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Effect of a conspecific's presence on deprived rats' performance: Social facilitation vs distraction/imitation*

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The present study investigated effects of (a) conspecific's "mere presence" and (b) water deprivation on emission of dominant responses by rats. Zajonc (1965) suggests that a conspecific's presence functions like a physiologically based drive in enhancing performance of dominant responses. Alternative interpretations suggest that a conspecific's presence impairs performance by distracting the observer or eliciting imitation of "irrelevant" responses. The social facilitation vs distraction/imitation hypotheses were tested in a 2 by 2 design: Barpress-trained rats, deprived of water for 4 or 23 h, barpressed for water in the presence of a naive rat or alone. Results supported social facilitation theory: Performance was significantly higher when the conspecific was present rather than absent and when the responder was 23 h rather than 4 h deprived. In reconciling these data with conflicting results, it was suggested that degree of contact may be important in determining how a conspecific's presence affects performance of dominant responses.

For 75 years investigators have been interested in how the presence of conspecifics affects individual behavior. Beginning with Triplett's (1898) early work, a large volume of seemingly disparate findings accumulated indicating that the presence of others sometimes enhances and sometimes inhibits performance. Zajonc (1965) brought order to the social facilitation literature by suggesting that the presence of others arouses general drive (D), which in turn enhances emission of dominant responses. If the dominant response is correct, performance is enhanced; if the dominant response is incorrect, performance suffers. This formulation, based on Hull-Spence theory, not only satisfactorily integrated existing data but also generated a good deal of new research (e.g., Cottrell, Wack, Sekerak, & Rittle, 1968; Henchy & Glass, 1968; Martens, 1969; Paulus & Murdoch, 1971; Zajonc, Heingartner, & Herman, 1969). Recently, Cottrell (1968, 1972) and Weiss and Miller (1971) modified Zajonc's (1965) theoretical analysis, in part by positing a learned basis for the drive produced by others' presence.

Evidence that "mere presence" of conspecifics can energize responses of several species (e.g., Tolman, 1968; Treichler, Graham, & Schweikert, 1971; Zajonc et al, 1969) should not, however, be interpreted to mean that conspecifics' presence cannot have additional effects on the behavior of observers. For example, imitation, or observational learning, has received much theoretical attention (Bandura, 1969; Gewirtz, 1969; Miller & Dollard, 1941) and has been demonstrated in several species, including rats (e.g., Bandura, 1965; Darby & Riopelle, 1959; Del Russo, 1971; Groesbeck & Duerfeldt, 1971; Herbert & Harsh, 1944; John, Chesler, Bartlett, & Victor, 1968).

A recent study (Zentall & Levine, 1972) attempted to unambiguously separate the relative contributions of the energizing (i.e., social facilitation) and directive (i.e., observational learning) aspects of a conspecific's presence to acquisition of a novel response (barpressing) by rats. Naive rats observed: (a) rats that made both instrumental (barpress) and consummatory (drinking) responses, (b) rats that made only consummatory responses, (c) rats that made neither instrumental nor consummatory responses ("pure" social facilitation), or (d) an empty box. Observational learning was demonstrated by the enhanced performance of animals in both conditions where response relevant cues were provided (a and b) compared to the two conditions where such cues were absent (c and d). Poorer performance of animals in the "pure" social facilitation than in the empty box condition indicated that the "mere presence" of a conspecific impaired acquisition of a nondominant response, consistent with Zajonc's (1965) social facilitation theory. However, Zentall and Levine's (1972) experimental procedure did not rule out two alternative explanations for the relatively poor performance of animals in the "pure" social facilitation condition, i.e., distraction by the naive demonstrator (Jones & Gerard, 1967) and imitation of the demonstrator's "irrelevant" behavior.

The present study was designed, in part, to test the validity of the social facilitation vs distraction or imitation explanations by investigating the effect of a conspecific's "mere presence" on the emission of dominant rather than novel responses. Both the distraction and imitation hypotheses would predict that, compared to a condition in which the animal responds alone, a naive conspecific's presence would produce poorer performance of dominant (as well as novel)

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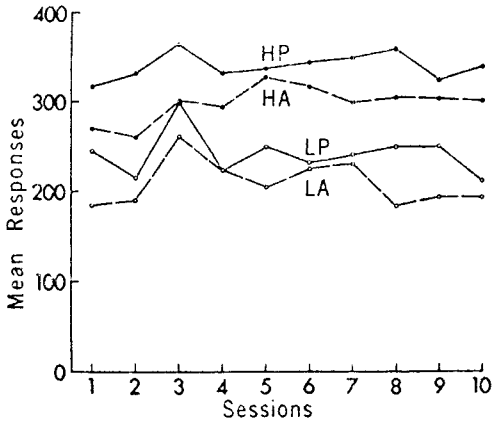

Fig. 1. Mean barpress responses per test session for rats under high (H) and low (L) water deprivation with a conspecific present (P) or absent (A).

responses; in contrast, social facilitation theory would predict that a conspecific's presence would produce enhanced performance of dominant (but not novel) responses.

In addition, the present study sought to compare the relative impact on performance of (a) a conspecific's presence and (b) a physiologically based appetitive drive (thirst). Since Zajonc's (1965) theory of social facilitation is based on the assumption that others' presence is a source of general drive (D), it would be useful, within the context of a single experiment, to compare the effect of another animal's presence or absence with the effect of variations in level of a "basic" drive. Such an endeavor seems especially useful in light of a recent study (Strobel, 1972) which manipulated both appetitive drive and social facilitation and which obtained rather unexpected findings in light of Zajonc's theory. Strobel examined emission of a well learned barpress response by hungry or satiated rats that were alone, in similar pairs (both hungry or both satiated), or in dissimilar pairs (one hungry and one satiated). In addition to an overall drive effect (more responding by hungry than by satiated rats), Strobel found, contrary to social facilitation theory, that hungry and satiated animals in the presence of a satiated animal and hungry animals in the presence of another hungry animal emitted significantly *fewer* barpresses than when responding alone. These findings are particularly striking because the observed rat in Strobel's experiment, unlike the observed naive animal in Zentall and Levine's (1972) study, was performing the operant response (approximately five responses per minute). In only one case did Strobel find that animals responded more frequently in pairs than when alone: low-responding satiated animals exposed to high-responding hungry animals.

A 2 by 2 design was used in the present experiment; factors were water deprivation (high, low) and presence of conspecific (present, absent). It was hypothesized, according to Zajonc's theory, that both water deprivation and a conspecific's presence would enhance the emission of a well learned barpress response. The effects of the two sources of D were expected to combine in an additive fashion, such that performance would be highest in the high-deprivation/conspecific-present condition, lowest in the low-deprivation/conspecific-absent condition, and intermediate in the remaining two conditions.

METHOD

Subjects

Thirty-two male Long-Evans rats, approximately 130 days old at the beginning of the experiment, were water deprived and maintained on 15 min/day access to water. All rats were individually housed and had continuous access to rat chow in their home cage.

Apparatus

Each of the four units used in this study consisted of two Lehigh Valley Electronics rat test boxes with liquid dipper (.1 ml). In each unit the two test boxes were placed side by side and close together so that Ss had unobstructed vision between boxes through Plexiglas side walls. Boxes were oriented so that a rat facing the bar in one box would face the same direction as a rat facing the bar in the adjoining box. All vertical walls of the two-box unit, except the walls between the two boxes, were opaque. A 7W lamp over each box provided the only illumination. Each two-box unit was placed in a separate sound-attenuated cubicle.

Procedure

Ss which had acquired the barpress response on a continuous schedule of reinforcement (CRF) in the present apparatus (see Zentall & Levine, 1972, for details) were given 20 daily 30-min sessions on a CRF schedule to insure stable response rates. All rats were run 23 h water deprived for the first 10 days; 15 min access to water was given in the home cage 30 min after each experimental session. Half of the animals (low deprivation) then were shifted to 6 h water deprivation for five sessions (15 min access to water 6 h before the experimental session) and then shifted again to 4 h water deprivation for five sessions (15 min access to water 4 h before the experimental session). The remaining 16 rats (high deprivation) were maintained on 23 h water deprivation throughout all baseline sessions.

Half of the Ss (eight in the high-deprivation and eight in the low-deprivation condition) were then given 10 test sessions with a naive rat in the adjoining box (conspecific present). During these sessions, rats in the high-deprivation condition were 23 h water deprived and rats in the low-deprivation condition were 4 h deprived. Barpresses by Ss were reinforced on a CRF schedule. Barpresses by the naive partners had no effect on reinforcement, and no water was available to these animals in the test box.[1] Remaining animals (eight in each deprivation condition) were tested alone for 10 sessions (conspecific absent); the adjoining box was empty during these sessions.

RESULTS AND DISCUSSION

Figure 1 shows mean barpress responses per test session in the four conditions. As expected, the mean number of barpresses per session averaged across the 10 sessions was highest in the high-deprivation/conspecific-present condition ($\bar{X}$ = 340.00), lowest in the low-deprivation/conspecific-absent condition

($\bar{X}$ = 209.50), and intermediate in the high-deprivation/conspecific-absent ($\bar{X}$ = 298.21) and low-deprivation/conspecific-present ($\bar{X}$ = 241.70) conditions. A 2 by 2 analysis of variance performed on the mean number of barpresses per session emitted by each animal indicated that both the water-deprivation and presence of conspecific main effects attained statistical significance [$F(1,28) = 29.73$, $p < .01$ and $F(1,28) = 4.65$, $p < .05$, respectively]. The interaction was not significant ($F < 1$). The water-deprivation effect was due to higher responding in the high-deprivation ($\bar{X}$ = 319.11) than in the low-deprivation ($\bar{X}$ = 225.60) condition, and the presence of conspecific effect was due to higher responding in the conspecific-present ($\bar{X}$ = 290.85) than in the conspecific-absent ($\bar{X}$ = 253.86) condition.

The fact that a conspecific's presence increased barpressing confirmed the hypothesis, derived from Zajonc's social facilitation theory, that a naive conspecific increases emission of a well learned response and disconfirmed the alternative hypotheses that a conspecific distracts the observer or elicits imitation of "irrelevant" responses. Moreover, the fact that a conspecific's presence affected performance in the same manner as an increase in a physiologically mediated appetitive drive supports Zajonc's contention that a conspecific's presence arouses D. The absence of a significant interaction can also be construed as consistent with Zajonc's position, in that the two sources of drive summated as Hull-Spence theory (Spence, 1956) would predict.[2]

Results did not confirm Strobel's (1972) findings that the presence of a conspecific generally impaired performance. One important difference between the two studies was the number of social cues available to animals in the "social facilitation" condition of each experiment. In the present study, pairs of rats were physically separated during testing and allowed only visual contact through a Plexiglas wall. In Strobel's study, pairs of rats were allowed unrestricted visual, tactual, auditory, and olfactory contact during the test session. This greater contact may have produced distraction and competing responses, which, in turn, produced performance decrements outweighing any performance enhancement caused by social facilitation.

Such a distraction hypothesis is consistent with Strobel's interpretation ("social interference") of the decreased performance of (a) hungry and satiated rats in the presence of satiated rats and (b) hungry rats in the presence of other hungry rats. In explaining the enhanced performance of satiated rats in the presence of hungry rats, Strobel suggested that social interference was outweighed by social facilitation, which was mediated by "reflex-like" triggering of operant responses and "neural mechanisms underlying a motivational state."

Although distraction may account for much of Strobel's data, the present study suggested that distraction-produced response decrement is not an inevitable consequence of a conspecific's "mere presence." Rather, at least in situations where physical contact is eliminated (e.g., Zentall and Levine's and the present study), a conspecific's presence operates like a physiological drive in enhancing the emission of dominant responses.

REFERENCES

Bandura, A. Vicarious processes: A case of no-trial learning. In L. Berkowitz (Ed.), *Advances in experimental social psychology*. Vol. 2. New York: Academic Press, 1965. Pp. 1-55.

Bandura, A. Social-learning theory of identificatory processes. In D. Goslin (Ed.), *Handbook of socialization theory and research*. Chicago: Rand McNally, 1969. Pp. 213-262.

Cottrell, N. B. Performance in the presence of other human beings: Mere presence, audience, and affiliation effects. In E. C. Simmel, R. A. Hoppe, and G. A. Milton (Eds.), *Social facilitation and imitative behavior*. Boston: Allyn & Bacon, 1968. Pp. 91-110.

Cottrell, N. B. Social facilitation. In C. McClintock (Ed.), *Experimental social psychology*. New York: Holt, Rinehart, & Winston, 1972. Pp. 185-236.

Cottrell, N. B., Wack, D. L., Sekerak, G. J., & Rittle, R. H. Social facilitation of dominant responses by the presence of an audience and the mere presence of others. Journal of Personality & Social Psychology, 1968, 9, 245-250.

Darby, C. L., & Riopelle, A. J. Observational learning in the rhesus monkey. Journal of Comparative & Physiological Psychology, 1959, 52, 94-98.

Del Russo, J. Observational learning in hooded rats. Psychonomic Science, 1971, 24, 37-38.

Gewirtz, J. Mechanisms of social learning: Some roles of stimulation and behavior in early human development. In D. Goslin (Ed.), *Handbook of socialization theory and research*. Chicago: Rand McNally, 1969.

Groesbeck, R. W., & Duerfeldt, P. H. Some relevant variables in observational learning of the rat. Psychonomic Science, 1971, 22, 41-43.

Henchy, T., & Glass, D. C. Evaluation apprehension and the social facilitation of dominant and subordinate responses. Journal of Personality & Social Psychology, 1968, 10, 446-454.

Herbert, M. J., & Harsh, C. M. Observational learning by cats. Journal of Comparative Psychology, 1944, 37, 81-95.

John, E. R., Chesler, P., Bartlett, F., & Victor, I. Observational learning in cats. Science, 1968, 159, 1489-1491.

Jones, E. E., & Gerard, H. B. *Foundations of social psychology*. New York: Wiley, 1967.

Martens, R. Effect of an audience on learning and performance of a complex motor skill. Journal of Personality & Social Psychology, 1969, 12, 252-260.

Miller, N. E., & Dollard, J. *Social learning and imitation*. New Haven, Conn: Yale University Press, 1941.

Paulus, P. B., & Murdoch, P. Anticipated evaluation and audience presence in the enhancement of dominant responses. Journal of Experimental Social Psychology, 1971, 7, 280-291.

Spence, K. W. *Behavior theory and conditioning*. New Haven, Conn: Yale University Press, 1956.

Strobel, M. G. Social facilitation of operant behavior in satiated rats. Journal of Comparative & Physiological Psychology, 1972, 80, 502-508.

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, 1968. Pp. 33-54.

Treichler, F. R., Graham, M. M., & Schweikert, G. E. Social facilitation of rat's responding in extinction. Psychonomic Science, 1971, 22, 291-293.

Triplett, N. The dynamogenic factors in pacemaking and competition. American Journal of Psychology, 1898, 9, 507-533.

Weiss, F. R., & Miller, F. G. The drive theory of social facilitation. Psychological Review, 1971, 78, 44-57.

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.
Zentall, T. R., & Levine, J. M. Observational learning and social facilitation in the rat. Science, 1972, 178, 1220-1221.

NOTES

1. Observation of these animals and comparable animals in the N (naive demonstrator) condition of Zentall and Levine's (1972) study indicated that barpresses were emitted only very rarely.

2. If in the high-deprivation condition a deprivation level closer to that needed to produce asymptotic responding had been used, a conspecific's presence no doubt would have produced a smaller performance increment than that observed in the present study. If so, a Water Deprivation by Presence of Conspecific interaction might have been obtained which, in and of itself, would not have been inconsistent with Zajonc's basic assumption that a conspecific's presence arouses D.

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