

Social facilitation effects on runway and maze behavior in mice

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Runway and maze acquisition and extinction performance of solitary, mirror-coaction, and audience groups of male albino mice were compared in an attempt to test Zajonc's theory of social facilitation. In each situation, one of the conspecific groups performed in a manner similar to the solitary group. The audience and solitary groups ran more slowly than the mirror group in the maze, and the mirror and solitary groups ran faster than the audience group in the runway. These findings failed to support predictions made from Zajonc's theory. Apparently nonallelomimetic mammalian species do not respond to social facilitation in the same way that nonallelomimetic insects (cockroaches) do.

From 1897 until the beginning of World War II, social facilitation was the subject of active research (Zajonc, 1965). Some studies found that the presence of others had a facilitating effect on task performance, while others reported an inhibiting influence. No general theories were forthcoming to explain the conflicting results of these studies. Renewed interest was generated in 1965 when Zajonc reviewed the literature of the area and suggested a hypothesis that would resolve the disagreement in the earlier findings. He reasoned that the presence of others of the same species (conspecifics) acted as a source of general drive. Zajonc (1965) speculated that "the presence of others, as spectators or as coactors, enhances the emission of dominant responses [p. 273]." He theorized that during learning, the appropriate response is not dominant, and the presence of others hampers acquisition. However, after the task is learned, presence of others facilitates performance.

Zajonc, Heingartner, & Herman (1969) tested the hypothesis in three experiments using cockroaches and comparing coaction vs alone, audience vs alone, and conspecific (cockroach odor and mirror image) vs alone groups. The groups in each experiment were tested for escape (from bright light) in maze or runway situations. The first two experiments supported the hypothesis that the presence of conspecifics results in the increased emission of dominant responses. The alone groups showed faster times relative to the social groups in the maze, but not in the runway. Results of the third experiment, which did not support the hypothesis, led Zajonc to

the conclusion that the odor and mirror conditions were too unlike the actual presence of conspecifics to elicit the facilitative effects in cockroaches.

Other studies of social facilitation have used nonhuman species such as fish (Welty, 1934), birds (Hake & Laws, 1967; Tolman, 1968a, b), rats (Morrison & Hill, 1967; Simmel, 1962), dogs (James, 1953, 1960; James & Cannon, 1955), opossums (Platt & James, 1966; Platt, Sutker, & James, 1968), and primates (Harlow & Yudin, 1933; Stamm, 1961). All of these studies measured the effects of social facilitation on naturally occurring behaviors rather than on learning tasks (eating, drinking, running in dogs, swimming in fish, or exploratory behavior in rats), and all the organisms with the exception of rats and opossums were allelomimetic species (species in which the tendency is strong to imitate the actions of a conspecific with some degree of mutual stimulation).

The present study was designed to evaluate Zajonc's hypothesis using a nonallelomimetic mammalian species (mice) in both natural and learning situations. Mice were chosen because

few nonallelomimetic species have been used to investigate social facilitation effects, despite the fact that Zajonc used what is probably a nonallelomimetic insect species (cockroaches) in his 1969 test of the position. Ss were run alone, in coaction (mirror image of self), or with an audience (live mice) in a straight alley runway or a Lashley III maze. As in Zajonc's experiment, the runway was considered a situation not requiring learning, while the maze was judged a learning task. The decision to use mirror rather than live conspecifics was based on Gallup's (1968) conclusion that mirrors represent a purer coaction situation than do live conspecifics because of the lowering of the distraction level.

SUBJECTS

The Ss were 36 male albino mice, 60 to 90 days old, obtained from the Texas Tech University colony and maintained in its laboratories.

APPARATUS

A straight-alley runway and a Lashley III four-compartment maze were used. The runway was a 5.7-cm clear Plexiglas tube, 85.1 cm long, with a flat wooden floor. The startbox was of the same tubing, 12.6 cm long, with wooden flooring and fiberboard guillotine gates at both ends. The goalbox was 11.4 cm long, 7.6 cm wide, and 5.0 cm high, constructed of wood with a wire top for accommodating the reinforcement bottle. The runway was suspended in a wooden cradle and supported at five points from the start- to goalboxes. The audience inhabited eight 11.4 x 7.6 x 5.0 cm wooden boxes with wire tops and were placed on a platform along one side and level with the tube. Plexiglas guillotine gates facing the runway prevented the audience from leaving their boxes. A mirror, 84.5 x 5.0 cm, occupied the same position in the coaction paradigm.

The wooden maze was

Table 1
Summary of Results from Analyses of Variance

Source	df	F Score					
		Maze			Runway		
		Treat- ment	Trials	Treat- ment by Trials	Treat- ment	Trials	Treat- ment by Trials
Acquisition		2/15	9/135	18/135	2/15	9/135	18/135
Start Time		.54	2.02*	.63	.40	3.72†	1.13
Run Time		1.37	12.15†	1.09	1.35	3.05†	1.73*
Total Time		1.34	8.74†	.97	.62	3.26†	1.72*
Errors		1.33	28.49†	1.87*			
Extinction		2/15	4/60	8/60	2/15	4/60	8/60
Total Time		2.25	7.49†	1.26	1.14	2.11	1.37
Errors		1.34	6.14†	.60			

* $p < .05$. † $p < .01$

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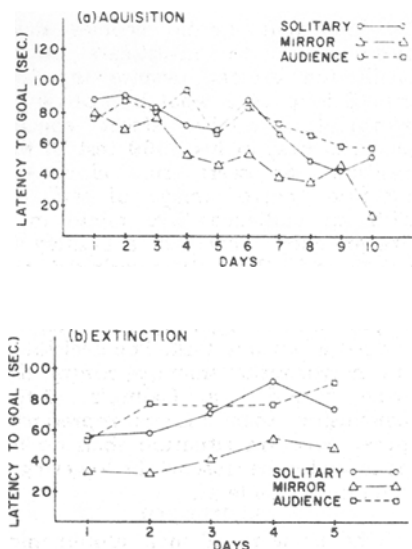


Fig. 1. Total times for maze groups during acquisition (a) and extinction (b).

50.7 x 30.4 cm in diam and 5.0 cm high, with a 15.2 x 7.6 x 5.0 cm tunnel leading to it from the startbox. The alleys and doors were 7.6 cm wide. The startbox was a 11.4 x 7.6 x 5.0 cm wooden box with wire on the top and a wooden guillotine gate for one 7.6-cm side. The goalbox was a 22.8 x 6.3 x 5.0 cm wooden box with a wire top to accommodate the reinforcement bottle. The 30.4-cm sides of the maze were removable so that mirrors (for the coaction situation) and glass (for the audience situation) could be inserted. The same type and size boxes were used for the audience as in the runway paradigm. The boxes were aligned along the 30.4-cm sides of the maze, four to a side, with clear glass separating them from the maze proper. The top of the maze was Plexiglas containing slits so that wooden guillotine blocks could be inserted after each choice point was passed to prevent retracing by the S. All wooden parts in the apparatus were painted light gray.

Two Cramer Controls timers were used, one for startbox latency and one for running time. A hand-held pushbutton arrangement activated the timers. Maze errors were counted and manually recorded.

PROCEDURE

A 15% sucrose solution was introduced to the group-housed Ss 2 weeks prior to the start of the experiment to accustom them to its taste. One week before the experiment, the Ss were individually caged, fed ad lib, and no longer given the sucrose solution. The audience Ss were housed in a group cage with

ad lib feeding throughout the experimental period.

The Ss were separated into six groups randomly, three groups to perform in the runway and three in the maze. Within each situation, performances of the solitary, audience, and coaction groups were compared. During acquisition, each S ran three consecutive trials a day for 10 days with continuous reinforcement. Extinction consisted of three consecutive trials a day for 5 days with the same confinement time in the goalbox after each trial but no reinforcement.

The S was transferred from its home cage to the startbox and transported to its appropriate starting point. Each trial began when the guillotine door was lifted and the timer activated. When the S left the startbox, the second timer was started. In the maze paradigm, guillotine blocks were dropped manually after each choice point to prevent retracing by the S. The trial was considered ended when the S's last foot crossed into the goalbox. The S was allowed to lick from the reinforcement bottle containing a 15% sucrose solution for 10 sec and was then placed in the startbox for another trial. At the end of the third trial, the S was returned to its home cage in the startbox.

During the first 2 days, the Ss either did not drink or drank sporadically from the reinforcement bottle. In order to insure a continuous reinforcement schedule, the Ss were placed on a 12-h water-deprivation schedule immediately preceding the

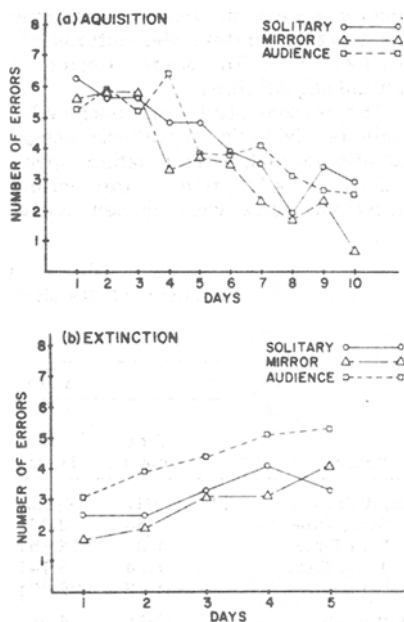


Fig. 2. Errors for maze groups during acquisition (a) and extinction (b).

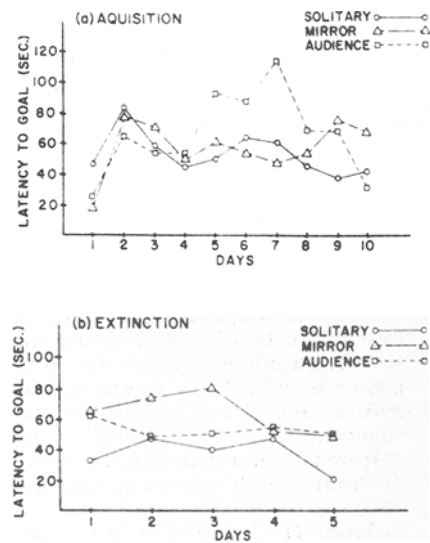


Fig. 3. Total times for runway groups during acquisition (a) and extinction (b).

daily trial period and continued on this schedule until extinction was completed. Group order of running was rotated daily to assure equal deprivation effects.

The maze and runway data were analyzed separately using split plot factorial analyses of variance. Median startbox latencies, running times, total running times, and errors (maze only) during acquisition and median total running times and errors (maze only) during extinction were compared for different groups. Times were measured to the nearest 10th of a second, with a 100-sec maximum allowed for startbox and running times during acquisition and for total time during extinction. If the S had not entered the goalbox when the allotted time was up, he was gently prodded the remaining distance.

RESULTS

Complete results of the analyses of variance are reported in Table 1. The most consistent finding was a reliable difference ($p < .05$ or $< .01$) with respect to learning over trials in all conditions except runway extinction times. Group effects did not reach reliability. The Treatment by Trial interaction reached significance only for errors during the maze acquisition ($p < .05$) and for running and total times during runway acquisition trials ($p < .05$). Failure of the other interactions to reach reliability seems due primarily to large intersubject variability and low power due to small sample size rather than to any similarity in learning across groups. These results are presented graphically in Figs. 1, 2, and 3. The low inter-S variability in maze errors during

acquisition resulted in a reliable interaction effect that appears much less obvious in the graphed results in Fig. 2 than are the analogous interactions for the time scores (Figs. 1 and 3).

Simple main effects tests revealed that in the maze condition both the audience and solitary groups were reliably outperformed by the mirror group, which had fewer errors on Days 4-10 and reliably fewer errors ($p < .05$) on Days 4, 7, and 10 (Tukey's test). The mirror group also showed faster running times for Days 4-10 (except for Day 9), although there were no reliable differences. During extinction, the mirror group ran consistently faster than the other two groups.

In the runway, the Treatment by Trial interaction was primarily due to the solitary and mirror groups running faster than the audience group on Days 5-7 of acquisition. Virtually no extinction was exhibited by Ss in the runway tested groups.

DISCUSSION

According to Zajonc's theory, the solitary group should have outperformed the other two groups in the maze, a learning situation where the presence of conspecifics should have interfered with learning of the task. The conspecific groups should have performed better than did the solitary group in the runway, a more natural situation requiring little or no learning. Our data indicate that the mirror group outperformed the other two groups in the maze and that the

audience group lagged behind the others in the runway. In each paradigm one of the conspecific groups performed like its respective solitary group. The audience and solitary groups ran more slowly than the mirror group in the maze, and the mirror and solitary groups ran faster than the audience group in the runway. Certainly Zajonc's theory is not supported by these findings. It may be that nonallelomimetic species, such as mice, are not as strongly or similarly affected by social facilitation as are allelomimetic species.

The finding that the maze mirror group showed faster learning and more resistance to extinction than did the other two groups appears to support Gallup's (1968) contention that a mirror has the benefits of the coaction situation while eliminating the distracting cues that usually occur with the use of live coactors. Further research needs to be undertaken to determine if the use of a mirror can similarly facilitate learning in other species and situations.

REFERENCES

- GALLUP, G. G., JR. Mirror-image stimulation. *Psychological Bulletin*, 1968, 70, 782-793.
- HAKÉ, D. F., & LAWS, D. R. Social facilitation of responses during stimulus paired with electric shock. *Journal of the Experimental Analysis of Behavior*, 1967, 10, 387-392.
- HARLOW, H. F., & YUDIN, H. C. Social behavior of primates: I. Social facilitation of feeding in the monkey and its relation to attitudes of ascendance and submission. *Journal of Comparative Psychology*, 1933, 16, 171-185.
- JAMES, W. T. Social facilitation of eating behavior in puppies after satiation. *Journal of Comparative & Physiological Psychology*, 1953, 46, 427-428.
- JAMES, W. T. The development of social facilitation of eating in puppies. *The Journal of Genetic Psychology*, 1960, 96, 123-127.
- JAMES, W. T., & CANNON, D. J. Variation in social facilitation of eating behavior in puppies. *The Journal of Genetic Psychology*, 1955, 87, 225-228.
- MORRISON, B. J., & HILL, W. F. Socially facilitated reduction of the fear response in rats raised in groups or in isolation. *Journal of Comparative & Physiological Psychology*, 1967, 60, 71-76.
- PLATT, J. J., & JAMES, W. T. Social facilitation of eating behavior in young opossums: I. Group vs solitary feeding. *Psychonomic Science*, 1966, 6, 421-422.
- PLATT, J. J., SUTKER, L. W., & JAMES, W. T. Social facilitation of eating behavior in young opossums: II. The effects of isolation. *Psychonomic Science*, 1968, 10, 267-268.
- SIMMEL, E. C. Social facilitation of exploratory behavior in rats. *Journal of Comparative & Physiological Psychology*, 1962, 55, 831-833.
- STAMM, J. S. Social facilitation in monkeys. *Psychological Reports*, 1961, 8, 479-484.
- TOLMAN, C. W. The role of the companion in social facilitation of animal behavior. In E. C. Simmel, R. A. Hoppe, and G. A. Milton (Eds.), *Social facilitation and imitative behavior*. Boston: Allyn & Bacon, 1968a.
- TOLMAN, C. W. The varieties of social stimulation in the feeding behavior of domestic chicks. *Behaviour*, 1968b, 30, 275-286.
- WELTY, J. C. Experiments in group behavior in fishes. *Physiological Zoology*, 1934, 7, 85-128.
- ZAJONC, R. B. Social facilitation. *Science*, 1965, 149, 269-274.
- ZAJONC, R. B., HEINGARTNER, A., & HERMAN, E. M. Social enhancement and impairment of performance in the cockroach. *Journal of Personality & Social Psychology*, 1969, 13, 83-92.