($t=2.19$, $p<.05$ one-tail for errors; $t=2.11$, $p<.05$ one-tail for trials). Other separate transfer effects were nonsignificant ($p>.05$).

Insert Table 2 about here

A 2 x 2 factoral analysis of variance format was used to examine performance on the second or transfer problem. The analysis for errors to criterion yielded a significant effect due to Learner (F 1/36 = 7.71, $p < .01$) but not for Concept (F 1/36 = 0.64, $p > .05$) or the Learner x Concept interation (F 1/36 = 0.07, $p > .05$). Similarly, the analysis for trials to criterion revealed a significant effect for Learner (F 1/36 = 8.19, $p < .01$) but not for Concept (F 1/36 = 0.01, $p > .05$) or their interaction (F 1/36 = 0.02, $p > .05$).

Discussion

In general, the findings of the investigation indicate differential transfer for models and observers. These results support the hypothesis that solution cues are more readily acquired by subjects working directly with the stimulus dimensions than by those observing the performance. Direct experience with affirmative and relational concepts commonly taught in the classroom should be more helpful in concept learning than listening to attribute naming, watching attribute selection, or some other vicarious procedure.

However, the extent to which teachers emphasize critical determinants in the teaching of school concepts remains to be investigated. The present paradigm should more closely approximate the typical concept instruction process if the model verbalized salient determinants of his selection for the observer's benefit. Such extension of social learning phenomena to rule governed behavior has briefly touched on moral judgments (Bandura & McDonald, 1963) and delay of gratification (Bandura & Mischel, 1965; Walls & Smith, 1970), but has been virtually nonexistant with regard to concept acquisition (Rosenthal, Moore, Dorfman, & Nelson, 1971).

While the conjunctive, disjunctive, conditional, and biconditional are legitimate primary bidimensional rules, the relational and affirmative do not strictly conform to this structure as described by Bourne (1970). However, when properly cast into the two-choice selection paradigm, their positions within the calculus of propositions become apparent as noted in Table 1. Transfer was best for models solving relational concepts. While the color dimension had two different attributes in the second problem (yellow, white) as compared to the first problem (blue, black), the size dimension did not (small, medium, large). This may, in part, account for this finding. Kendler and Kendler (1959) have indicated the reversal shift to be less difficult than the nonreversal for children of this age. While the tasks used herein do not conform to the reversal-nonreversal shift paradigm, the loci of parameters are analogous. This construction of tasks, as noted previously, was necessary to provide analysis and interpretation of affirmative and relational concepts.

Calvin and Clifford (1956) reported greater difficulty for the color dimension than position in the two-choice discrimination task for first grade children. The children apparently conceptualized both cards as "colored" instead of treating one as blue and the other as green. Further comparison should be forthcoming of concept classes possessing dissimilar rules but similar truth table patterns. Only by systematic variation in such investigation can the similarities of laboratory and school concepts be noted and a science of concept teaching and learning be built.

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Footnotes

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TABLE 1

Assignment of Stimulus Classes
to Response Categories(+ and -)
under Affirmative and Relational Rules

Stimulus Class	General Notation	Stimulus Set	Affirmative B	Relational L
LB	TT	MB[a], GB	+	+
$L\bar{B}$	TF	MY, GY	-	+
$\bar{L}B$	FT	MB, SB	+	-
$\overline{LB}$	FF	MY, SY	-	-

NOTE.---T= true(or present), F= false(or absent), L= larger, $\bar{L}$= not larger, B= blue, $\bar{B}$= not blue, Y= yellow, S= small, M= medium, G= large.

[a]Medium(M) may be larger(L) or not larger($\bar{L}$) depending upon its pairing in the two-choice paradigm.

TABLE 2

Means of Trials and Errors

for All Conditions

Condition	Problem 1		Problem 2	
	Trials[a]	Errors	Trials	Errors
Affirmative Models	26.4	10.1	12.4	4.0
Affirmative Observers	26.4	10.1	25.3	11.4
Relational Models	27.4	11.8	11.3	2.7
Relational Observers	27.4	11.8	25.5	8.8

[a]Includes five trials to criterion.