Linear pattern completion by chimpanzees'

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Two chimpanzees were trained to complete linear patterns contained within a 4 by 4 stimulus matrix. It was found that the animals were significantly inferior when required to complete diagonal as compared to vertical and horizontal patterns. Rotation of the stimulus matrix 45 degrees decreased this deficiency but failed to equate the rotated displays with their vertical and horizontal controls.

Contemporary discussions of primate discrimination performance seem to concentrate on the various determinants of efficient stimulus sampling, or rather the lack of it, Meyer, Treichler, & Meyer, 1965 and Stollnitz, 1965. While there is little doubt that if a monkey observes the discriminative cue it is a most adept performer, there is some disagreement as to the particular mechanisms operating as directive forces in cue selection. As a result of this problem and its importance to general discrimination theory, researchers have directed much of their attention toward the relatively limited area of the stimulus occupied by the differentiating cue while largely ignoring other aspects of the stimulus display. However, it would seem that dismissing the "extra-cue" areas of the stimulus as unimportant for learning and performance is at least premature if not unwarranted. It is equally important to ask, for example, why performances with diagonally oriented linear patterns are inferior to their horizontal and vertical counterparts (see Sutherland, 1959). Clearly, since the patterns, disregarding orientation, are identical, the answer must involve "extra-cue" portions of the stimulus display. The present research attempts to support this notion by training two chimpanzees to complete linear patterns on both upright and rotated square matrices to assess display orientation, independent of cue or pattern orientation, as a possible factor in performance.

Method

Subjects. Two naive chimpanzees, one male, Kenny, and one female, Pat, both approximately three years old, served as Ss for this study.

Apparatus. The apparatus, originally conceived at the University of California (Adey & Rhodes), involved a 4 by 4 matrix of 1-1/2 in., round, stimulus-response buttons which were separated by 2-3/4 in. center to center. Each of the S-R buttons could be illuminated from behind with either a green or a yellow light. The matrix display was arranged on one surface of a 15-1/2 in. square box mounted on the rear wall of the test chamber. The chimpanzee, restrained in an aluminum chair in front of the display, was required to press the unlighted stimulus-response button which completed a presented row, column, or diagonal of three illuminated lights (Fig. 1). A press to any unlighted button illumi-

Fig. 1. Pattern and display arrangements of the four experimental conditions.

nated that button and if it was correct, i.e., completed the presented linear pattern, a tone was sounded and the animal was rewarded. On the other hand, if the response was incorrect, i.e., did not complete the presented pattern, no tone or reward was given. Responses to lighted buttons were not counted and the problem remained until the animal pressed a darkened S-R button.

The display panel and the animal's restraining chair were isolated in a 7-ft. square room with a 100-watt overhead light. Programming was accomplished with a manually operated switchboard located outside the animal's chamber while the rewards were automatically delivered to a receptacle within the wall of the chamber directly to the animal's left.

Procedure. Four concurrently trained conditions were employed to study the effects of extra-cue factors. These conditions (Fig. 1) can be described as (1) rows and columns with the display in a "normal" position, i.e., bottom edge parallel to the floor, (2) diagonals with the display in a "normal" position, (3) rows and columns with the display rotated 45 degrees to the "normal" position, and (4) diagonals with the display rotated 45 degrees to the "normal" position. With these conditions one would predict that if extra-cue factors contributed to the diagonal deficiency rotation should fail to equate treatments one and four on the one hand and treatments two and three on the other.

Daily training consisted of testing each of the four conditions for thirty-two consecutive, non-correctional trials yielding a total of 128 problems per day. The order of presentation of the various conditions was balanced so that each animal experienced the rotated displays equally often as the initial and as the terminal conditions.

Fig. 2. Percent correct performance of Pat over blocks of 5 days on all conditions. Vertical extensions represent .05 confidence intervals.

Both animals were trained five days out of the week and received the major portion of their ad lib fruit and pellet ration as rewards; that not earned in the test situation was provided in the home cage not sooner than two hours post test.

Results

The results from this procedure are depicted in Figs. 2 and 3 where the mean percentages of correct responses are presented over blocks of 5 days (160 trials) on each experimental condition. The vertical extensions about each point represent .05 confidence bands and statistically validate the obtained differences between treatment conditions 1 and 2. Similarly, the performances on the two rotated displays are significantly different from each normally oriented control position but not from each other.

Discussion

These results have led us to conclude that the deficiency observed with obliquely oriented patterns is, at least in part, precipitated by extra-cue factors. An interesting speculation into the nature of these factors concerns the relation of the pattern to the perimetry and overall organization of the stimulus display. It is possible, in this vein, to argue that both the square peri-

Fig. 3. Percent correct performance of Kenny over blocks of 5 days on all conditions. Vertical extensions represent .05 confidence intervals.

meter and the predominantly vertical and horizontal arrangement of the matrix impose constraints upon the display to the extent that congruent patterns are more easily completed. Whether or not this is a valid analysis requires further experimentation but the more important fact that absolute pattern orientation is not the sole cause of the diminution in performance observed with oblique linear patterns still remains. This in turn further implies that the most recent concern with only the discriminative cue and/or its location is overly restrictive and will yield only partial explanations of primate discrimination performance.

References

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