A comparison of learning based on social or nonsocial discriminative stimuli

VAUGHN E. STIMBERT*
Memphis State University, Memphis, Tenn. 38111

Two groups of six rats each were trained to run across an open-field maze with four choice-point alternatives. For one group the correct response was based upon a social discriminative stimulus and for the other it was based upon a nonsocial discriminative stimulus. Results indicated that social responses were learned faster and were more durable under extinction conditions than were responses based on nonsocial stimuli.

Previous studies in the area of animal social learning (Nakamura, Smith, & Schwartz, 1963; Stimbert, 1970) have suggested that responses based on social cues may be acquired faster and be more durable than responses to nonsocial cues. Although numerous investigations (Daniel, 1942; Husted & McKenna, 1966; Miller, Banks, & Ogawa, 1962; Murphy, Miller, & Mirsky, 1955; Skinner, 1962; Wiest, 1969) have shown the feasibility of using social cues in learning studies, apparently no direct comparisons have been made between social and nonsocial discriminative stimuli utilizing identical apparatus and similar response topographies. Since a large part of the adaptive behaviors of animals requires responses based on social learning, it is of some concern to determine how this learning differs, if at all, from that based on nonsocial stimuli. The present study was designed to determine *if* such differences exist, and no attempt was made to identify the specific components of social or inanimate stimuli that might produce such differences.

SUBJECTS

The experimental Ss were 12 experimentally naive Sprague-Dawley female albino rats about 126 days old at the beginning of the study. Six Ss were assigned randomly to the social group and six to the nonsocial group. Twelve female Sprague-Dawley rats, approximately 300 days old, were used as stimulus (leader) Ss. These rats had been used in two previous studies and were highly proficient in traversing an open-field apparatus with other Ss present.

APPARATUS

The apparatus was an open-field maze with double startboxes in tandem on one side and four double-compartment goalboxes on the other side. Photocells were located 1 in. in front of the rear startbox and at the entrance to each goalbox. They were programmed through relays and timers to record the latencies of experimental Ss leaving the startbox and the running times of all Ss. Running times included both start times and time to enter the goalbox. Other features of the apparatus and the training procedures have been previously described in detail (Stimbert, 1969).

PROCEDURE

The social response to be acquired by the social group in this study was following behavior. A leader S previously trained to a specific goalbox (three leader Ss per box) was released from the front startbox and simultaneously a follower S was released from the rear startbox. The follower was reinforced with .5 ml of water for entry into the same goalbox as the leader. The double-compartment goalboxes separated leader and follower Ss and precluded viewing of the other S being reinforced. Leaders were alternated randomly so that on any one trial each goalbox had an equal probability of being correct.

For the nonsocial group Ss were also released from the rear startbox; however, they were trained to run down a black strip of cloth tape, 1 in. wide, which began at the front startbox and ended at one of the four goalboxes containing .5 ml of water. The tape was alternated from goalbox to goalbox in the same random fashion as the leader Ss in the social group. This arrangement produced nearly identical behavioral topographies in both groups.

Extinction sessions were identical to acquisition sessions, with the exception that water was unavailable for any experimental S. Each experimental S performing without error during one acquisition session (10 trials) was placed on extinction the subsequent session. All Ss were run under 24-h water deprivation.

RESULTS

The accuracy of rats learning a social cue vs an inanimate cue is displayed in Fig. 1. During acquisition all Ss in the social group learned to follow other Ss in a maximum of 80 trials, whereas after 200 trials, the nonsocial group was running with only 72% accuracy and only two Ss in the group had reached the 100% criterion level. Based on number of trials to criterion, these differences were statistically significant ($t = 269$, $df = 10$, $p < .001$). Due to time limitations, the acquisition phase was discontinued after 200 trials and extinction sessions were run on those Ss having reached criterion.

It can also be seen in Fig. 1 that during extinction nonsocial Ss reached a chance level (25%) of performance after 40 trials, while social Ss were following above 40% after 130 trials. Based on trials to criterion for those Ss reaching an extinction criterion of 0% following for one session, these differences were statistically significant ($t = 10.95$, $df = 2$, $p < .01$).

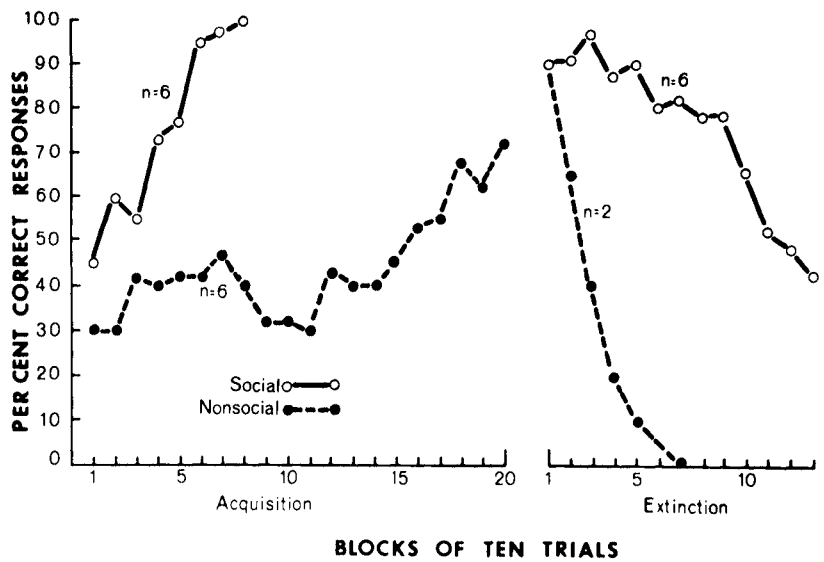

Fig. 1. Percentage correct in acquisition and extinction by blocks of 10 trials.

*Now at the Child Development Center, University of Tennessee Medical Units, 711 Jefferson Ave., Memphis, Tenn. 38105.

Differences in running speeds during acquisition and extinction are shown in Fig. 2. Again, the performance of the social group is consistently superior to that of the nonsocial group. In acquisition, group differences are not as marked as in extinction, where, after 20 trials, the running speeds in the nonsocial group dropped to less than .2 ft/sec. On the other hand, social Ss maintained speeds consistent with their terminal acquisition performance of about 1 ft/sec.

DISCUSSION

The present findings support the hypothesis that a response to an animate, social discriminative stimulus is learned faster and is more durable than a response to an inanimate, nonsocial discriminative stimulus. Even after reaching the same asymptotic level of performance in acquisition, differences between the groups during extinction are striking and favor the social response. Individual social Ss have been observed to follow at an 80% level of accuracy after as many as 150 extinction trials.

Informal comparisons of previous studies on following behavior in rats with other studies involving nonsocial situations lead to conclusions that are consistent with the extinction data from this experiment. For example, it appears that approximately 150 trials are required to reduce social following behavior to a chance (25%) level once acquired under continuous reinforcement. With partial reinforcement experience, 150 trials only reduces following to 60% (Stimbert, 1970). Using counterconditioning procedures during extinction, whereby nonfollowing responses are reinforced, the number of extinction trials required to obtain a chance performance is approximately 75 (Stimbert, 1969) or one-half that of extinction procedures making reinforcement unavailable for any response. In contrast, studies of extinction in straight runways or T-mazes frequently show Ss reaching criterion in 25 trials or less. In fact, it is unusual to find extinction data reported on more than 30 trials, which suggests extinction is essentially complete at that point. Thus, the fastest extinction obtained in studies of social following behavior indicates more durability than extinction in nonsocial situations.

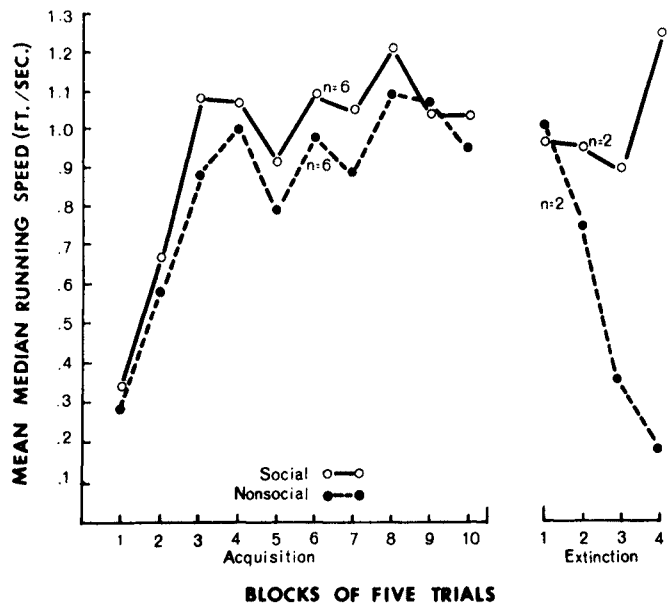

Fig. 2. Running times in acquisition and extinction by blocks of five trials.

At this time it is difficult to identify the specific factors responsible for the superiority of social discriminative stimuli. Even though the social stimulus is typically available for viewing less than 2 sec, the response is acquired more rapidly than one based on a nonsocial, fixed and, what would seem to be, a more discriminable visual stimulus. Using present procedures, assessment of the importance of olfactory, auditory, and movement cues in facilitating what is primarily a visually controlled response might be accomplished. For example, it may be productive to study following behavior in anosmic rats or to compare social learning based on moving vs fixed social stimuli. Following behavior could also be investigated by systematically changing the leader S so as to include other strains of rats or possibly a different species. This methodology provides an additional approach for determining the variables relevant to animal social behavior.

REFERENCES

DANIEL, W. J. Cooperative problem solving in rats. Journal of Comparative Psychology, 1942, 34, 361-369.

HUSTED, J. R., & McKENNA, F. S. The use of rats as discriminative stimuli. Journal of the Experimental Analysis of Behavior, 1966, 9, 677-679.

MILLER, R. E., BANKS, J. H., JR., & OGAWA, N. Communication of affect in "cooperative conditioning" of rhesus monkeys. Journal of Abnormal & Social Psychology, 1962, 64, 343-348.

MURPHY, J. V., MILLER, R. E., & MIRSKY, I. A. Interanimal conditioning in the monkey. Journal of Comparative & Physiological Psychology, 1955, 48, 211-214.

NAKAMURA, C. Y., SMITH, J. C., & SCHWARTZ, F. W. Establishment of a lasting discriminative stimulus in rats by competition training. Journal of Comparative & Physiological Psychology, 1963, 56, 852-856.

SKINNER, B. F. Two "synthetic social relations." Journal of the Experimental Analysis of Behavior, 1962, 5, 531-533.

STIMBERT, V. E. Effects of early experience on social learning in rats. Journal of Comparative & Physiological Psychology, 1969, 69, 640-643.

STIMBERT, V. E. Partial reinforcement of social behavior in rats. Psychological Reports, 1970, 26, 723-726.

WIEST, W. M. Socially mediated stimulus control in pigeons. Psychological Reports, 1969, 25, 139-148.