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ABSTRACT

The purpose of this study was to identify the nature of the information which preschool-age children must attend to and maintain within problems in order to solve a series of two-choice simultaneous discrimination problems. Twenty-four preschool children participated in the experiment. The stimuli used in these problems consisted of planometric geometric forms with seven values on each of the visual dimensions of color and form. Children were first overtrained on a two-choice simultaneous discrimination problem and subsequently were tested on a series of new problems. Prior to testing, trials of the previously overlearned problem were interpolated between the training and test trials. Also, to maintain attention to the originally trained cue and to test for its maintenance, three trials of the overlearned problem were presented between new problems. The new problems used in the test trials were of two types: those in which the correct cue value was on the same dimension as the original problem, necessitating an intradimensional shift in attention, and those in which the correct cue was on a different dimension from the original, thus involving an extradimensional shift. Each child received a total of eight, two-trial problems: four intradimensional and four extradimensional and interpolations in between, for a total of 54 trials. Results indicate that preschool children performed better when an extradimensional shift was called for than when an intradimensional shift was required. (Author/RH)

Interference in preschool children's learning sets

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This study is part of a series in our laboratory investigating control processes in learning set acquisition. The paradigm involves the presentation of a series of problems having a common basis for solution. Learning set acquisition is said to occur with the formation of a solution rule which will enable the subject to perform in a virtually error-free fashion. For the present study, the series of problems used required a two choice discrimination in which the solution rule can be described in terms of win, stay; lose, shift (with respect to the rewarded stimulus dimension).

The first trial of each problem was a training trial in which the subject had a 50 percent chance of choosing the experimenter-designated correct stimulus. With a correct choice or "win" on Trial 1, the subject's task for a correct Trial 2 response was to "stay". That is, to choose the stimulus which contained the same previously rewarded stimulus information. Given an incorrect choice on Trial 1 the subject had to make a "shift" for a correct Trial 2 response. That is, to avoid the stimulus with the previously unrewarded information (See Figure 1).

The purpose of this study was to identify the nature of the information which the child must attend to and maintain within problems. One aspect of learning set acquisition involves attending to dimensional information, or, what Restle (1958) calls acquisition of type-b cues within problems. (This should not be confused with what it is important to maintain between or across problems — a topic I will leave for later discussion.)

Having to retain specific dimensional information within a given problem has obvious implications for memory processes in learning set acquisition, and, indeed, recent research suggests that this is so: Knight (1968), Roxborough and Cameron (1978), and Digdon, Cameron and Nichols (1980) have demonstrated that interpolating a comparatively long time interval between training and test trials of a problem yields inferior performance compared to performance when a relatively short time interval is inserted.

Although such interval effects implicate memorial processes in learning set acquisition, manipulation of unfilled time alone gives little information concerning the specific nature of the processes involved. In 1968, House conducted a miniature experiment with retarded children for whom she interpolated a "well learned problem" instead of unfilled time between the training and test trials of problems. It was expected that the interpolation of a problem, taking time to present, would yield performance decrements compared to performance when no interpolations occurred. Overall, such decrements were observed, but they were found to be selective. That is, they were dependent on the type of problem within which the interpolation occurred. More specifically, it was found that when subjects were trained on a specific type of problem (i.e., color or form) performance was inferior on problems involving the same dimension (i.e., those requiring an intradimensional shift in attention) than it was on problems requiring a response to a different dimension or those requiring an extradimensional shift. In other words, interpolations were more detrimental if they occurred on problems similar dimensionally.

These results suggest that interference operates in miniature experiment performance of learning set acquisition for retarded children. Moreover, the interference appears to be dimensional in nature. The present study extends such findings to a population of normal children in which learning set transfer can be expected to occur.

Twenty-four preschool children from a predominantly middle class community participated in the experiment. The median age was 4 years, 11 months, with a range of 4 years, 8 months to 5 years, 11 months.

A vertical stand was used to display the stimuli and to shield from view of the children score sheets, extra stimuli, and the like. The stimuli were comparable to those used by House and consisted of planometric geometric forms: seven values on each of two visual dimensions, color and form. Stimuli were randomly paired and problem orders randomly determined with the following constraints: 1) no pair of stimuli was repeated within a session; 2) form and color appeared equally often as the relevant dimension; 3) the same dimensional cue did not appear in consecutive problems. Stimulus correctness and position were randomly designated with the restriction that the correct stimulus could not occur in the same position more than three times in a row and that there be an equal number of left- and right-correct designations (Fellows, 1967).

Using a procedure designed by Shepp & Gray (1971), children were specially trained to solve a two-choice simultaneous discrimination problem, that is, they were overtrained on a particular problem. Eleven of the children were trained on a color problem, and thirteen on form. Following this, the children were tested on a series of new problems. Interpolated between the training and test trials of these new problems were trials of the previously overlearned problem. Also, to maintain attention to the originally trained cue and to test for its maintenance, three trials of the overlearned problem were presented between new problems. New problems were of two types: Those in which the correct cue value was on the same dimension as the original problem, necessitating an intradimensional shift in attention, and those in which the correct cue was on a different dimension from the original, thus involving an extradimensional shift. Either one or two trials of the overlearned problem were presented between training and test trials.

Each child received a total of eight, two-trial, problems: Four intradimensional and four extradimensional and interpolations in between, for a total of fifty-four trials. Children were instructed to choose one of the stimuli by touching it. They were reinforced verbally for their choice with "good" or "no". A non-correctional procedure was maintained.

Two effects were predicted: First, it was expected that performance on problems requiring an extradimensional shift would be better than performance on problems in which an intradimensional shift was required. This is because dissimilar material is expected to create less interference than similar material. Second, it was predicted that two interpolations, taking more time to present, would lead to a greater decrement in performance than would one because the longer time interval could lead to the decay of information. The manipulation of these variables results in a 2(dimensions: color vs form) x 24(subjects) x 2(shifts: intradimensional vs extradimensional) x 2(interpolations: 1 vs 2) design.

A multifactorial, mixed analysis of variance calculated on the total number of correct test trial responses yielded a significant main effect due to type of shift presented, $F\,(1,11) = 6.32$, $p < .05$. Children performed better when an extradimensional shift was called for (66% correct) than when an intradimensional shift was required (52% correct). There were no other significant effects.

The first and most obvious point to note is the successful extention of House's findings to a population of normal children. Our results seem to implicate dimensional interference, a finding that supports the notion that there is a retentional component in learning set acquisition (Fisher & Zeaman, 1973). The lack of an effect of number of interpolations might suggest that the direction of attention to dimensional information, or interference, plays a larger role in performance than time alone, or decay.

These data confirm the hypothesis that the retention of specific stimulus information is important in the acquisition of what Restle calls type-b cues. The child must remember specific stimulus information in order to perform well within problems (Cameron, 1981).

What we have not addressed in this study is the very interesting role that retention must play between problems. The task between problems involves the generation and transfer of an abstract solution rule or Restle's type-a cues which will enable the subject to perform in an error-free fashion. The acquisition of type-a cues is a very different task and would appear to us to involve the ignoring, forgetting, or even suppression of specific stimulus information or type-b cues along with the transformation or organization of certain cues into a superordinate solution rule.

Unfortunately, investigation of basic processes between problems is difficult because of the methodological peculiarities involved. The usual learning set procedure requires the repeated presentation of identical stimulus pairs within problems. Because Trial 1 is an information trial, such a procedure maximizes the possibility that events on Trial 1 will confound the data gathered at Trial 2. One solution to this difficulty is to use variable stimuli within problems, such as those used in this study.

Another difficulty in investigating retention between problems results from the fact that the traditional learning set procedure is designed to minimize retentional processes, though it does not eliminate them. The stimulus counterbalancing and randomization procedures employed are designed to control for the very processes one would manipulate in exploring retentional mechanisms. Luckily, this problem is not particularly difficult to remedy, but it is worth noting that the modifications necessary to investigate retentional processes are not now commonly applied. Still another difficulty lies in operationalizing and manipulating solution rule generation. Recently, we have interpolated problems with different solution rules between problems. The results have been suggestive but require refinement.

At this point in time, we have more information about the retentional processes which are involved within problems of a learning set sequence than those operating between problems. The present results are a case in point. It would appear that identification of the memory processes crucial to learning set transfer is a more complex task, but one worthy of investigation.