
Group formation of previously single-caged adult rhesus macaques for the purpose of environmental enrichment

*Gruppenbildung einzeln gehaltener erwachsener
Rhesusaffen zur Verbesserung der Haltungsbedingungen*

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Received April 5, 1991; accepted June 3, 1991

Key words: Adult rhesus macaques, group formation, environmental enrichment, behavior

SUMMARY

An attempt was made to form two groups of 6 previously single-caged adult female and 6 previously single-caged adult male rhesus macaques. The study was based on the premise that simultaneous introduction of familiar animals reduces the risks involved during group formation. Future group members were therefore given ample opportunity to physically interact with each other on a one-to-one basis and were considered ready for group formation only when they had demonstrated compatibility and clear-cut dominance-subordination relationships.

Both group formation attempts were failures. Aggressive incompatibility was heralded by certain subjects challenging other partners to whom they had originally been subordinate. Aggressive harassment was intensive and persistent. Victims showed no resistance, except for fear-grinning and crouching in submission. They did so to no avail. Both groups were split again within the first hour of introduction to avoid fatal consequences.

It was concluded, that unlike pair-housing, group-housing of previously single caged adult rhesus macaques is associated with considerable risks which cannot be overcome by systematically familiarizing all group members before the animals are introduced as a group. There is no guarantee that well established dyadic relationships do not break down within the more complex social structure of the group, thereby triggering aggressive conflicts that put the animals' safety into undue jeopardy.

INTRODUCTION

There is strong public concern and growing scientific awareness that laboratory primate's should not be housed singly but in a setting that meets their social needs (USDA 1991, § 3.81).

Over the past 4 years, simple techniques have been developed to pair previously single-caged nonhuman primates with compatible conspecifics (REINHARDT et al. 1989; LINE et al. 1990 a). Pair-housing enables the animals to express many facets of their social disposition but it is only a compromise, since most primates are inherently adapted to living in groups.

Several attempts have been made to establish groups of previously single-caged subjects. While group formation of young animals poses little risk (BERNSTEIN and DRAPER 1964; VALERY and SYMNES 1966; ALFORD et al. 1990; WOLFF and RUPPERT 1991) group formation involving adults is associated with considerable risks.

Comparing the various group formation options for adult animals the following conclusion can be drawn:

1. Simultaneous release of group members results in less aggression and hence is associated with fewer risks of trauma and death than sequential introduction of group members (KAWAI 1960; BERNSTEIN and MASON 1963; BERNSTEIN 1969; BERNSTEIN et al. 1974; SOUTHWICK 1967; TOKUDA and JENSEN 1969; FAIRBANKS and McGUIRE 1977; WOLFF and RUPPERT 1991).
2. Familiarity is a deterrent to violence while unfamiliarity contributes to the risk of violence (BERNSTEIN 1969; BERNSTEIN et al. 1974; WILSON and ELICKER 1976; BERNSTEIN et al. 1979; ERWIN 1979; FRITZ and FRITZ 1979; BERNSTEIN and GORDON 1980; FRITZ 1989).

LINE et al. (1990b) were the first who consistently applied both conclusions to form a group of previously single-caged adult rhesus macaques for the purpose of environmental enrichment. LINE et al. (1990b) introduced 6 adult male rhesus macaques as one group and 7 adult females as another group. Before the groups were formed, each monkey was familiarized with each group member by placing two partners in wire-mesh transport cages at 7 cm distance for 15 minutes. "Fights were common during the first day" (LINE et al. 1990b) of group formation. By day four, "one male was depressed and withdrawn, and was regularly harassed by two of the other males" (LINE et al. 1990 b). At this point both groups were mixed by opening a connecting chute. "The depressed male continued to be threatened, chased and attacked ... Two hours after the chute was opened he was permanently removed from the group and taken to the hospital for supportive care and treatment of several bite wounds" (LINE et al. 1990b). Four days later, "the top-ranking female ... was found dead in the cage from trauma" (LINE et al. 1990b). This did not solve the problem and fighting was still a common event two weeks later (end of study).

Only 56 % of dyads had established clear-cut dominance-subordination relationships before the groups was formed (LINE et al. 1990b). This suggests that the animals had been given inadequate opportunity (physical contact; more time together) to get fully familiarized with each other.

The present group formation attempts to extend the study of LINE et al. (1990b). It is also based on the premise that simultaneous introduction of familiar animals reduces the risks involved during group formation. At the same time, however, it is also based on the assumption that adequate familiarization of potential group members cannot be achieved in the course of brief non-contact encounters. Future group members were therefore given ample opportunity to physically interact with each other on a one-to-one basis, and they were considered ready for group formation only when they had demonstrated compatibility and clear-cut dominance-subordination relationships.

METHODS

Subjects of the study were 6 adult (5 years and older) unrelated singly caged female and 6 adult unrelated singly caged male rhesus macaques (*Macaca mulatta*). All males had their canines blunted. Each set of animals was prepared for group formation by systematically familiarizing all future group members.

Three compatible female-female pairs and three compatible male-male pairs were established by using a non-contact-familiarization pairing technique (REINHARDT 1989a). Partners were allowed to live with each other for one week. They were then separated and paired with another same-sexed animal by using a direct repairing technique (REINHARDT 1989; REINHARDT 1991). Partners were again allowed to live together for one week after which they were again re-paired. This procedure was repeated until each male and each female had lived with each other male/female as a compatible pair. A pair was considered to be compatible, if no partner inflicted a serious injury on the other, if no partner showed signs of depression, and if both partners secured an adequate share of the food. Partners were observed during the first 30 minutes after pair formation and checked at least three times daily thereafter.

The 3 temporary pairs of each set of animals were housed in 85 x 170 x 85-cm upper-row cages facing each other. Future group members were thus able to keep visual contact with each, other throughout the entire familiarization process. The males were housed in male-only rooms, the females in female-only rooms. The animals were fed commercial dry food at 07:30, fruit at 15:00. Water was available ad libitum. Room temperature was 20-22°C, with a 12-hr light/dark cycle.

Once all future group members had been familiarized, group formation was carried out by simultaneously releasing all 6 animals into a group cage at 10: 00. Each group cage consisted of two runs of three 85 x 85 x 85 cm upper-row cages, installed back-to-back and interconnected by 2 short tunnels. Subsequent observations were carried out until group compatibility could be assessed. A group was considered to be compatible, as long as no animal suffered a serious (requiring medical care) bite injury, no animal was in danger others or of dying as a result of harassment.

Table 1. Characteristics of 6 adult male and 6 adult female rhesus macaques familiarized on a one-to-one basis for possible group formation.

Sex/Name	Age	Dominance rank No.
Male		
Eric	18 years	1
Steve	12 years	2
Mist	7 years	3
Nice	7 years	4
Bruno	5 years	5
Edd	5 years	6
Female		
Jessy	23 years	1
Brenda	17 years	2
Jolly	14 years	3
Chase	11 years	4
Swift	15 years	5
Muckie	5 years	6

RESULTS

Familiarizing all future group members with each other for one week in pairs was associated with no fighting in all 15 male-male dyads. No signs of incompatibility were noted. Familiarizing all future group members in pairs was associated with fighting in 4 of the 15 female-female dyads. One fight occurred during original pairing, 3 fights occurred during repairing. The fights were restricted to the first few minutes and resulted in minor injuries. After these initial dominance determining disputes partners proved to be compatible like partners of all other dyads.

Dominance-subordination relationships could be determined within the first 30 min of familiarization in all 30 dyads. Subordinate partners showed their status by unidirectional fear-grinning and/or yielding. The hypothetical rank order was strictly linear among males and among females, with older animals generally dominating all younger animals (Tab. 1).

The events during group formation were more dramatic in females than in males. Shortly after the 6 females were transferred to their new group cage, Chase on dominance rank position 4 threatened Jolly on rank 3. Jolly had been the dominant one of the two during the one-week familiarization, and she returned the threat and slapped Chase. After 9 min Chase dashed toward Jolly who ran away. A vehement chase developed. After a few seconds, Jessy on rank 1 and Brenda on rank 2 joined the dispute. The four females were milling around and it was impossible to tell who fought against whom, but it quickly became clear that the three top ranking females had formed a coalition against Chase. Chase fear-grinned and crouched submissively to no avail. The three dominant females had cornered their victim and bit it repeatedly in the face, arms and fingers, back and tail. They briefly paused in their attacks only to harass Chase again and again. The observer tried to distract the attackers by shouting at them and by poking them with a stick. This meant only very brief relief for Chase. She managed several times to escape but each time she was instantaneously cornered and vigorously attacked again. Seven minutes after the beginning of the communal attack, Chase stopped showing any resistance and made no more attempts to flee. Yet, Jessy, Brenda and Jolly pursued their merciless attacks. The observer decided to intervene so as to avoid serious consequences. The group was quickly split up again in pairs. Chase's face and arms were badly bruised, but she required no medical treatment.

A few seconds after the 6 males were transferred into their new group cage, Mist on dominance rank position 3 started threatening Steve on rank 2. Steve had been clearly the dominant of the two during the familiarization week. He initially ignored Mist's challenges. Mist continued his provocations, but he did so only when Eric, the top ranking male was close to the scene. The moment Eric went into another section of the cage and was no longer visible, Mist stopped threatening Steve and retreated. Eric seemed to ignore the dispute during the first 12 min. In the 13th minute, however, he also got involved in it. Mist stood in front of him as usual and excitedly threatened against Steve who looked away. Mist repeatedly glanced back over his shoulder to Eric, who watched the encounter. Soon, Eric started grunting more and more loudly and finally dashed forward and attacked Steve. The two engaged in a fight which was won after a few seconds by Eric. Steve crouched and fear-grinned. He finally managed to escape through one of the two tunnels out of sight into the other section of the group cage. Neither Eric nor Mist followed. It was only after 4 minutes that Eric crossed into the section where Steve was hiding. Steve showed his submission by fear-grinning and Eric did not molest him in any way. A few moments later, however, Mist joined Eric and instantaneously chased Steve out of his corner. Eric did not hesitate but vehemently attacked Mist's victim. He bit Steve several times who crouched and showed no resistance. Mist and Edd, the lowest ranking male, took the opportunity and bit Steve from behind. Eric soon let go of Steve who remained motionless, crouching in a corner. Mist induced Eric to attack Steve again on several occasions. At the same time, he also started threatening and chasing Nice, the male on rank 4. He would typically threaten against fear-grinning Nice, glance back over his shoulder to Eric, and

charge toward Nice. It did not take long, and Eric attacked Mist's second victim also. Within the first 52 minutes of group formation Mist induced Eric to attack Nice 3 times and Steve 4 times. One hour after group formation, Mist and Eric had not calmed down despite the fact that Steve and Nice showed no resistance to the repeated attacks. The observer therefore decided to split the group again into 3 pairs. Steve and Nice suffered extensive yet not serious bruises and multiple minor bite injuries.

DISCUSSION

The present group formation attempts were not successful because both groups had to be split again within a short time. No animal was seriously injured, but the intensity of aggressive harassment indicated that none of the group could be considered compatible. The harassed victims showed no resistance but fear-grinned and crouched in submission. They did so to no avail. Rhesus macaques have the reputation of being particularly aggressive (SOUTHWICK 1967; LINDGURG 1971; FAIRBANKS et al. 1978; TEAS et al. 1982; THIERRY 1985; LINE 1987). This trait is probably exacerbated in captivity where victims have no effective options of escape but are bound to remain within easy reach of aggressors. Aggressive harassment may have fatal consequences (ERWIN 1977; KESSLER et al. 1985; RHINE and COX 1989; LINE et al. 1990 a) even though victims show only minor bite wounds and bruises (BERNSTEIN 1969). No group formation technique can be recommended as a standard management procedure unless it has proven to circumvent these extreme risks.

The aggressive harassment observed in both groups was not expected because all group members had lived together in compatible pairs with clearly established dominance-subordination relationships for one week before the group was formed. In theory, the animals had no reason to establish new relationships. Aggressive incompatibility was heralded in both groups by certain subjects challenging other partners to whom they had originally been subordinate and with whom they had been compatible. This leads to the conclusion that unlike pair-housing, group-housing of previously single-caged adult rhesus macaques is associated with considerable risks which cannot be overcome by systematically familiarizing all group members on a one-to-one basis and ensuring that all possible dyads are compatible before the animals are introduced simultaneously as a group. There is no guarantee that well established dyadic relationships do not break down within the more complex social structure of a group, thereby triggering aggressive conflicts that put the animals' safety into undue jeopardy.

ACKNOWLEDGMENTS

I wish to express my gratitude to ERWIN BERNSTEIN and FRANS deWAAL for their advice, to my wife ANNIE for providing valuable critical comments on this manuscript and to JACKIE KINNEY for proofreading. This project was supported by NIH grant RR00167 to the Wisconsin Regional Primate Research Center.

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