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AUTHOR	Walls, Richard T.; Rude, Stanley H.
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ABSTRACT

The study assessed contributions of different novelty pairings and reward types to exploration behavior across three successive discrimination learning problems in a 3 x 2 x 3 mixed design. After learning a simple two choice discrimination problem, Headstart subjects responded to six double reward trials and six extinction trials. A learning-to-learn effect occurred with regard to both problem solution and decision time. Epistemic curiosity was evident across problems to the extent that children would explore a novel object even after learning that the familiar object was associated with reward. Reward type did not affect response selection but did increase response latency on initial double reward trials. (Author)

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Abstract

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Specific and diversive exploration appear to relate, at least in part, to novel cues or change in the stimulus environment (Berlyne, 1960; Montgomery, 1953). The occurrence of selective orienting responses in the presence of such novel cues has often been termed curiosity. Day and Berlyne (1971) have described curiosity as, "the state of a person, who has been aroused by a stimulus environment which induces a high level of uncertainty and who engages in exploration in order to gain information and reduce arousal." This condition of arousal, or high drive, has been assumed to be induced by conceptual conflict ascribed to collative properties of external stimulus patterns, such as, novelty, surprisingness, incongruity, or power to induce subjective uncertainty (Berlyne & Frommer, 1966). Further, collative properties have been assumed to be dependent upon the comparison or collation of different elements from present and previous stimulus fields.

The two major dependent measures in such experiments are the choices subjects make between stimuli and the amount or direction of fixation on one, rather than another, stimulus. However, investigation has gone beyond simple orienting responses to varying stimulus complexity. Novelty, for example, has been related to: manifest anxiety and physiological arousal (Haygood, 1962); creativity (Houston & Mednick , 1963); developmental and intellectual characteristics (Pielstick & Woodruff, 1964); imaginative productions (Maddi, Charles, Maddi, & Smith, 1962); and, children's preferences (Mendel, 1965). Charlesworth (1964) reports that a surprising event, congruent with the general parameters expected by the subject, may promote and maintain curiosity behavior more effectively than novel events, for which his expectations are imprecise. In a simple two-choice color discrimination task, Greene (1964) found that preschool children tended to select a novel stimulus rather than a previously rewarded or nonrewarded stimulus. However, the children were not taken to a learning criterion before being given such choices.

Harlow (1949) has suggested that the organism's history of learning sets should be considered in explanation of "perceptual selection." Such a gradual learning history is able to account convincingly for cognitive phenomena formerly considered properties of the innate organization of the individual. Various investigators have examined human efficiency in learning-to-learn simple discriminations (Kaufman & Gardner, 1969; Shepard, 1957), paired associate lists (Duncan, 1964; Keppel & Postman, 1966), and concept attainment (Di Vesta & Walls, 1968; Saravo & Kolodny, 1969).

The present experiment was designed to investigate the effects of these variables on the selection decisions of disadvantaged preschool children. In particular, the purpose was to determine the nature of exploratory activity in the two-choice discrimination paradigm for which a learning criterion is attained prior to introduction of a novel stimulus. Further, how does repeated problem exposure and solution effect epistemic behavior? It was assumed that there would be a tendency to explore novel stimuli replacing formerly nonrewarded stimuli and, to a greater extent, those replacing formerly rewarded stimuli. Different reward types were incorporated into the procedure to approximate an element of diversive as opposed to the specific exploration stimuli. While it is feasible that these novel reward types would increase the exploration for those stimuli with which they are associated, prediction in the absence of prior evidence is difficult; it is unlikely that they would be as powerful in directing exploratory activity as the discriminative cues of specific curiosity for the stimuli themselves.

Method

Subjects

The subjects were 60 preschool children (33 males and 27 females) emrolled in the full year Headstart program. These children were accepted into the program of a single semi-rural county in West Virginia on the basis of standard Headstart socioeconomic disadvantagement criteria. Fewer than five percent of the subjects were Negro.

Design

The overall design consisted of the two factors with three similar problems. There were three variations in the Stimulus-Cover condition.

In one variation, (a) a novel cover replaced the previously rewarded cover; in another, (b) a novel cover replaced the previously nonrewarded cover; in the third variation, (c) no novel cover was introduced. There were two treatments in the Reward-Type condition. In the first, (a) novel rewards (trinkets) replaced familiar rewards (marbles); in the second, (b) reward-type was unchanged. Each subject was tested separately on three successive problems, differing only in that the stimulus covers were different for each problem (cups, cans, or boxes). The format was thus a 3 x 2 x 3 mixed design with two between subjects factors and one within subjects factor. The 60 subjects were assigned to the six treatment conditions by reference to a table of random numbers, with the restriction that assignment was balanced (n=10) over cells.

Apparatus and Materials

The apparatus was basically a large wooden box (28 in. long x 13 in. wide x 23 in. high) constructed for the experiment. The bottom of the box was 18 in. 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 two shallow reward dishes (2 in. in diameter) were located on the approximate midline of the floor of the apparatus and were separated by 10 in. from center to center.

For each of the stimulus covers, three distinguishable attributes were available to facilitate discrimination. For example, each cup differed from all other cups in size, shape, and color. There were eight cups of the common coffee or household types, eight boxes of approximately the same size as the cups with various product labels and pictures, and eight cans of similar sizes with the labels intact.

Procedure

After initial instructions, the experimenter sat opposite the subject at the apparatus. The experimenter's head and torso were not visible to the subject during the remainder of the experiment. The subject was instructed to look for a prize under one of the two stimulus covers ("cups", "cans", or "boxes"). All subjects first learned a two-choice discrimination to a criterion of five errorless trials, e.g., cup 1 (rewarded) versus cup 2 (nonrewarded). The experimenter closed the curtain before placing a marble in the reward dish and covering both dishes on each trial. Care was taken to avoid audible cues. The position of the covers as well as the order of the three problems was randomly determined.

Following attainment of discrimination criterion on each problem, and with no further instructions or interruption of the procedure, six double-reward and six extinction trials were presented. It was during these 12 trials that the experimental treatments were in effect. For example, in the Stimulus-Cover condition variation--a novel cover replaced the previously nonrewarded cover--a subject's six double-reward trials for the cup problem would be the following: (a) cup 1 versus cup 3, (b) cup 1 versus cup 4, (c) cup 1 versus cup 5, (d) cup 1 versus cup 6, (e) cup 1 versus cup 7, and (f) cup 1 versus cup 8. The presentation (right-left) of the stimulus covers was again random. There was a reward under each cover in the double-reward trials.

These were followed by six extinction trials in which no rewards were present. The extinction trials had the same right-left presentations and cover pairings as the six double-reward trials.

The rewards used in the discrimination learning problems were multicolor marbles. Marbles continued to be the prize in double-reward trials for one half the subjects (Reward-Type unchanged). For the remainder of the subjects, (Reward-Type novel) small trinkets (e.g., rings, plastic insects, etc.) provided different reinforcing stimuli on each double-reward trial.

Results

The subjects' responses on each trial were recorded. The discrimination learning data were analyzed by overall Stimulus-Cover x Reward-Type x Problems (3 x 2 x 3) mixed analyses of variance for trials and for errors to criterion. Repeated Problems yielded a significant effect for both trials (F 2/108 = 5.48, p <.01) and errors (F 2/108 = 7.16, p <.01). As would be expected on the basis of the random assignment of subjects to both Stimulus-Cover and Reward-Type conditions, no other significant main effects or interactions (p >.05) occurred at this juncture. The means for trials and errors to criterion indicate a learning effect across the three problems.

In order to determine the relative ease in making a decision regarding double-reward and extinction choices, the experimenter used a stop watch to record the time between the opening of the curtain and the subject's response. Using number of seconds as the dependent measure, a 3 x 2 x 3 x 2 mixed analysis of variance crossed Stimulus-Cover and Reward-Type (between subjects) with Problems and Trials in blocks of three (within subjects). The results of this analysis yielded significant effects due to Stimulus Cover (F 2/54 = 21.83, p <.01), Problems (F 2/270 = 6.07, p <.01), and Trials (F 1/270 = 27.55, p <.01). Additionally, there was a significant Stimulus-Cover x Problem interaction (F 4/270 = 7.29, p <.01), a Problems x Trials interaction (F 2/270 = 4.62, p <.01), and a Reward-Type x Problems x Trials interaction (F 2/270 = 3.38, p <.05). A similar analysis of variance for extinction trials yielded significant main effects due to Stimulus Cover (F 2/54 = 9.70, p <.01), Problems (F 2/270 = 3.80, p <.05), and Trials (F 1/270 = 41.27, p <.01). Other main effects and interactions were nonsignificant for these analyses.

Insert Table 1 About Here

The frequency of choices across the six double-reward and six extinction trials are presented in Table 1. Four cell chi-square analyses (df=1) comparing appropriate rewarded cover, nonrewarded cover, and novel cover conditions yielded the following findings for double reward trials. In double reward trials, subjects selected the novel covering more often than the previously nonrewarded covering when the pairing was with the previously rewarded covering (X^2 = 7.62, p <01 for problem 1-choice 1; X^2 = 13.33, p <01 for problem 2-

choice 1; $\underline{X}^2 = 7.03$, $\underline{p} < .01$ for problem 3-choice 1; $\underline{X}^2 = 66.45$, $\underline{p} < .01$ for problem 1-all choices combined; $\underline{X}^2 = 61.53$, $\underline{p} < .01$ for problem 2-all choices combined; and $\underline{X}^2 = 37.06$, $\underline{p} < .01$ for problem 3-all choices combined. These findings support the major hypothesis that there is a tendency to select a novel stimulus instead of the reward associated stimulus.

It should then hold that the subject selects the novel cover when it replaces the previously rewarded stimulus. This was indeed the case ($\underline{X}^2 = 7.62$, $\underline{p} < .01$ for problem 1-choice 1; $\underline{X}^2 = 3.96$, $\underline{p} < .05$ for problem 2-choice 1; $\underline{X}^2 = 10.99$, $\underline{p} < .01$ for problem 3-choice 1; $\underline{X}^2 = 17.05$, $\underline{p} < .01$ for problem 1-all choices combined; $\underline{X}^2 = 24.30$, $\underline{p} < .01$ for problem 2-all choices combined ; and $\underline{X}^2 = 43.20$, $\underline{p} < .01$ for problem 3-all choices combined). Comparison was with the control condition in the above chi-square analyses.

Similar chi-square analyses for extinction trials yielded similar findings. However, as would be expected, response switching during extinction reduced these effects somewhat.

Partitioning the data to assess the possible effect of Reward-Type, appropriate four cell chi-square analyses indicated no systematic effect. That is, there was little indication that Reward-Type was a significant determinant of response selection in either double-reward or extinction trials. The reader will, however, recall an interaction of Reward-Type with Problems and Trials when time to decision was the dependent measure. Subjects took more time to decide when confronted with new rewards (trinkets) on the first few double-reward trials of problem 1. By the second block of three trials of the double-reward, and on subsequent problems, their response times were similar to subjects receiving marbles throughout.

Discussion

In this study, the effects of exploration conditions and reward types were investigated as they relate to nonspecific transfer. Manipulation of stimulus covers for the rewards in the two-choice discrimination paradigm was found to affect selection performance across the three problems for both double-reward and extinction trials. The type of reward involved did not affect response selection, but it did increase the time required to make a response on the initial double reward trials of the first problem.

There was a learning effect across problems evidenced by a decrease in trials and errors to solution. This is, of course, to be expected when stimuli and responses are members of the same concept class (Bourne, 1970; Osgood, 1949). The cans, boxes, and cups of the present investigation apparently provided sufficiently similar effective stimuli to facilitate positive transfer (Securro & Walls, 1971). The learning set was also evident across problems and blocks of trials with respect to response latency. That is, decision time decreased for double-reward and extinction trials within and across problems. This reduction was, however, differential for the Stimulus-Cover treatments. As expected, control subjects required least time to decide during double-reward and extinction trials ($\bar{X}$ = 3.9, $\bar{X}$ = 4.9 seconds respectively), the novel cover replaced previously nonrewarded cover treatment required most time ($\bar{X}$ = 6.5, $\bar{X}$ = 7.3 seconds respectively), with the novel cover replaced previously rewarded cover treatment requiring an intermediate amount of decision time ($\bar{X}$ = 5.5, $\bar{X}$ = 6.3 seconds respectively).

The added decision difficulty associated with the novel stimulus event was reflected in the choices as well. Berlyne and Frommer (1966) propose that novel or surprising items arouse curiosity since more questions are asked about such items. While young children ask few questions, such a lack of questioning is probably related more to lack of verbal skills than to perceptual or epistemic curiosity. The disadvantaged preschool children of the present study did demonstrate interest in exploring a specific stimulus object. They did so even when the familiar reward associated stimulus was present. Further, evidence of diversive, epistemic processes operating may be inferred from the response latency data.

The subject apparently learns, not only a general solution rule associated with the two-choice paradign (Harlow, 1949, Walls & Smith, 1970) but also a generalized expectancy regarding the utility of exploration behaviors. While the mechanized presentation of simple prerequisite problems is often construed as guiding the student to desired solution (Gagne, 1965), the possibilities for teaching the heuristics of discovery (Bruner, 1966) and exploration should not be discounted.

References

Berlyne, D. E. Conflict, arousal, and curiosity. New York: Mc Graw-Hill, 1960.

Berlyne, D. E. & Frommer, F. Some determinants of the incidence and content of children's questions. Child Development, 1966, 37, 177-189.

Bourne, L. E., Jr. Knowing and using concepts. Psychological Review, 1970, 77, 546-556.

Bruner, J. S. Toward a theory of instruction. Cambridge, Mass.: Belknap Press, 1966.

Charlesworth, W. R. Instigation and maintenance of curiosity behavior as a function of surprise versus novel and familiar stimuli. Child Development, 1964, 35, 1169-1186.

Day, H. I. & Berlyne, D. E. Intrinsic motivation. In G. S. Lesser (Ed.), Psychology and educational practice. Glenview, Ill.: Scott, Foreman and Co., 1971. Pp. 294-335.

Di Vesta, F. J. & Walls, R. T. Multiple versus single problem training and variations of solution rules in the formation of learning sets. Journal of Educational Psychology, 1968, 59, 191-196.

Duncan, C. P. Learning to learn in response-discovery and in paired-associate lists. American Journal of Psychology, 1964, 77, 367-379.

Gagne, R. M. The conditions of learning. New York: Holt, Rinehard & Winston, 1965.

Greene, F. M. Effects of novelty on choices made by preschoolers in a simple discrimination task. Child Development, 1964, 36, 1257-1264.

Harlow, H. F. The formation of learning sets. Psychological Review, 1949, 56, 51-65.

Haygood, H. C. Novelty seeking behavior as a function of manifest anxiety and physiological arousal. Journal of Personality, 1962 30, 63-74.

Houston, J. P. & Mednick, S. A. Creativity and the need for novelty. Journal of Abnormal and Social Psychology, 1963, 66, 137-141.

Kaufman, M. E. & Gardner W. I. Learning set efficiency in mentally retarded children. American Journal of Mental Deficiency, 1969, 73, 798-800.

Keppel, G. & Postman, L. Studies of learning to learn: Conditions of improvement in successive transfer tasks. Journal of Verbal Learning and Verbal Behavior, 1966, 5, 260-267.

Maddi, S. R., Charles, A. M., Maddi, D. R. & Smith, A. J. Effects of monotony and novelty on imaginative productions. Journal of Personality, 1962, 30, 513-527.

Mendel, G. Children's preference for differing degree of novelty. Child Development, 1965, 36, 453-465.

Montgomery, K. C. Exploratory behavior as a function of similarity of stimulus situations. Journal of Comparative and Physiological Psychology, 1953, 46, 129-133.

Osgood, C. E. The similarity paradox in human learning: A resolution. Psychological Review, 1949, 56, 132-143.

Pielstick, N. L. & Woodruff, A. B. Exploratory behavior and curiosity in two age and ability groups of children. Psychological Reports, 1964, 14, 831-838.

Saravo, A. & Kolodny, M. Learning set and shift behavior in children. Journal of Experimental Child Psychology, 1969, 7, 21-30.

Securro, S., Jr. & Walls, R. T. Concept attainment of culturally advantaged and disadvantaged children utilizing artificial and lifelike stimulus tasks. Journal of Educational Psychology, 1971, 62, 531-538.

Shepard, W. O. Learning set in preschool children. Journal of Comparative Physiological Psychology, 1957, 50, 15-17.

Walls, R. T. & Smith, T. S. Development of preference for delayed reinforcement in disadvantaged children. Journal of Educational Psychology, 1970, 61, 118-123.

Footnotes

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[2] Request for reprints should be sent to Richard T. Walls, Educational Psychology, 806 F.T., West Virginia University, Morgantown, West Virginia 26506.

Table 1

Choice for all Conditions[a]

Across Six Trials

Reward Type	Problem	Double Reward						Extinction					
		N vs.	R	N vs.	NR	NR vs.	R	N vs.	R	N vs.	NR	NR vs.	R
Novel	1	37	23	52	8	7	53	33	27	41	19	24	36
Rewards	2	32	28	49	11	3	57	37	23	41	19	20	40
(Trinkets)	3	35	25	49	11	8	52	36	24	39	21	21	39
Reward	1	38	22	51	9	7	53	34	26	37	23	21	39
Unchanged	2	30	30	49	11	4	56	30	30	38	22	15	45
(Marbles)	3	21	39	55	5	5	55	19	41	37	23	23	37

[a]
N=Novel Stimulus Cover
R=Previously Rewarded Stimulus Cover
NR=Previously Nonrewarded Stimulus Cover