

Optional shift behavior in children and young and elderly adults

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Optional intradimensional and extradimensional shift behavior in preschool children, college-aged adults, and two groups of elderly adults was investigated in this study. The young adults made reliably more intradimensional shifts than did the children. This finding is in accord with the results of earlier studies in which optional reversal and nonreversal shift behavior has been investigated as a function of age. While the two elderly groups did not differ reliably in their shift behavior, the performance of the younger elderly Ss was comparable to that obtained for the college Ss, while the performance of the older elderly Ss was comparable to that obtained for the children.

The optional shift paradigm has been used by the Kendlers (Kendler, Kendler, & Learnard, 1962; Kendler & Kendler, 1966, 1970) for examining the development of mediational processes in children's discrimination learning. This research has consistently indicated that between preschool and college age, the percentage of Ss making an optional reversal shift increases with age, while the percentage of Ss making an optional nonreversal or nonselective shift decreases. On the basis of these findings as well as other data (e.g., Kendler & Kendler, 1959), the Kendlers have proposed a developmental mediation theory which assumes an ontogeny of children's shift behavior.

The Kendlers' mediation theory can be contrasted to alternative models that hold that mediation is not related to the phylogenetic or ontogenetic level of the S. For example, Zeaman & House (1963) hold that discrimination learning requires a chain of two responses. The first is a central mediating response to the relevant stimulus dimension; the second is an instrumental response of approach to a particular dimensional cue. This view holds that discrimination learning is always governed by mediation and that reported ontogenetic differences are due, in part, to artifacts involving procedural factors (see, e.g., Dickerson, Wagner, & Campione, 1970).

Campione (1970) recently obtained evidence which he interpreted as being inconsistent with the Kendlers' notion that there exists an ontogeny of shift behavior. He employed the total-change optional-shift paradigm to examine the behavior of preschool and second-grade children and found that the children's tendency to make optional intradimensional shifts was independent of age level. However, this evidence is not necessarily inconsistent with the Kendlers'

developmental theory in that they have suggested that the probability that children's behavior will be mediated *gradually* increases with increasing age. Thus, Campione's failure to find age differences may have resulted because the age difference between his two age groups was too small. To investigate this possibility, a greater age difference—preschool vs college age—was used in the present study. It was hypothesized that the college-aged Ss would make reliably more optional intradimensional shifts than would the preschool children.

A second purpose of the study was to examine the shift behavior of elderly adults. Although age differences between young and old adults in the use of mediators in paired-associate learning has been reported (Hulicka & Grossman, 1967; Hulicka, Sterns, & Grossman, 1967), little attention has been focused upon possible age differences in the various shift paradigms (Botwinick, 1970). Crowitz (1964) found that only 10 of 26 aged men (mean age, 65.1 years) were able to learn a reversal shift, whereas 28 of 32 young Ss (mean age, 23.8 years) learned the problem. She suggested that aged Ss may be comparable to young children in terms of a "mediational deficiency." In a study examining the reversal, intradimensional, and extradimensional shift behavior of elderly men (mean age, 66 years), Nehrke & Coppinger (1971) obtained evidence which led them to suggest that their Ss were functioning in a manner similar to children in transition from mediational deficiency or single-stage theory to a mediational level. On the basis of the preceding results, it was predicted that the optional shift behavior of the elderly Ss would parallel that obtained for the children.

SUBJECTS

The Ss included 32 preschool

children, 32 college students, and 32 elderly adults. The data for 4 additional college Ss were discarded because of experimental error; no S was excluded for failure to learn either the initial or the optional shift discrimination. The children were obtained from two private preschools and ranged in age from 36 to 61 months, with a mean age of 52.4 months. The college Ss were obtained from general psychology classes at the University of Arkansas and ranged in age from 18 years, 7 months to 25 years, 3 months, with a mean age of 19 years, 9.2 months. The older adults were obtained from an adult center in Fayetteville, Arkansas. Their ages ranged from 53 years, 0 months to 81 years, 0 months, with a mean age of 69 years, 0.2 months. All but three of these Ss had completed high school, and 14 had some college training; they all reported that they currently were in good health.

STIMULI

Colored geometric forms pasted on 5 x 8 in. white cards served as stimuli. There were a total of 64 color-form patterns resulting from the factorial combination of eight forms (square, circle, cross, triangle, diamond, star, X, and T) and eight colors (red, blue, gray, green, black, brown, orange, and yellow). Maximum height of the forms was 4.75 in., while the maximum width was 3.75 in. Sixteen different sets of problems were generated from these stimuli, and two Ss from each age level were tested with each set.

PROCEDURE

Each S was tested individually. The stimulus cards were kept behind a small screen; E initiated a trial by manually presenting a given stimulus card. The S pointed at the stimulus he thought to be correct; a noncorrection procedure was used throughout the experiment, and the Ss' responses were verbally reinforced by E. The intertrial interval was approximately 5 sec. On the initial discrimination, half the Ss within each age level were trained with color relevant, while the remaining Ss were trained with form relevant. The irrelevant dimension varied within trials. The spatial arrangement of the stimuli on each trial was determined by a Fellows' (1967) series. On both the initial and optional shift discriminations, each cue was positive and negative an equal number of times within each age group. Training was continued on the initial discrimination to a criterion of 10 successive correct responses.

After the S reached criterion on the initial problem, the optional shift discrimination was introduced with no ostensible break in the procedure. For each S, entirely new color and form stimuli were presented, and Ss were

required to learn a discrimination in which color and form were relevant and redundant. The spatial arrangement of the stimuli was again determined by a Fellows' series, and the Ss were tested to the same criterion used in the initial problem.

A 20-trial test series was given immediately after the S had attained criterion on the optional shift problem. On a random 10 of these trials, the pair of stimuli used during the optional shift were presented and the reward contingencies remained the same. On the remaining 10 trials, the color and form cues were re-paired, with each spatial setting appearing five times and all responses being rewarded. If, on these trials, the S selected eight or more times the positive cue from the dimension which was relevant on the initial discrimination, his shift was classified as intradimensional; if the S chose eight or more times the positive cue from the dimension which was initially irrelevant, his shift was classified as extradimensional. Those Ss who did not choose one of the stimuli at least eight times were classified as nonselective.

RESULTS

It was hoped that data from 32 elderly Ss of approximately the same age could be obtained. However, since wide age differences did exist among the 32 elderly Ss tested (27 years maximum), and since the discrimination performance of a 53-year-old adult might differ markedly from that of an 81-year-old adult, the elderly group was divided into two groups on the basis of the median age (69 years, 7 months) of the entire group. The median age of the younger of the two resulting groups was 65.0 years, while the median age of the older group was 74.5 years.

Median trials to criterion on the initial problem for the four age groups, in order of increasing age, are presented in Table 1. A Kruskal-Wallis one-way analysis by ranks revealed a significant age effect, $H(3) = 8.67$, $p < .05$. Mann-Whitney U tests were then used to examine differences between all possible pairs of age groups; the only significant difference obtained was that between the preschool and college Ss ($z = 2.95$, $p < .01$).

The four age groups did not differ reliably in trials to criterion on the optional-shift discrimination. The median number of trials to criterion was 1.0 for each age group (see Table 1).

The number (percentage) of Ss in

Table 1
Trials to Criterion on the Initial and Optional Shift Discrimination Problems

Age Level	Problem			
	Initial		Optional	
	Median	Range	Median	Range
Preschool	9.5	0-63	1.0	0-11
College	2.5	0-55	1.0	0-7
Young Elderly	6.0	0-31	1.0	0-25
Old Elderly	2.5	0-62	1.0	0-22

each age group, in order of increasing age, making optional intradimensional shifts was 14 (43.8), 27 (84.4), 12 (75.0), and 9 (56.2). An overall chi-square analysis indicated that the four groups differed reliably, $\chi^2(3) = 12.80$, $p < .01$. Follow-up analyses (all with $df = 1$ and one-tailed) revealed the following significant differences between pairs of groups: (1) the college Ss made more intradimensional shifts than the children, $\chi^2 = 9.77$, $p < .005$; (2) the younger group of elderly adults made more intradimensional shifts than did the children, $\chi^2 = 3.03$, $p < .05$; and (3) the college Ss made more intradimensional shifts than did the older group of elderly adults, $\chi^2 = 3.12$, $p < .05$.

DISCUSSION

The finding that the college Ss made reliably more intradimensional shifts than did the children confirms and extends the empirical ontogeny of optional reversal shift behavior reported by the Kendlers. Conversely, this age difference in shift behavior is inconsistent with the predictions of Zeaman & House's (1963) mediation theory and with the data obtained by Campione (1970), who found that the probability of Ss' making an intradimensional shift was independent of age level. It is possible that Campione's failure to find age differences resulted from his use of age levels for which the differences in ages were insufficiently large to reveal any gradual developmental trends.

The shift performance of the two groups of elderly Ss, in conjunction with that obtained for the college Ss and the children, suggest that there may be gradual changes in mediational ability at the far end of the developmental continuum. That is, while the two groups of elderly Ss did not differ reliably in their shift behavior, the performance of the younger elderly Ss was comparable to that obtained for the college Ss, while the performance of the older elderly Ss was comparable to that obtained for the children. The present data, plus the evidence obtained by Crovitz (1964) and Nehrke & Coppinger

(1971), would seem to lend some credence to a developmental hypothesis indicating that aged adults may be comparable to young children in terms of a "mediational deficiency."

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