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THE EFFECT OF A MANIPULATORY INCENTIVE ON SOCIAL INTERACTIONS OF RHESUS MONKEYS*

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Experimental tests of social dominance in pairs of rhesus monkeys have almost invariably used competitive food-getting situations to determine dominance status. Although a few of these studies (Hamilton, 1960; Miller & Murphy, 1956) have reported incidences of friendly behaviour (e.g. grooming and huddling) during dominance testing, it is not clear whether such interactions occur during presentations of the food incentive or only between presentations. Presumably, as soon as one of the animals consumes the incentive the competitive situation is terminated—allowing for only a brief competitive interaction. If, however, a situation was designed in which the element of competition was persistent, it would then be possible to study and directly compare continuous competitive social interactions with interactions during non-competitive conditions. It has been shown that manipulatory objects are effective incentives for rhesus monkeys (Harlow, Harlow & Meyer, 1950) and it seems reasonable that such objects could serve as incentives in competitive test situations.

The purpose of the present study was to determine whether a manipulatory object would have any effect on the social interactions of young rhesus monkeys. More specifically, a piece of rope was introduced into the home cage of a pair of rhesus monkeys to determine whether there was any change in the form and frequency of social responses from that of the normal social activity shown by the pairs. The length of the rope was varied to determine the effect of this variable on competitive interaction.

Method

Subjects

Ten rhesus monkeys (*Macaca mulatta*) were housed and tested as fixed pairs. Three pairs were female and two were mixed. All *S*s were feral animals, approximately three years old, having lived at the laboratory for two years. They ranged in weight from approximately 7 lb. to 11 lb. Each pair shared the same cage for at least two months and these living arrangements were preserved throughout the present experiment.

Apparatus

The home cages were outdoors and were 3 feet wide, 4 feet deep and 8 feet high. They were constructed of 2 by 4 inch turkey wire over a wooden frame. Indoor hutches were located approximately 5 feet from the ground and were locked during observational periods. The incentives were a 10-inch and a 36-inch length of No. 7 rope (sash cord). Observations were recorded by 30-second intervals on a time-ruled check sheet.

Procedure

Prior to data collection *E* sat within 3 feet of the home cages of each of the five pairs for 5 minutes on two successive days. On the following two days *E* dropped a total of 20 raisins (10 each day) in front of the cages and recorded the number of raisins each animal obtained. All *S*s were then tested individually with the 10-inch rope for a period of 5 minutes, and the amount of time each *S* was in contact with the rope was recorded. Cage partners were placed in a holding cage during this test.

During formal testing two pairs were generally tested each day between 9.30 a.m. and 4.00 p.m. All pairs received a total of eight 20-minute test sessions—four with the 10-inch rope and four with the 36-inch rope. Rope size was alternated from session to session. Two pairs of animals began with the 36-inch rope and three with the 10-inch rope.

The procedure on individual sessions was as follows:

1. *Adaptation.* *E* fed each of the two cage mates a few raisins and sat down within 3 feet of the cage for 3 minutes.

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2. *Pre-test.* *E* recorded social behaviours for 5 minutes.

3. *Competitive test.* *E* dropped the rope in front of the cage and recorded social behaviours for 5 minutes.

4. *Post-test.* The rope was removed from the cage and social behaviour was recorded for 5 minutes.

The check-sheet data indicated the number of 30-second intervals in which: (*a*) one *S* alone possessed the rope, (*b*) both *S*s were in contact with the rope, (*c*) one *S* attempted unsuccessfully to secure the rope from the other, (*d*) all contacts between *S*s (except tail contacts), (*e*) threat, (*f*) aggression (biting, slapping and chasing associated with threat, fear, grimace and screeching), (*g*) play-fight, (*h*) sex (present and/or mount), (*i*) groom, (*j*) huddle. Definitions of these social response categories may be found in Hinde & Rowell (1962), Chance (1956) and Mason (1960). Each measure was scored only once during a 30-second interval.

Results

The median time of rope contact for individual animals during preliminary testing with the 10-inch rope was 285 seconds out of a possible 300. Five of the animals achieved the maximum score; the lowest score was 16 seconds. The animal with the lowest rope contact score during the individual test, however, had the highest number of contacts during the tests of competitive interaction.

The left panel of Fig. 1 shows that there was significantly more simultaneous contact with the longer rope than the shorter rope ($p<\cdot02$).

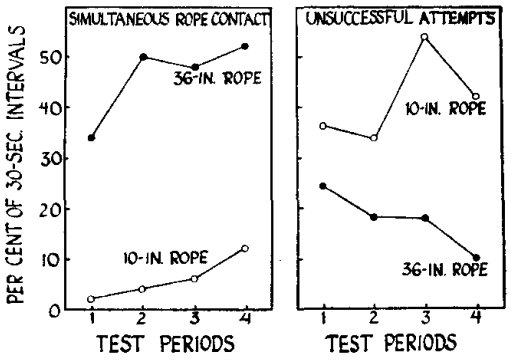

Fig. 1. (Left panel): Mean percentage of 30-second intervals in which both animals were simultaneously in contact with either the 10-inch or 36-inch rope. (Right panel): Mean percentage of 30-second intervals in which animals made unsuccessful attempts to obtain the incentive from their partners.

(Note that unless otherwise indicated statistical comparisons were performed by matched *t*-test on total scores of the *five* pairs of animals). Thus, the longer rope was shared more often than the shorter rope, and as would be expected on the assumption that the ropes had an equal incentive value, unsuccessful attempts to obtain the shorter rope were more frequent than unsuccessful attempts to obtain the longer rope (right panel of Fig. 1). It should also be noted that for all pairs of animals and for both rope sizes there was no 30-second interval in which the rope was not contacted by at least one animal. In fact, the rope was dropped only once by a single animal and it was immediately picked up by its cage mate.

Social contact scores during test periods were almost identical for the different length ropes. This was also the case when pre- and post-test periods were compared with each other. Therefore, scores for the different rope lengths were combined and compared with the combined scores of pre- and post-test observations. Fig. 2 shows that social contacts were substantially

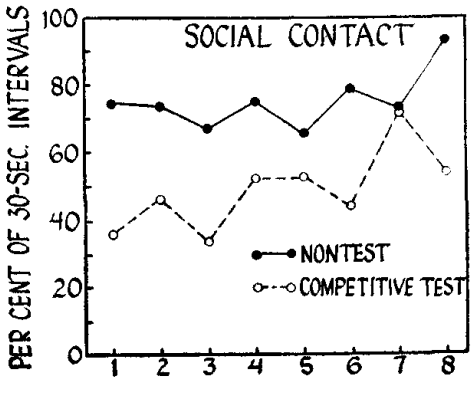

Fig. 2. Mean percentage of 30-second intervals in which animals of a pair were in social contact.

more frequent when the rope was present than when it was absent ($p<\cdot02$). The increase in social contacts over sessions probably reflects a drop in temperature from a mean of 77°F on the first three sessions to a mean of 52°F on the last three sessions.

It is evident from Fig. 3 that threat and aggression were far more prevalent during test periods, whereas friendly behaviours such as grooming and huddling occurred more often during nontest periods. Since statistical tests yielded no significant differences (·10 level) between rope length conditions for any of the behaviour categories except aggression (there were no instances of grooming for either rope

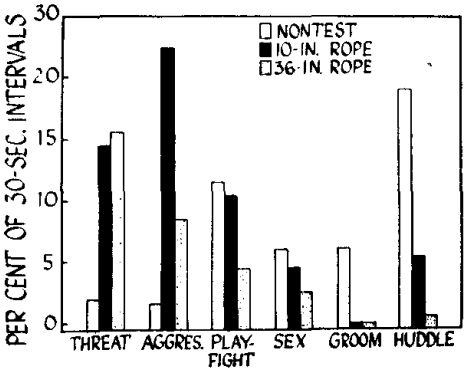

Fig. 3. Mean percentage of 30-second intervals in which the various social behaviours were observed during test and combined pre- and post-test conditions.

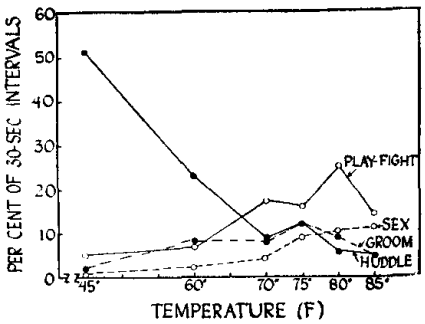

Fig. 4. Mean percentage of 30-second intervals in which animals indulged in various social activities as a function of temperature.

condition), the scores for both rope conditions were combined and compared with the combined scores for pre- and post-test conditions. The differences for threat, groom and huddle were all significant ($p<\cdot05$). There was a greater amount of aggression with the 10-inch rope than with the 36-inch rope ($p<\cdot10$) and aggression was significantly greater under both test conditions than under the nontest condition ($p<\cdot05$). There was more play-fighting and sex behaviour when no incentive was present although the differences were not significant.

Fig. 3 shows that during non-test periods the most prevalent behaviour was huddling. The high incidence of huddling was probably a response to cold weather. As can be seen in Fig. 4, below 70°F, huddling was inversely related to temperature during nontest periods. During coldest sessions huddling accounted for more than 50 per cent. of all behaviours. The figure also shows that other social behaviours dropped out as temperature decreased.

Statistical comparisons of results presented in Table I (one-tail tests) indicate that although dominant animals held the 36-inch rope alone to a significantly greater extent than did subordinate animals, such was not the case with the shorter rope. In addition, dominant animals showed significantly more threat and aggression under both rope conditions than did subordinate animals.

In the case of the shorter rope, once an animal gained possession of it he sat and manipulated it, usually by holding one end between his teeth and pulling the other end with his hands or feet or both. Any attempt by the other member of the pair to touch the rope was usually met by either threat or flight behaviour with ensuing aggression. On the other hand, when the 36-inch rope was introduced into the cage both animals would often grab an end and tug. Tugging continued, punctuated by threat behaviour with some aggression, until both animals returned to manipulate their end of the rope.

Discussion

The results demonstrate that a manipulable object such as a rope serves as a strong incentive when introduced to a pair of young rhesus monkeys. The technique of using a non-consumable incentive is of value in studying

Table I. The Effects of Rope Size and Dominance Status (as Determined by the Total Raisins Secured during 20 Trials) on Selected Behaviours during Competitive Testing. Rope possession refers to an animal being in sole possession of the incentive for at least three seconds.

Behaviour	No. of 30-sec. intervals				% by dom. *S*	
	36 in. rope		10-in. rope		36-in.	10-in.
	Dom.	Sub.	Dom.	Sub.		
Rope possession	134	36	118	88	78·8*	57·2
Threat	28	4	29	4	87·5*	87·8*
Aggression	16	0	44	3	100·0**	93·6**

*$p<\cdot05$. **$p<\cdot01$.

competitive social interaction since it allows for quantification of ongoing social behaviours which may be compared to social behaviours when no such incentive is available.

Comparison of social contact scores during competitive testing and in non-competitive situations shows that competition decreases social contact between animals. Analysis of social responses suggests that the decreased social contact during competition is based on increasing amounts of threat and aggression, and a corresponding decrease in friendly social contacts, such as grooming and huddling. Even during cold weather, when the animals appeared strongly motivated to huddle, introduction of the incentive drastically reduced this activity.

The most important outcome with respect to varying the incentive size was the finding of greater sharing with the longer rope and greater aggression with the shorter rope. In contrast to the shorter rope, the longer rope was more amenable to simultaneous contact and manipulation and thus appeared to maintain frustration at a lower level for both animals, particularly the dominant animal.

The high incidence of threat and aggression directed by dominant animals toward subordinates during competitive tests is in good agreement with the data reported by Mason (1961) using food incentives. Although dominance as measured by the number of raisins secured during the initial food-getting test was clearly related to initiation of threat and aggression, sole possession of the incentive was less strongly related to dominance. The reason for this is probably that subordinate animals sometimes picked up the rope and then fled from the dominant animal while maintaining possession. If chased, the subordinate would frequently fear grimace and scream while continuing to hold the rope tenaciously.

The scope of this study was limited due to the fact that many of the *S*s had been previously committed for use in other experiments. Thus, it was not determined as to how long the ropes would retain their incentive value nor whether other manipulatory objects would elicit the kind of competition elicited by the ropes. However, casual observation of juvenile and even adult macaques at the Yerkes Laboratories and at zoos suggests that other manipulanda such as cardboard boxes, chains, burlap and wooden blocks could also serve as incentives over fairly extensive periods of time for the purposes of studying competitive behaviour.

Summary and Conclusions

A manipulatory object (piece of rope) was introduced into the home cages of five pairs of adolescent rhesus monkeys to determine the change in the form and frequency of social responses from that of the normal social activity shown by the pairs. The length of the rope was varied (10 inches and 36 inches) to determine the effect of this variable on competitive interactions.

1. The results showed rather conclusively that a manipulatory incentive is just that, and operates similarly to a food incentive during a competitive situation. Thus, even a strong temperature regulating behaviour, such as social huddling, is abandoned when competitive behaviour is aroused by a manipulatory incentive.

2. It also has been shown that normal friendly social gestures and postures of juvenile rhesus monkeys are incompatible with unfriendly aggressive behaviours when a non-specified physiological motive, such as manipulation, has been aroused.

3. Further, these results suggest that incentives which are not consumable may be more advantageous than food incentives for studying continuous competitive interactions of young rhesus monkeys.

4. Finally, these results suggest that the degree of mutual accessibility to the incentive is a key variable in the production of aggression during competitive social interaction.

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