Prompted vs. trial-and-error 3-trial object discrimination learning by monkeys¹

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Four relatively naive monkeys were given extended 3-trial object discrimination training under either conventional trial-and-error or prompting procedures. Whether Ss were prompted on only the first trial of each problem or on all 3 trials of alternate problems, their performance on test trials was equivalent to that of Ss receiving conventional training.

Test-naive monkeys given conventional trial-and-error discrimination training, especially on problems with few trials-per-problem and hence many chance-determined first trials, necessarily make a high proportion of nonrewarded responses which could conceivably lower motivation and result in the early and persistent adoption of response patterns which are incompatible with problem solution. It is conceivable that a prompt (i.e., an established cue which indicates the baited object) would insure a greater percentage of rewarded responses during training and thereby produce relatively better learning. The primary purpose of this study was to test this possibility by comparing the *relative* performance of monkeys given either conventional trial-and-error training or prompted training on object discrimination problems.

Of secondary interest was the *absolute* levels of performance of monkeys given 3 trials-per-problem (t/p). Levine et al (1959) trained naive monkeys under either 3 t/p or 12 t/p, and on the basis of those and other re-examined data they suggested that, at least within the range of 3 to 12 t/p, the acquisition of a learning set was a function of the number of training trials regardless of the way in which the trials were distributed among problems. In his recent review of the effect of t/p on discrimination learning Miles agreed with this generalization. However, the literature reveals a disconcerting lack of consensus regarding the absolute level of performance around this apparently practical lower limit of 3 t/p. With monkeys, for example, both Miller et al (1955), using 3 t/p, and Davis (1953), using 4 t/p, obtained poorer performance than that reported by Levine et al, and Hayes (1953) has even reported no interproblem improvement in one chimpanzee trained under 2 t/p.

PHASE 1

Method

Four 4-year-old female rhesus monkeys served as Ss. Approximately 3 mo. prior to this study each S was tested on two 36-trial object discrimination problems (see Fletcher et al, 1965).

All testing took place in a WGTA with a modified test tray made completely from opaque white acrylic plastic and containing two channels in which slid 4 x 4 in. white plastic bases. In their forward position the bases butted

against the front edge and covered two foodwells 10 in. apart. The tray's front edge, which was 2-1/2 in. high and angled 45 degrees from horizontal, contained two 1-in. jewelled amber lights (prompts) centered directly in front of each foodwell. Multidimensional junk objects were attached to the bases, and S was required to push the object (not the base) back to expose a foodwell.

Although all Ss were familiar with the apparatus and testing procedures, each was required to demonstrate retention of an appropriate response in the presence of the prompt. On each of 36 trials per session two identical gray blocks were presented with the prompt lighted in front of the baited foodwell. Each S was tested until a criterion of 30 correct responses in any session was reached. Raisin rewards and non-correction procedures were used during this and subsequent testing.

Sixteen test sessions followed, and each session consisted of 16, 3-trial object discrimination problems presented under either of two procedures. For two randomly selected Ss the prompt (light) was lighted in front of the correct object, and S responded in the presence of the prompt, on Trial 1 only of each problem; the remaining two trials continued without the prompting. For the other two Ss conventional trial-and-error procedures (no prompting) were used for all three trials. Within each session rewarded position was balanced with respect to first trials and the total 48-trial session. Because they were part of the laboratory's breeding program and not always available, Ss averaged only 2.7 sessions per week.

Results and Discussion

The data presented in the left panel of Fig. 1 reveal first that the prompt was moderately effective in controlling correct responses on Trial 1. However, subsequent intraproblem performance was essentially identical following either Trial 1 procedure. Thus, despite the greater number of rewarded Trial 1 responses, this type of prompted training resulted in learning which was no different from that which followed conventional trial-and-error training.

The absolute level of performance of all Ss on Trials 2 and 3 was much lower than that reported by other investigators even though these Ss had previously demonstrated excellent intraproblem learning following the first six trials on two initial 36-trial object discrimination problems (88% following six prompted trials, 95% following six conventional trials; Fletcher et al, 1965). Nevertheless, the percent of correct responses on both Trial 2 and Trial 3 for all four Ss combined was significantly above chance ($t=4.298$ and 7.561 , respectively; $df=3$; $p<.025$).

Fig. 1. Intraproblem performance under conventional trial-and-error training (triangles), in the presence of the prompt (open circles), or on test trials following prompting (closed circles).

PHASE 2

Problem

Trial 1 prompting cannot, of course, provide intraproblem training, i.e., the adoption of any 3-trial sequence or strategy, and Ss obviously did not utilize the minimum information provided on Trial 1. An attempt was made in this phase, therefore, to facilitate intraproblem learning by training an appropriate 3-trial sequence (win-stay). This was accomplished by prompting all three trials of alternate problems.

Method

This phase continued with a procedural modification for only the two Ss which had previously been prompted on Trial 1. On all odd-numbered problems of each session the prompt was lighted in front of the correct object for all three trials. The remaining eight even-numbered problems per session were presented under conventional trial-and-error procedures as were all 16 problems for the two Ss given conventional training previously. Fifteen such sessions, averaging 3.7 sessions per week, were given.

Results and Discussion

The data in the right panel of Fig. 1 demonstrate again that the prompt was moderately effective in eliciting a correct response on Trial 1. Subsequent prompted performance on Trials 2 and 3, however, was considerably better, in fact characteristic of test-sophisticated monkeys. Thus throughout the entire phase Ss' performance on 50% of the problems was excellent. Yet despite their excellent intraproblem performance (on prompted problems) Ss demonstrated (on alternate test problems) a level of learning which was virtually identical to that obtained from Ss trained under conventional trial-and-error procedures.

In general, the test performance of all four Ss remained low but significantly above chance (for Trials 2 and 3, respectively, $t=9.106$ and 13.865 ; $df=3$; $p<.005$). In fact, the performance of all four Ss was so homogeneous that the range of scores on Trials 2 and 3 for both phases averaged only 5 percentage points.

GENERAL DISCUSSION

It is interesting to note that during the prompted problems of Phase 2 Ss were in fact responding almost completely according to a "win-stay" strategy. It is obvious, however, that training on only this half of a "win-stay, lose-shift" learning-set strategy had neither a beneficial nor a detrimental effect on learning.

Thus, with respect to relative performance following prompted or trial-and-error training, these data convincingly indicate no differential effect of training procedure. Positive effects of guidance, or prompting, on discrimination performance of monkeys have, of course, been demonstrated. Cochrane & Davis (1961), for example, reported a facilitative effect of "forced choice" pretraining with young monkeys, and Fletcher & Takemura (1965) found better concept discrimination learning by sophisticated monkeys following one form of prompting. Differences in subjects, problems, and specific forms of prompting vitiate any meaningful comparisons of existing research, and the critical variables underlying the facilitating effects of prompting remain unspecified.

The absolute level of performance of Ss given conventional training was surprisingly low during these almost 1500 trials. This poor performance may be due to the fact that Ss were not available daily and were consequently learning under an unfortunately distributed training schedule. Or these data may reflect an actual lower limit of monkeys' performance on 3-trial object discrimination problems. As mentioned before, the literature is discouragingly inconsistent with regard to performance around 3 t/p, and this fact alone indicates a need for parametric investigations of the relative efficiency of various t/p on discrimination learning.

References

- Cochrane, R., & Davis, R. T. Guided-choice training of young monkeys. *Psychol. Rep.*, 1961, 9, 223-226.
- Davis, R. T., McDowell, A. A., & Thorson, N. Four-trial object-quality discrimination learning by monkeys. *Proc. S. D. Acad. Sci.*, 1953, 32, 132-142.
- Fletcher, H. J., & Takemura, K. Prompted vs trial-and-error concept discrimination learning in monkeys. *Percept. Mot. Skills*, 1965, 20, 737-743.
- Fletcher, H. J., Davis, J. K., Orr, B. M., & Ross, P. Prompted versus trial-and-error initial object discrimination learning by monkeys, retardates, and preschool children. *Psychon. Sci.*, 1965, 2, 59-60.
- Hayes, K. I., Thompson, R., & Hayes, C. Discrimination learning sets in chimpanzees. *J. comp. physiol. Psychol.*, 1953, 46, 99-104.
- Levine, M., Levinson, Billey, & Harlow, H. F. Trials per problem as a variable in the acquisition of discrimination learning set. *J. comp. physiol. Psychol.*, 1959, 52, 396-398.
- Miles, R. C. Discrimination - learning sets. In A. M. Schrier, H. F. Harlow, & F. Stollnitz (Eds.), *Behavior of nonhuman primates: modern research trends*. Vol. 1 New York: Academic Press, 1965.
- Miller, R. E., Murphy, J. V., & Finocchio, D. V. A consideration of the object-quality discrimination task as a dependent variable. *J. comp. physiol. Psychol.*, 1955, 40, 29-31.

Note

- The author wishes to thank Dr. Harry F. Harlow for providing facilities and subjects for this research.