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SOCIAL FACILITATION IN MONKEYS[1]

JOHN S. STAMM

Institute of Living, Hartford, Connecticut

One of the characteristic patterns of social interaction observed in human *Ss* (Allport, 1924) and in many species of vertebrates (Bayer, 1929; Crawford, 1939) is that of social facilitation. This term, according to Crawford (1939), refers to "any increment of individual activity which results from the presence of another individual, and can be regarded as one of the most basic forms of social interaction" (pp. 410-411). Animal experiments with rats (Harlow, 1932; Bruce, 1937) and with monkeys (Harlow & Yudin, 1933) have shown increased food intake in the presence of other individuals of the same species.

Investigations with human *Ss* have generally been concerned with rates of work output on relatively routine tasks. Although increased work output under social conditions has been obtained both in experimental (Allport, 1924) and in real-life situations (Wyatt, *et al.*, 1934), the effectiveness of the social stimulation was found to be dependent upon several factors. As summarized by Kelley and Thibaut (1954), social facilitation may be dependent upon the difficulty and monotony of the task, rate of work under solitary conditions, degree of activity of others in the group, adaptation to the task, and motivational factors.

The present investigation was concerned with social facilitation when pairs of monkeys performed simple tasks for which a food reward was given. The task of pushing a disk against a relatively heavy spring could be readily learned by young monkeys and imposed only few restrictions on the rate of work output. The influence of social status on measures of social facilitation was also assessed.

METHOD

Subjects.—Eight pairs of experimentally naive rhesus monkeys (6 to 7½ lb. body weight) were used. Each pair lived in the same home cage for at least two weeks prior to and then throughout the experimental period. Pairings were arranged so that the two partners were of approximately equal age and body weight; hence, four pairs of *Ss* consisted of two males each, one pair of two females, and in three pairs a male was with a female.

Apparatus.—Each *S* was tested in a wire mesh testing cage, the front of which consisted of vertical bars spaced 2½" apart. This cage was placed in a soundproof box, arranged so that an illuminated plastic disk (2½" diameter) was in front of the cage and 13" above its bottom. When this disk was pushed

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with a force of 4 lb. over a 1½" stroke, a ½-gm. Lab Chow food pellet was delivered in a cup directly beneath the disk. A second testing cage could be placed in the box so that each of two monkeys could press on a disk and receive a reward independently of the other one. This arrangement permitted the two *Ss* to see and hear each other, but one *S* could not take food pellets from the other. *Ss* could be observed by *E* through a one-way vision screen mounted on top of the test box. *Ss'* responses were recorded on counters and on a continuously running Operation Recorder.

Testing procedure.—During preliminary training each *S* learned to jump into the testing cage, to take pellets from the food cup, and to push against the disk in order to obtain a few pellets. During this training each *S* was alone in the apparatus.

The experimental period consisted of 30-min. daily testing sessions, six sessions per week. On alternate days *S* was alone in the apparatus (*solitary testing*), while on the intervening days it was tested next to its partner (*social testing*). On the first day four pairs of *Ss* were tested under the solitary and four pairs under the social condition. Immediately after termination of a testing session *S* was given additional Lab Chow. The amount of this feeding was adjusted so each *S*'s total daily food intake, including pellets received during testing, remained constant. *Ss'* body weights were taken periodically and remained essentially constant throughout the experimental period. Eight sessions were given under each of the two experimental conditions.

Determination of social status.—Several hours after testing *E* presented a quarter of an orange to each pair of monkeys in the home cage. That *S* which seized the orange first was given a dominance score. Additional pieces were presented until the submissive *S* could eat one.

S obtaining the most dominance scores for the series of daily tests was considered the dominant, and its cage mate the submissive, partner.

RESULTS

Daily response rates for the group of monkeys, as seen in Fig. 1, were consistently higher under social than under solitary testing. For each *S* the means of the responses per session were computed for the eight sessions under each of the two experimental conditions. As seen in Table 1, every *S* obtained a higher score under social testing than it did under solitary testing. Comparisons of these two sets of scores by the *sign test* (Siegel, 1956) yielded $p < .01$. For the total group of *Ss* median scores were 47.5 responses under solitary and 78.5 responses under social testing.

When the response scores were grouped according to social status, no appreciable difference was obtained under social testing between the dominant (78 responses) and the submissive (82 responses) groups (see Fig. 2). However, under solitary testing the mean score for the dominant group (34 re-

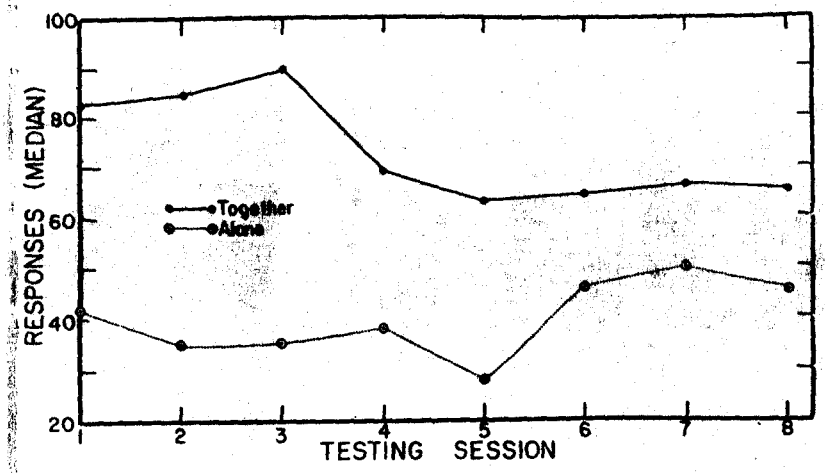

FIG. 1. Number of responses (group medians per session) for successive testing sessions under social (together) and solitary (alone) conditions

sponses) was markedly lower than that for the submissive group (58 responses). Under this condition seven submissive *Ss* responded at higher rates than did their dominant partners ($p = .035$), whereas under social testing only five submissive partners were the higher respondents.

As seen in Fig. 1, the response curve under social testing dropped markedly after the third session. This change may be attributed entirely to response rates of the submissive group. Seven *Ss* in this group pressed less during the last three sessions than during the first three sessions, whereas only three dominant monkeys followed this trend. For the submissive group this difference yielded a p of .035. This finding suggests that during the course of the experiment the submissive monkeys modified their response rates so they corresponded more closely with the rates of the dominant partners.

TABLE 1

MEAN NUMBER OF REWARDED RESPONSES PER SESSION UNDER TWO CONDITIONS

Pair	Solitary		Social	
	Dominant	Submissive	Dominant	Submissive
A	3	69	136	144
B	11	25	60	54
C	17	26	44	45
D	25	34	74	49
E	44	93	64	116
F	54	66	83	96
G	62	121	92	158
H	126	51	143	69

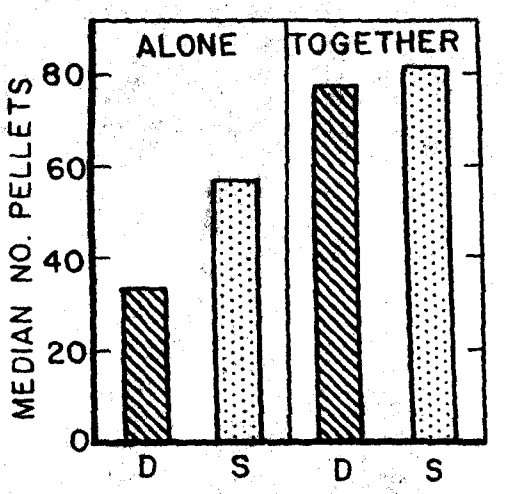

FIG. 2. Group scores for Dominant (D) and Submissive (S) groups under solitary (alone) and social (together) testing conditions. Each response was rewarded with a pellet.

DISCUSSION

The apparatus in the present experiment was designed so each *S* would "work" at a simple task for food reward and establish its own rate of responding. The task of pushing against a disk with a force of 4 lbs. over a 1½" stroke was found, during preliminary experiments, to be of maximum difficulty for some of the immature *Ss*.

In the present experiment response rates were found to be affected by three forms of social interaction: (a) social facilitation, observed in every *S*; (b) social status; i.e., under solitary conditions the dominant *Ss* pressed significantly less than did the submissive partners; and (c) interaction patterns, as seen under social testing by the decrease in pressing rates by the submissive *Ss* so their rates conformed more closely to the rates of the dominant partners.

When tested under the solitary condition, the submissive *Ss* maintained reasonably high response rates, with the lowest respondent obtaining a score of 25 presses per session. Several of the dominant *Ss*, however, exhibited unusually low response rates under this condition, with the lowest three respondents obtaining scores of 3, 11, and 17 presses. Under social testing these three *Ss* obtained scores of 136, 60, and 44 responses per session, rates which are similar in magnitude to those obtained by their submissive partners. Since the daily food intake for each *S* was held constant throughout the experimental period, these marked variations in response rates on successive days could hardly be explained in terms of hunger or satiation.

Direct observations of the monkeys revealed that during solitary testing

several of the dominant *Ss*, including the three low respondents, exhibited repeated episodes of rapid pacing, jumping, somersaults, violent shaking of the cage, and yelling. These patterns of emotional expression were only rarely observed when *Ss* were in the apparatus with their partners and were never exhibited by submissive monkeys. It appears, therefore, that the reduction in rates under solitary testing was related to patterns of emotional disturbance which may have been the consequence of *Ss'* insecurity in the testing situation. Since two monkeys were living together in their home cage, a separation during the half-hour test sessions on alternate days may have been emotionally disturbing. Thus, the reduction in response rates under the solitary condition might be considered as "solitary inhibition." The finding that the dominant *Ss* were more strongly affected by being alone in the test situation may be related to their being dependent on associations with other monkeys. Emotional security for them, therefore, may require the presence of submissive partners, whereas the submissive monkeys did not require social contacts in order to adjust to new situations. The results of the present investigation suggest that emotional stability, or *security*, may be an important determinant of measures of social facilitation.

SUMMARY

Eight pairings of naive rhesus monkeys were arranged, each pair living in one cage. *Ss* were trained to push on a disk against a heavy spring for food reward. During 30-min. daily testing sessions each *S* was alone in the apparatus (*solitary testing*) on alternate days, while on the intervening days its cage mate was tested in an adjacent cage (*social testing*). The dominance-submission status was determined by presenting one piece of orange to each pair in its home cage. The total daily food intake was kept constant for each *S*. Throughout the experimental period every monkey responded more often under social than under solitary testing. Under the social condition the dominant group gave 78 responses, the submissive group 82; while during solitary testing the scores were 34 and 58 presses, respectively. Several dominant monkeys responded only rarely during solitary testing. Direct observations revealed that these *Ss* went through repeated episodes of "emotional expressions." Interpretation of the results suggests that emotional stability (or security) is an important determinant in social facilitation.

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