tion (9). All scotophobin solutions were touched only by siliconized glassware, plastic, or stainless steel.

Both groups injected scotophobin intraperitoneally in volumes of 0.1 ml (Illinois) and 0.25 ml (Michigan). Controls received injection of the vehicle (distilled water with methanol as appropriate) only. All mice were coded and the tests were run "blind."

Figure 1 shows the effects of 0.8 μg of scotophobin (Illinois) and the effects of 3.0 μg of scotophobin (Michigan) on dark-light preference. Analysis of the data by the nonparametric Mann-Whitney U test shows significant drops in dark-box time in the scotophobin-treated groups as compared to the controls. The Michigan group also found significant and prolonged effects with doses of 1.5 μg and 2.2 μg. The Illinois and Michigan mice started out with different levels of dark preference, but in each case there was a shift in the same direction. Our experiments, therefore, confirm the dark-avoidance producing effect of scotophobin.

DAVID H. MALIN*
Mental Health Research Institute, University of Michigan, Ann Arbor
HELENE N. GUTTMAN
Department of Biological Sciences, University of Illinois at Chicago Circle, Chicago 60680

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* Present address: Department of Anesthesiology, Baylor College of Medicine, Texas Medical Center, Houston 77025.

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Observational Learning and Social Facilitation in the Rat

Abstract. *Learning by rats was facilitated when response-relevant cues were provided by other rats; learning increased as a function of number of cues provided. These results suggest that rats can learn by imitation. Learning by rats that observed conspecifics not emitting response-relevant cues was retarded compared to learning by rats that did not observe conspecifics. This indicates that a conspecific's presence can also inhibit learning, a result consistent with social facilitation theory.*

The effects of a conspecific's presence on the behavior of observers are typically viewed as energizing (that is, social facilitation) or directive (that is, observational learning). A theory (1) that clarified existing research on social facilitation and stimulated new empirical (2) and theoretical (3) work suggests that the "mere presence" of others arouses general drive, which, in turn, enhances emission of dominant responses (those responses most likely to occur). If the dominant response is correct, performance improves; if the dominant response is incorrect, performance suffers.

Observational learning, analyzed from several theoretical perspectives (4–6), has been demonstrated in several species, including rats (4, 7). However, learning by rats that observe conspecifics performing the response to be learned may be attributable, not to directive cues emitted by the model, but rather to the energizing effects of the model's "mere presence" (8). Thus, observational learning as a general phenomenon in lower animals is still in dispute 30 years after Miller and Dollard's work (6).

The purpose of the present study was to unambiguously separate the relative contributions of observational learning and social facilitation to acquisition of the bar-press response by rats. Naive rats observed (i) rats that made both instrumental (bar-press) and consummatory (drinking) responses; (ii) rats that made only consummatory responses; (iii) rats that made neither instrumental nor consummatory responses (that is, provided "pure" social facilitation); or (iv) an empty box. We expected that, compared to observation of the empty box, observation of rats making both instrumental and consummatory responses would facilitate learning (because of observational learning) and that observation of naive rats would inhibit learning (because of social facilitation of incorrect dominant responses). Also, we predicted that the group observing rats making only consummatory responses would learn somewhat faster than the groups observing naive rats or an empty box because the drinking response would provide a partial directive cue.

Fifty-five male Long-Evans rats, approximately 100 days old, were deprived of water; access to water (15 minutes daily) was permitted 30 minutes after each experimental session. Animals, housed individually, were tested in an apparatus consisting of two rat test boxes, each with a microswitch bar and liquid reinforcement dipper mounted on the front wall. Test boxes were adjacent, with unobstructed vision between boxes through Plexiglas sidewalls. Front walls of the two boxes were aligned so that rats oriented toward the bars in both boxes would face the same direction. All vertical walls of the two-box unit except the common wall between boxes were opaque. A 7-watt lamp on top of each box provided the only illumination.

Fifteen naive rats were randomly assigned to three groups of five each. Animals in group B (bar-press demonstrator) were trained to drink whenever the water dipper (0.1 ml) was raised in the operant box, and then trained to press the bar on a continuous schedule of reinforcement (CRF). After training, each rat in group B was placed in the operant box for daily 30-minute periods for 8 days to establish consistent bar-pressing behavior. At the end of this period all rats pressed the bar at least eight times per minute.

Rats in group D (drinking demonstrator) were similarly trained to drink from the dipper, but were not trained to press the bar. Any bar-presses by these rats had no effect on reinforcement. After dipper training, each rat in group D was placed in an operant box that was yoked to a group B box (in a separate two-box unit), such that each bar-press by a group B rat raised the dipper in the box of the yoked group D rat. Animals in group D received eight 30-minute yoked drinking sessions to establish consistent drinking.

Animals in group N (naive demonstrator) were given no training and thus made neither instrumental nor consummatory responses. Bar-presses by these rats had no effect on reinforcement, and no water was available when they were in the boxes.

Forty naive rats were randomly assigned to four observation conditions. The experiment was done in two consecutive replications of 20 observers each. Demonstrator rats served in the same condition in both replications.

The left box of each unit (when rats faced the bar) served as the observer box. Each observer rat was placed in an observer box, without prior training, for 19 daily 30-minute experimental sessions. During these sessions bar-presses were reinforced on a CRF schedule. Each group OB (observe bar-pressing) rat observed a group B rat; each group OD (observe drinking) rat observed a group D rat; each group ON (observe naive) rat observed a group N rat; and each group OE (observe empty box) rat observed an empty box.

Figure 1 shows the bar-press acquisition curves (*9*) for the four conditions (responses made during presentation of reinforcement are omitted).

A one-way analysis of variance performed on total responses across sessions in the four conditions was significant [$F(3,36) = 5.03$, $P < .01$]. Mean total responses were 5699.5 for group OB, 3611.6 for group OE, 1904.3 for group ON, and 4065.6 for group OD. The t-tests on these scores indicated that group OB learned significantly faster than group OE [$t(36) = 2.12$, $P < .05$], group ON [$t(36) = 3.86$, $P < .01$], or group OD [$t(36) = 1.66$, $P < .10$]. In addition, group ON learned significantly slower than either group OE [$t(36) = 1.73$, $P < .05$] or group OD [$t(36) = 2.20$, $P < .05$]. The difference between groups OD and OE, although in the expected direction, was not significant.

Both observational learning and social facilitation apparently occurred in the present study. Both groups given response-relevant cues (OB and OD) learned faster than the group observing a conspecific that gave no such cues (ON); this indicated that both the bar-press and consummatory responses of a demonstrator facilitated acquisition of the bar-press response by means of observational learning. Also, the faster learning found for group OB than for group OD indicated that more was

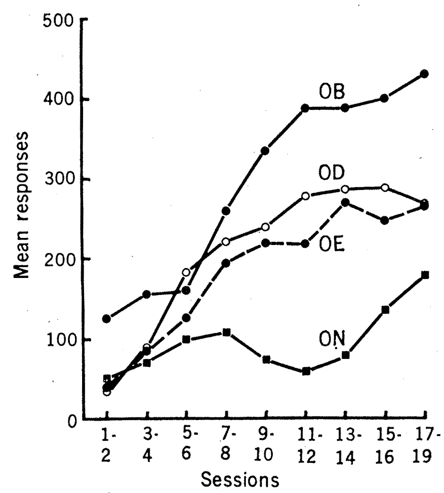

Fig. 1. Acquisition of the bar-press response for rats observing a bar-pressing rat (OB), a drinking rat (OD), a naive rat neither drinking nor bar-pressing (ON), or an empty box (OE).

learned from observing both bar-press and consummatory responses than from observing the consummatory response alone.

The slower learning found for group ON than for group OE indicated that the mere presence of a conspecific impaired acquisition of a nondominant response (that is, bar-pressing), as predicted by Zajonc's social facilitation theory (*1*). Social facilitation may also account for the lack of significant difference in performance between groups OD and OE. That is, the positive effect of observational learning in group OD was perhaps mitigated by the negative effect of social facilitation. In contrast, the enhanced performance of group OB relative to group OE suggests that observation of the total response sequence to be learned (bar-pressing and drinking) overwhelms any impairment produced by the demonstrator's tendency to elicit incorrect dominant responses.

Although social facilitation can adequately account for slower learning in group ON than in group OE, this effect might also be attributed to distraction by the naive demonstrator (*10*). The demonstrator was not only a salient, moving stimulus, but also one which might have elicited learned responses because of its similarity to "meaningful" conspecifics (for example, mother and siblings). Any tendency for the observer animal to orient toward the demonstrator or attempt to approach it would probably compete with bar-press acquisition. We did not distinguish operationally between social facilitation and distraction, but the two hypotheses lead to differing predictions. If the distraction hypothesis is correct, presence of a conspecific would lead to poorer performance regardless of whether the measured response is dominant. In contrast, if the social facilitation theory holds, presence of a conspecific would lead to poorer performance only if the measured response is nondominant. Thus, observation of a conspecific should enhance bar-press performance of a well-trained animal, according to social facilitation theory, but should disrupt that response, according to the distraction hypothesis.

THOMAS R. ZENTALL
JOHN M. LEVINE

Department of Psychology, University of Pittsburgh, Pennsylvania

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