Procedure and instructions in kindergartners' matching-to-sample¹

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An observing response procedure and instructions designed to induce a problem-solving set were examined in a study of 48 kindergartners presented with matching-to-sample problems. The antecedent variables were found to facilitate performance. Analysis of individual records suggested that solution was on an all-or-none basis, that the observing response requirement influenced the probability of early solution, and that the problem-solving instructions influenced later performance.

This study was prompted by a disparity between the findings of laboratory studies of matching and oddity-learning and those of psychometric studies involving test items based on matching or oddity principles. In the typical learning study (e.g., Lipsitt & Serunian, 1963) older children do surprisingly poorly on problems conceptually similar to such Stanford-Binet Form L items as IV,5 and IV-6,3 (Terman & Merrill, 1937). This discrepancy suggested that procedural and instructional variables that have not been investigated systematically play a powerful role in children's performance on matching and oddity tasks.

In the laboratory, many children seem to fail to attend to the sample cue and compare it to the choice alternatives. Accordingly, it was hypothesized that a requirement that the child touch the sample on each trial would influence problem-solution. Levinson (1958) documented the importance of such observing responses in oddity problem learning for *rhesus*.

Another problem in laboratory studies is that children often start with strategies, such as position alternation, which compete with the correct strategy. Therefore, it was hypothesized that instructions which emphasized the possibility and desirability of being correct on all trials would reduce Ss' tendency to retain strategies which produce only partial reinforcement.

Method

The Ss were from middle-class neighborhoods. They were studied individually in a cubicle in a campus laboratory. They were studied early in the academic year, during October and November, and had a mean age of 64.8 months. They were randomly assigned to four procedure groups, each including six boys and six girls.

Group C. Rapport was established. Then Ss in this control group were seated in front of a panel in the wall which contained three rear-projection windows (5.1 x 5.1 cm) in a triangular arrangement. There

was a window on top and two placed symmetrically below it. A red light was above each of the bottom windows to indicate correct responses. Pretraining taught Ss how to operate the apparatus. Four slides, each containing three different line drawings, were used. On each trial, S was asked to select a bottom window and press it. E made the red light above the chosen window light up on the first two trials and explained that this meant the correct window had been chosen. On the third trial E introduced the incorrect response procedure and explained that there was no red light when the incorrect window was chosen. On the final pretraining trial E illuminated the red light, gave S a plastic ring, and said, "Now we're going to start the real game. If you do really well on this game and make the red light come on often enough, you'll get these prizes to keep." E then displayed more trinkets.

Training consisted of 36 trials distributed equally over three problems known to be difficult for this age group. Each problem included two different geometric forms similar to those used by Bijou (1964).

Group O. Group O was treated exactly as Group C except for the addition of an observing response requirement. During pretraining, Ss were told, "Now look at the top window and press it," before they were told to pick a bottom window. This instruction was repeated whenever an S forgot to press the top window.

Group I. Group I was treated exactly as Group C except for the addition of a sentence in the instructions designed to induce a problem-solving set. Just before training, these Ss were told, "If you look real carefully at all three pictures you can figure out how to make the red light come on all the time."

Group OI. This group was treated similarly to Group C and, in addition, was given the additional treatments of both Group O and Group I.

Results

Inspection of individual records indicated that there were three patterns of performance. Thirty-one Ss performed consistently at a chance level throughout training and did no better than chance on new matching problems presented after the training trials. Thirteen Ss started on a chance level and later made an abrupt shift to perfect, or near perfect, performance. Four Ss started off matching and continued performing perfectly, or nearly perfectly, thereafter. Thus, it seemed appropriate to compare groups in terms of the number of Ss who mastered the task, rather than by using means or medians. All 17 of the Ss viewed as master-

ing the task ended training with runs of at least 10 consecutive correct trials. None of the 31 Ss considered as not having mastered the task ended training with runs of more than four consecutive correct responses.

The treatment groups differed markedly in the predicted manner. With 12 Ss in each group, it was found that eight of those in Group OI mastered the task, six in Group O, three in Group I, and none in Group C. Groups OI and C differed reliably at the .005 level, Groups O and C at the .01 level, and Groups OI and I at the .05 level by the Fisher exact probability test (Siegel, 1958). Other differences between individual groups were not reliable. The separate role of the problem solving instructions was evaluated by combining Groups OI and I and comparing them with Groups O and C combined. The difference was reliable at the .01 level. Similarly, the role of the observing response was examined by combining Groups OI and O and comparing them with Groups I and C. Here the difference was reliable at the .001 level.

The findings were examined to see if the two independent variables influenced performance in different ways. The results indicated that in Groups OI and O six Ss mastered the task in the first four trials, while none of those in Group I mastered it before Trial 5. In contrast, while six Ss in Groups OI and I mastered the task after Trial 11, none of those in Group O mastered it after this point.

Discussion

The results were consistent with the expectations

that prompted the study and help to put the disparity between psychometric findings and learning studies in perspective. The implication is that in many laboratory studies the essential learning has been the discovery of the nature of the game that E was playing.

While the present findings document that kindergartners do persist in such strategies as position alternation under some conditions, they indicate that children will seek and find more elegant solutions when the task is set up to encourage such an orientation. We have seen a similar trend in our studies of reversal. Kindergartners will be quick or slow in switching from matching to oddity depending upon whether or not such cues as instructions and interruptions in procedure imply that a "new game" has been started.

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Note

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