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Effects of Brief Separation from Mother on Rhesus Monkeys

Temporary absence of the mother affects behavioral development in rhesus monkeys (*Macaca mulatta*).

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That the development of the human child's personality is profoundly influenced by his social environment is a commonplace. That a temporary or permanent disruption of the child's relationship with the most important individual in that environment—his mother—may have far-reaching effects, is also becoming widely accepted (*1*). But the severity of the effects, the bases of the wide individual variation that they show, and the conditions under which they can be ameliorated, are still matters for dispute. Since an experimental approach is not possible with human subjects, a number of workers have investigated the possibilities of using monkeys instead (*2–4*).

In the present series of experiments (*5–9*), rhesus monkeys (*Macaca mulatta*) were used. The animals were kept in small groups (one male, two to four females, and their offspring), each group occupying an outdoor cage (5.50 by 2.44 by 2.44 meters) which was connected to an inside room (2.29 by 1.83 by 1.37 meters). These conditions were intended as a compromise which provided the animals with a reasonably complex (though, of course, not a natural) social environment, while permitting reasonably precise experimental control and recording. The groups proved to be social units in the sense that the responses of individuals to mildly disturbing situations were reduced by the presence of their companions (*10*).

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Course of the Mother-Infant Relationship

It was first necessary to standardize appropriate recording techniques and to study the development of the mother-infant relationship in this situation. This is illustrated in Fig. 1; the data are based on observations of 16 infants during the first 6 months of life, and eight infants thereafter. The data were collected between 0900 and 1300 hours, each infant being watched for 6 hours a week, a fortnight (2 weeks), or a month, according to age (*11*). The time off the mother increased to a plateau at the end of the first year, and then further, to 100 percent at the end of the second year. This increase was associated with a decrease in the mother's role in initiating nipple contacts, as measured by the ratio of the number of nipple contacts initiated by the mother (M) to the total number successfully initiated by either mother (M) or infant (A). Concomitantly, the absolute frequency of nipple contacts attempted by the infant that were rejected by the mother (R) increased up to the end of the first year. So did the proportion of nipple contacts or attempted nipple contacts that were rejected by the mother [R/(A + M + R)]. The subsequent decrease in the absolute frequency of rejections implies lessening demand by the infant.

The proportion of the time off the mother that the infant spent more than 60 centimeters away from her (60 centimeters is roughly the distance a rhesus mother can reach in a hurry) increased to about 60 percent at the end of the first year, and thereafter remained fairly constant. Each time the distance between mother and infant changed from more than 60 centimeters to less, or vice versa, we recorded whether the approach or leaving was due to mother or infant. The difference between the proportions of approaches (Ap) and of leavings (L) due to the infant (% Ap − % L) gives a measure of the infants' role in maintaining proximity (*12*). This was negative for the first 4 to 5 months, indicating that the mother was then primarily responsible for maintaining proximity to the infant: their roles were subsequently reversed.

Mother-Infant Interaction

All the measures illustrated in Fig. 1 depend on the behavior of both mother and infant. To understand the dynamics of changes in mother-infant interaction, it is necessary to tease apart the roles of mother and infant. Some progress toward this can be made by considering the relations between measures (*13*). Table 1 shows the predicted consequences, on selected measures of mother-infant interaction, of four simple types of change in the behavior of mother or infant. For instance, if the infant changes in such a way that he tends to leave the mother more, the time off the mother and the time at a distance from the mother (> 60 centimeters) will increase, and the relative frequency of rejections [R/

Table 1. Predicted direction of changes in various measures of mother-infant interaction produced by four simple types of change in the behavior of either mother or infant.

Change in behavior	Time off mother	Relative frequency of rejections R/(A+M+R)	Time at a distance from mother (> 60 cm)	Infant's role in maintaining proximity (% Ap − % L)
Infant leaves mother more	+	−	+	−
Infant seeks proximity more	−	+	−	+
Mother seeks proximity more	−	−	−	−
Mother leaves infant more	+	+	+	+

(A + M + R)] and the infant's role in maintaining proximity (% Ap − % L) will decrease. Similar predictions can be made for each of the four types of change shown on the left of Table 1. Of course the implied hypothesis that changes in mother-infant interaction depend on only four types of basic change will prove an oversimplification. However it is useful in showing how correlations between measures provide a means of differentiating between changes in the interaction immediately due to changes in the mothers' behavior and those due to changes in the infants' behavior. Thus Table 1 shows that a change in time off the mother would be positively correlated with the frequency of rejections if immediately due to the mother, and vice versa.

Spearman rank order correlation coefficients between the median values of some of the measures for successive age periods (weeks, fortnights, or months) are shown in Table 2. They show that the increase, with age, in time off the mother was positively correlated with the relative frequency of rejections, and thus immediately due to changes in the mothers' behavior. Similarly, the positive correlations between the time spent at a distance from the mother and the infants' role in maintaining proximity also indicate a prime role of the mother in the increasing independence of the infant. The positive correlations between the relative frequency of rejections and the infants' role in maintaining proximity can be interpreted on the view that it was those infants that were rejected most which had to play the greatest role in maintaining proximity [for further interpretation of these and other correlations, see (*5*) and (*13*)]. Thus, even during the first few months, when it was the mother who was primarily responsible for maintaining proximity between mother and infant, it was changes in the mothers' behavior that were immediately responsible for the decrease in proximity with age.

This conclusion was somewhat surprising, since the growing independence of the infants was correlated with, and appeared to be due to, their increasing physical strength and activity. But the conclusion is in harmony with Hansen's (*14*) earlier findings that the frequency of mother-infant contacts decreases more slowly with age when the "mother" is an inanimate (and therefore nonrejecting) mother surrogate than when it is a real mother; and also with Harlow's (*15*) emphasis on the persistence of mutual clinging in infants raised in groups without mothers. Kaufman and Rosenblum (*16*), by contrast, argue that maternal rejections serve to increase rather than decrease the infants' dependent behavior, but this is probably a short-term effect and most likely to be conspicuous when a mother rejects an infant not yet ready to leave (*17*). Of course it is not implied that the changes in the mothers' behavior arise endogenously: they may be initiated by changes in the infants' behavior, such as its demand for milk or locomotor activity. These are consequences of development, which, in turn, depends on the mother. The infants' development involves both increasing locomotor activity and self-initiated exploratory behavior, and increasing readiness to respond to the changing behavior of the mother with greater independence. While the changes in the relationship due to age thus depend on complex in-

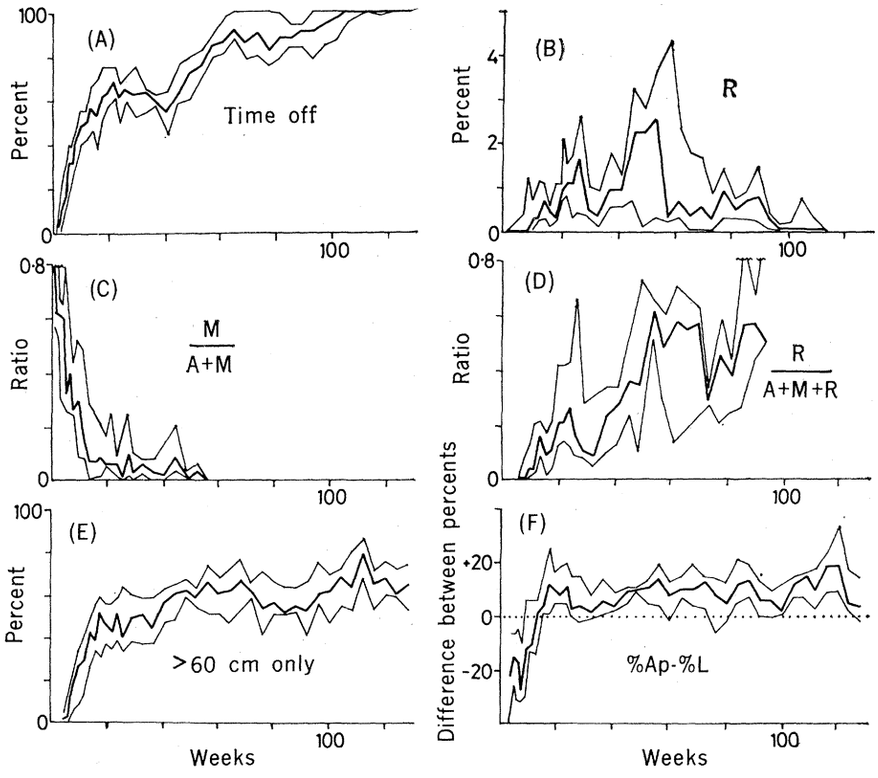

Fig. 1. Age changes in mother-infant interaction. Medians and interquartile ranges for $N = 16$ (weeks 1 to 24) or $N = 8$ (weeks 24 to 130). (A) Number of ½-minute periods in which infant was off mother (as percentage of the number of ½-minute periods observed). (B) Number of times infant attempted to gain nipple and was rejected, per 100 ½-minute periods (R). (C) Maternal initiative in nipple contacts [M (number of times infants were picked up by mothers) divided by A (number of times infants were accepted by mother) + M]. (D) Relative frequency of rejections [R/(A + M + R)]. (E) Number of ½-minute periods that infants spent wholly more than 60 centimeters from their mothers (as percentage of the number of ½-minute periods in which they were off her). (F) Infant initiative in maintaining proximity [percentage of approaches (Ap) due to infant minus percentage of leavings (L) due to infant [% Ap − % L)].

teractions between mother and infant, this analysis shows that the mother plays a large role in promoting the infants' independence.

Table 1 can be applied not only to changes with age, but also to individual differences at any given age. The correlations between measures taken from different infants in one age span show that differences among mothers are of prime importance in determining individual differences in mother-infant interaction in the early months, but that differences among infants are important subsequently (*5*).

Individual differences among the mother-infant relationships tend to remain stable from one age period (6 weeks) to the next over the first 5 to 6 months of life, as indicated by significant rank order correlations in measures of mother-infant interaction from one age period to the next. The correlations are rather less strong for the time spent by the infant off and at a distance from its mother than for measures such as the relative frequency of rejections and the infants' role in maintaining proximity. But the correlations are usually not sufficiently high to permit long-term predictions from one age period to another some months distant (*5*).

Table 2. Rank order correlation coefficients between median values of measures for all individuals in each age span. Rejections were rare in the early period.

	Relative frequency of rejections R/(A+M+R)	Time at a distance from mother (> 60 cm)	Infant's role in maintaining proximity (% Ap−% L)
Time off			
Week 1–6 (N=6)	No data	+.98†	+.96†
Week 7–20 (N=7)	+.54	+.96†	+.94†
Week 21 + (N=17 to 20)	+.69†	+.74†	+.38*
R/(A+M+R)			
Week 1–6 (N=6)		No data	No data
Week 7–20 (N=7)		+.50	+.36
Week 21 + (N=17 to 20)		+.57†	+.63*
> 60 cm			
Week 1–6 (N=6)			+.79
Week 7–20 (N=7)			+.93†
Week 21 + (N=17 to 20)			+.57†

* $P < .05$. † $P < .01$.

Other Social Companions

So far we have considered mother and infant as though they were unaffected by the other animals present. This is far from the case, for the other animals in the group may interact with both mothers and infants. Females other than the mother interact with infants more than males do; and, among the former, interactions are most common with nulliparous females about 2 years old. The nature of the interaction varies with the age of the infant, partly because of the decreasing protectiveness of the mother. In general, tentative maternal responses from animals other than the mother are commoner with younger infants than with older ones, whereas grooming or aggressive responses are commoner with older infants (*18*).

The mothers vary in the extent to which they permit other animals to interact with their infants. They are most likely to tolerate females with which they are frequently in company and subordinate females that they can control (*19*). Thus, the infants' relations with the other females are affected by the relations between those females and the mother. Furthermore, the infants' relations with its mother are affected by the other females present, for infants living alone with their mothers were off them more, and went to a distance from them more, than did infants with group companions present. Since the infants living alone with their mothers were rejected more and played a larger role in maintaining proximity with their mothers, the difference was primarily due to the mothers (Table 1). In a group situation, the mothers tend to keep their infants near them more—in part, to protect them from other females (*13*, *20*).

Since the male is not impartial, often interceding in disputes, the mother's relations with the male may affect other females' interactions with the infant. Infants also spend much time in interaction with peers (*21*); in a social situation, relations with peers are influenced by the relations among the adults. The infant is thus part of a complex nexus of social relations, each link in which may be influenced by many types of change elsewhere. The nature of this nexus varies considerably between species of primate (*17*): in some, mothers allow much more interaction between their infants and other adults than is the case in rhesus monkeys (*22*).

Temporary Removal of the Mother

The separation experiments were carried out when the infants were between 21 and 32 weeks old (Table 3). At this age, infants still get some milk from their mothers, but they are capable of feeding themselves. The mother is playing only a small part in initiating nipple contacts, rejections are still increasing in frequency, and the infant has recently become primarily responsible for maintaining proximity (Fig. 1). Whereas female infants before

Table 3. Scheme of separation experiments. One of the infants in the second group died before its second separation.

Groups		Length of separation (days) of infants at:		
Separations	N	21 weeks	25–26 weeks	30–32 weeks
Single	5			6
Two	5 + 1	6		6
Two	5		6	6
Long	6			13

Table 4. Days on which data were collected for short- and long-separation experiments. Solid lines enclose separation periods; broken lines indicate separation periods within which data were pooled.

Length of separations	Days on which data were collected		
	Preseparation	Separation	Postseparation
6 days	1 2 3 | 4 5 . 7 . 9 | 10 11 12 . 14 . 16 | . . . 23 . . 30 . . 37		
13 days	1 2 3 | 4 5 . . . 9 . . 12 . . 15 16 | 17 | 18 19 . 21 . 23 | . . 30 . . . 37 . . . 44 .		

week 20 tend to be more independent of their mothers than males are, males are more independent than females after week 30 (*11*).

Our experiments involved removing the mother from the group to a distant indoor cage for 6 or 13 days. During the mother's absence, the infant remained with the same animals he had been with before, though the mother's removal from the nexus sometimes led to changes in the relationships among individuals.

Data on mother-infant relations were collected routinely from birth until the infants were 2½ years old, but we shall be concerned here only with the periods immediately before, during, and for a month after the mother's removal. The days on which data on the mother-infant relationship and infant activity were gathered are shown in Table 4.

Over the period studied, the age at which the experiment was performed made little difference in the response to separation. In Figs. 2 and 3, the data for all first 6-day separations are pooled ($N = 16$, see Table 3) (*6*). These figures show the median for each measure and the individual data for those two animals with the extreme preseparation scores. When the mother was removed, there was much whoo-calling, an indication of distress. The locomotor and play activity decreased, and the frequency with which the infant was seen sitting motionless increased. Some infants spent time on, or leaning against, group companions.

When the mother was first returned, most infants spent more time on her, and less of their time off her at a distance from her, than before separation. The latter was associated with an increase in the infants' role in maintaining proximity and so, by an argument similar to that of Table 1, was immediately due to a change in the infants. When the mother first returned, there were frequent tantrums. [In fact, in the days after the mother's return, there were complex interactions between the demands of the infant and the behavior of the mother that are not shown in the pooled data of Figs. 2 and 3 (*3*).]

More qualitative descriptions of the effects of a period of maternal deprivation are in substantial agreement with these data (*2*), although it seems that bonnet monkey (*Macaca radiata*) infants, which receive more care from social companions in the mother's absence, are less affected than rhesus infants are (*4*).

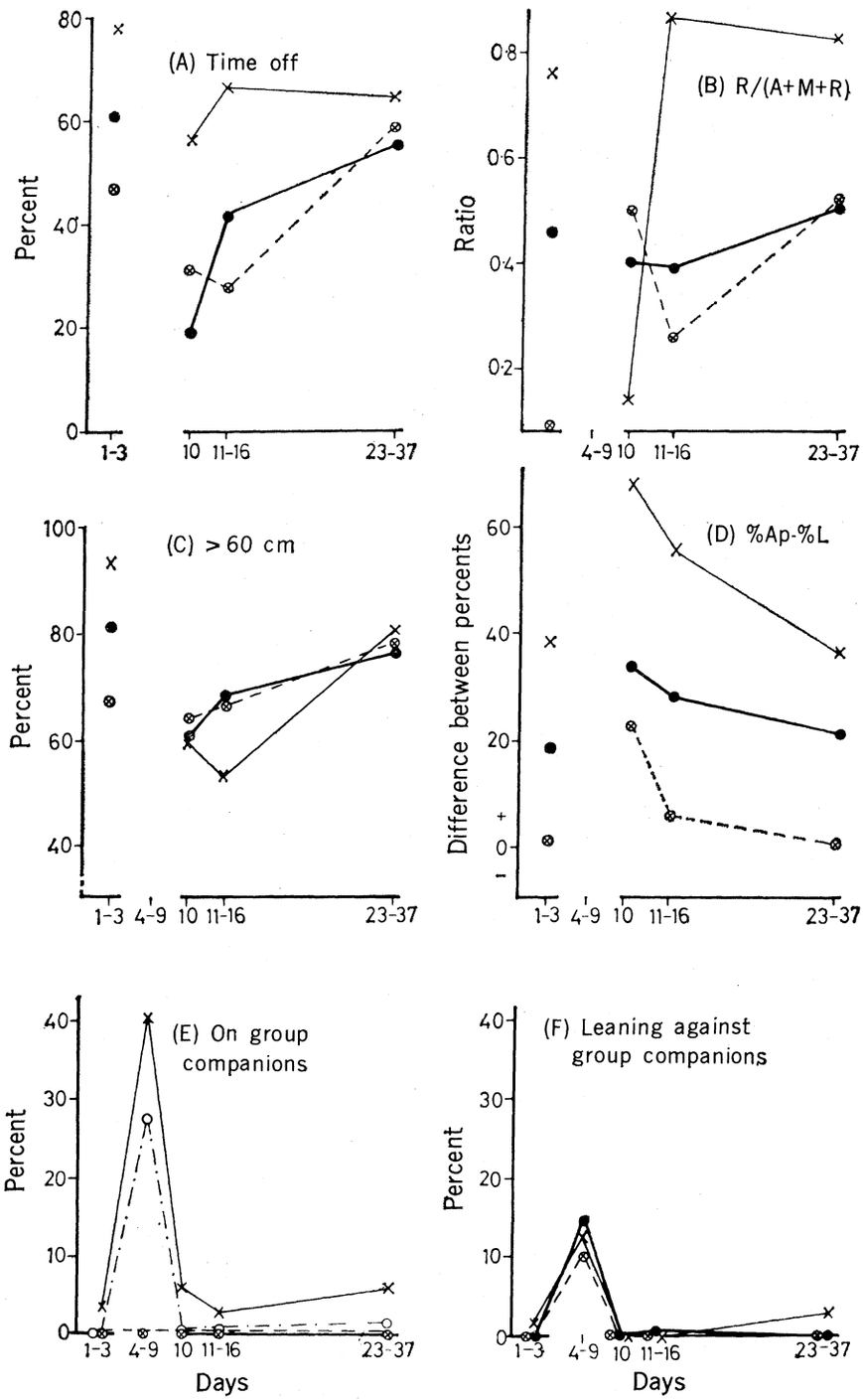

Fig. 2. Effects of a period of separation from mother on relations of infant with mother and group companions. Break in abscissa indicates period of mother's absence. Ordinates: (A) number of ½-minute periods in which infant was off mother, as percentage of ½-minute periods observed; (B) ratio of number of times infants were rejected to total number of times infants attempted to gain nipple and were rejected by their mothers; (C) number of ½-minute periods in which infants were more than 60 centimeters from their mothers, as percentage of ½-minute periods off mother; (D) infant's role in maintaining proximity, as shown by difference between percentage of approaches and percentage of leavings due to infant; (E) and (F) percentage of ½-minute periods watched in which infant was recorded on or leaning against group companions. Thick line gives median for 16 infants; thinner lines, data for those two individuals with the most extreme preseparation scores on the measure in question (except for "On group companions," where median was zero throughout and three individuals are shown). Modified from (*8*).

Length of the Separation

The effects of removing the mother for a few days are dramatic and last for at least some time after the mother's return. Is the severity of the effects related to the length of the separation period? Data on the separations at 30 to 32 weeks permit comparison between the effects of a single 6-day period of separation, the second of two 6-day periods, and one 13-day period (*8*). Figure 4 shows that, during the postseparation period, there were no significant differences between the groups in the time spent off and at a distance from the mother. Though the infants that had had a long separation were rejected less by their mothers, this was largely a reflection of a difference between groups before separation. There were, however, marked differences in the behavior of the infants when off their mothers. Those infants that had had only a 6-day separation experience had less depression of activity and recovered from it more rapidly, were more active when active, and gave fewer distress calls than did the infants that had had two 6-day separation experiences or one 13-day separation. Thus the relation between the length and the effects of a separation period is quantitative.

Sources of Variation

One of the most conspicuous features of the data from these experiments was the marked individual variability (see Figs. 2 and 3). In order to assess the factors contributing to this, it is convenient to use an index of the distress shown by the infants when the mother is removed. We have seen that in the mothers' absence the infants tend to move about less, to sit more, and to whoo-call more. The 16 infants whose data are shown in Figs. 2 and 3 were ranked on each of these measures and the ranks summed to give a "distress index." The three measures on which the distress index is based are positively, but not always significantly, correlated with each other: some infants respond to the mother's disappearance primarily with depressed locomotor activity, others with frequent crying. Clearly, the distress index is useful only so long as the basis of the correlations between those measures is the focus of interest: it will cease to be useful when individual differences in the pattern of responding are studied.

The distress index was positively correlated between the different phases of the separation experiment (Table 5). This was, in part, a reflection of similar correlations between its constituent measures. Since the rank ordering of individuals on these measures remained similar, even though the absolute values and ranges of the measures increased, the effects of the mother's removal can be seen as an accentuation of preexisting differences (*7*).

When we examined the extent to which the variation among individuals in response to maternal separation

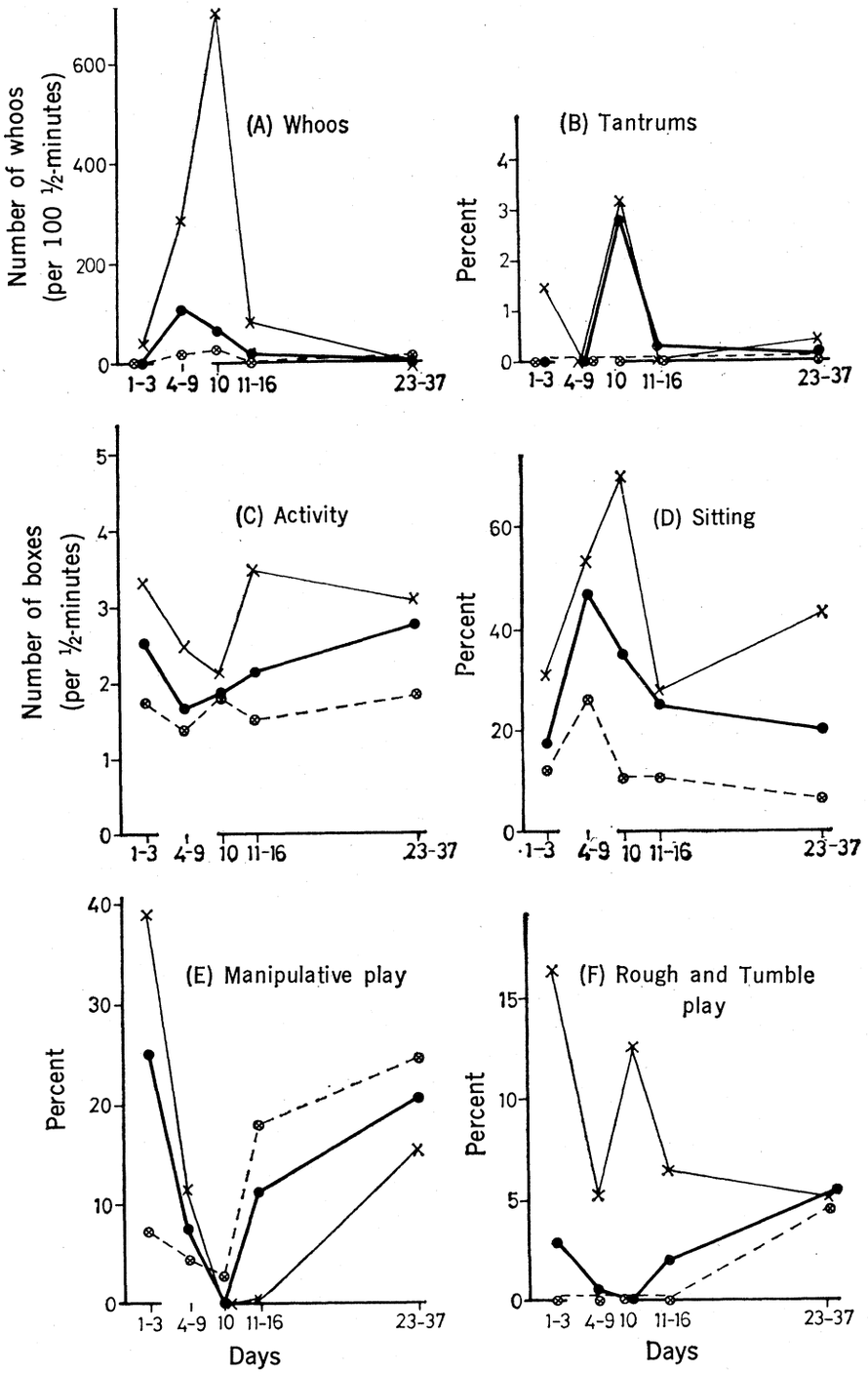

Fig. 3. Effects of a period of separation from mother on infants' behavior when off mother. Break in abscissa indicates period of mother's absence. Ordinates: (A) number of whoos per 100 ½-minute periods off mother; (B), (D), (E), and (F) number of ½-minute periods in which behavior indicated was recorded, as percentage of number of ½-minute periods off mother; (C) mean number of sections (out of 16) of the pen entered per ½-minute period off mother. Modified from (*8*).

Table 5. Distress index. Spearman rank order correlation coefficients between the different stages of the 6-day separation experiments. ("Separation mean"—mean of all days on which data were collected during separation period.)

Stages of 6-day separation experiments	Correlation coefficients
Preseparation	+ .68†
Separation mean	+ .40
Day 10	+ .50*
Days 11–16	+ .66†
Days 23–37	

+ .53* + .55* + .60*

* $P < .05$. † $P < .01$.

could be attributed to various factors (*6*), the age of the infant (within the range studied) and the extent to which the infant was taken on by group companions proved to be of minor importance at most (*23*). The parity of the mother and the presence of peers could not be examined, since the mothers were multiparous and the peers were present in nearly all cases. There were, however, some differences related to sex. The mean distress index of male infants was higher throughout the experiment; the constituent measures did not differ significantly between the sexes before separation, but during and after the separation the males sat and whoo-called significantly more than the females did in some periods.

Table 6. Spearman rank order correlation coefficients between distress index in three postseparation periods and contemporaneous or preseparation measures of mother-infant relationship.

Measures of mother-infant relationship	Correlation coefficient		
	Day 10	Days 11–16	Days 23–37
(*a*) *Contemporaneous*			
Time off	− .09	− .39	− .37
R/(A+M+R)	+ .18	+ .51*	+ .59*
>60 cm	− .32	− .58*	+ .11
% Ap − % L	+ .22	+ .51*	+ .45*
(*b*) *Preseparation*			
Time off	+ .02	− .07	− .13
R/(A+M+R)	+ .41	+ .59*	+ .43*
>60 cm	− .26	− .28	− .18
% Ap − % L	+ .30	+ .64†	+ .41

* $P < .05$. † $P < .01$.

Of greater interest was the finding that the distress index was closely related to certain aspects of the mother-infant relationship (*7*). Table 6 (a) shows the rank order correlations between the distress index and four measures of the contemporaneous mother-infant relationship after the mothers' return. The correlations were low on the day that the mothers were returned, when most infants spent most of their time on their mothers. Subsequently, there was some tendency for those infants that were most distressed to be off their mothers least, and to spend less of that time at a distance from her. But more conspicuous were the tendencies for those that were most distressed to be (i) those that were rejected most by their mothers and (ii) those that played the greatest relative role in maintaining proximity with her (that is, high % Ap − % L).

Table 7. Kendall τ partial rank order correlation coefficients between measures of mother-infant interaction and postseparation distress index.

Measures of mother-infant relationship	Correlation coefficient		
	Day 10	Days 11–16	Days 23–37
R/(A+M+R)			
Preseparation, postseparation constant	.23	.24	.08
Postseparation, preseparation constant	.09	.13	.37
% Ap − % L			
Postseparation, preseparation constant	.19	.40	.23
Postseparation, preseparation constant	.12	.17	.23

Now most of the various measures of the relationship were correlated between pre- and postseparation periods —although the nature of the relationship changed, the individual differences remained similar. The question therefore arises as to whether the distress index after separation was related to the nature of the relationship before separation. Table 6 (b) shows that distress after separation was related, once again, to the frequency with which the mother had rejected the infant and the infant's role in maintaining proximity before separation. Thus the distress index was only loosely related to the more obvious measures of the mother-infant relationship, such as how much time the infant spent on or near its mother, but was clearly related to measures that could colloquially be described as indicators of tension in the relationship. It will be remembered that it is these same measures that are more stable with age.

We must now ask how much the postseparation distress index is related to aspects of the preseparation mother-infant relationship and how much to the postseparation relationship. Calculation of Kendall τ partial rank order correlation coefficients (Table 7) shows that, as might be expected, the preseparation relationship is the more important just after the mother's return, but subsequently the postseparation

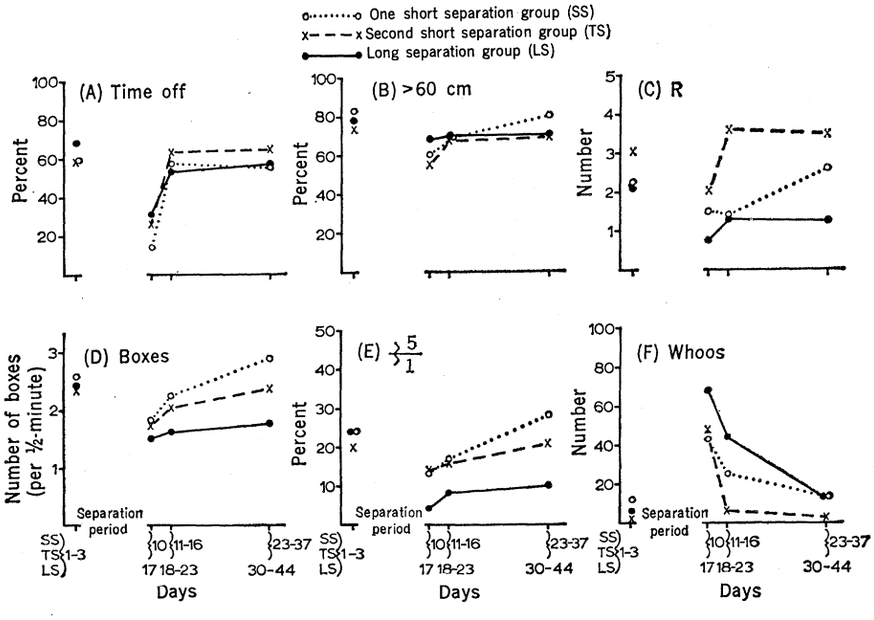

Fig. 4. Effects of removal of the mother (for 6 days, for the second of two periods of 6 days, or for 13 days) on behavior of rhesus infants in the month after the mother's return. Ordinates: (A) number of ½-minute periods as percentage of ½-minute periods observed; (B) number of ½-minute periods as percentage of ½-minutes off mother; (C) number of times infant attempted to gain nipple and was rejected, per 100 ½-minute periods; (D) number of boxes per ½-minute period; (E) number of ½-minute periods in which infants entered > 5 boxes, as percentage of ½-minute periods in which entered > 1 box; (F) number of whoos per 100 ½-minute periods (*8*).

(contemporaneous) relationship becomes paramount.

Thus the response of rhesus monkeys to a period of maternal deprivation is related to the nature of the mother-infant relationship both before and after the separation period. Such correlations do not justify the conclusion that differences in the mother-infant relationship cause the differences in the infant's response to separation, but it seems likely.

Long-Term Consequences

So far, we have been concerned with the consequences of a short period of maternal separation on behavior during the month after the mother's return. But how long do the effects last? Are we dealing with a temporary phenomenon of no long-term importance? To assess this, mother-infant relations, infant activity, and infant performance in a variety of simple tests (*24*) were assessed when the infants were 12 and 30 months old. Most of the tests consisted of confronting the infant with mildly disturbing or frustrating situations. Infants that had been given one or two 6-day separation experiences were compared with control infants that had lived with their mothers continuously. (The tests were not devised in time for all of the control infants, which were studied earlier than the separated infants, to be tested, and a few of the separated infants were not available for the tests.) The diversity of the procedures used make it impossible to describe the results succinctly, but two selected examples are given in Tables 8 and 9. Table 8 gives measures of infant activity off the mother at 12 and 30 months. Table 9 contains data, obtained when 12-month-old juveniles had been moved with their mothers to a strange laboratory cage, on the readiness with which the infants would approach objects that were placed in an adjoining cage, from which their mothers were excluded.

The results of these and other tests can be summarized as follows (*9*). At 12 months, there were few significant differences in measures of the mother-infant relationship between control and previously separated infants, either in the home run or after mother and infant had temporarily been removed to a strange indoor cage. Nor were there any significant differences in measures of the infants' readiness to approach strange objects in the home run. The previously separated infants were, however, less ready than the controls to take vitamin pills from Y.S.-B., who had been involved in catching the mothers. In addition, the previously separated infants still showed some signs of the depression of locomotor and play activity that occurred during the separation period (Table 8). But it was when the infants were confronted with strange objects in the strange cage that differences between controls and experimentals became most conspicuous. Experimentals were less ready to approach, by a number of measures; and the differences tended to be more marked with the infants that had had two previous separation experiences than with those that had had just one (Table 9). Thus, the effects of a mere 6-day absence from the mother were clearly discernible 5 months later. When tested at 30 months of age (2 years after the separation experience), the differences were much less marked, but the previously separated infants were still less active than the controls (Table 8) and differed significantly from them on a number of other measures in a manner similar to that seen at 12 months.

Table 8. Activity of infants when off mothers: controls (infants with no separation experience) and infants that had had one (SS) and two (TS) 6-day separation experiences when 20 to 30 weeks old (see Table 3). Mean number of sections of the pen (out of 16) entered per ½-minute period (a). A measure of how active when active—the ratio of the number of ½-minute periods in which the infant entered five or more boxes, to the number of periods in which it entered more than one box (b). Percentage of ½-minute periods in which the infant was seen sitting (c). Rough and tumble (d) and approach/withdrawal (e) social play. Manipulative (nonsocial play (f). *P* values based on Mann-Whitney U test, two-tailed.

Measure of activity	12-month infant			30-month infant		
	Controls ($N = 3$)	SS ($N = 5$)	TS ($N = 8$)	Controls ($N = 8$)	SS ($N = 5$)	TS ($N = 5$)
(a) Sections of pen entered (mean)	3.1	3.2	2.8	3.1	2.4	2.5
(b) $\frac{>5}{>1}$ (%)	36	32	25	42	36	28
(c) Sitting (%)	2	10	35	23	27	35
	$P = .012$			$P = .020$		
	$P = .036$					
(d) Rough and tumble (%)	6	13	5	4	0	0
				$P = .02$		
(e) Approach/withdrawal (%)	8	1	.5	1	0	0
	$P = .05$			$P = .14$		
(f) Manipulative (%)	5	16	17	5	11	13
	$P = .032$			$P = .01$		
	$P = .024$					

Summary and Conclusion

To summarize, data on the course of development of mother-infant relations in rhesus monkeys have been presented; a method for teasing apart the relative roles of mother and infant in causing changes or differences in the interaction described; and the complexity of the social nexus, within which the relationship is set, stressed. When the mother is removed for a few days, the infant calls a great deal at first and then shows depressed locomotor and

Table 9. Tests in strange laboratory cage at 12 months. The test object was placed in an adjoining cage that was connected by an aperture large enough for the infant, but too small for the mother. Test objects were a mirror outside the far wall of cage for 30 minutes; a mirror with grass in front of it, for 15 minutes; and a banana, for 10 minutes. Figures give latency to enter this cage, total time in the cage, and median length of the visit. Mirror and grass tests were on the sixth day after moving to strange cage; banana test on days 1 and 6 (figures give medians of sums of individual scores). *P* values based on Mann-Whitney U test, two-tailed.

Measure (minutes)	Controls ($N = 6$)	SS ($N = 5$)	TS ($N = 8$)
Mirror (day 6)			
Latency	.2	1.3	2.4
		$P = .042$	
Total time	7.9	6.5	6.7
	$P = .03$		
Median visit length	.4	.3	.3
		$P = .03$	
Mirror and grass (day 6)			
Latency	.2	.1	.4
Total time	9.7	8.7	4.2
		$P = .004$	
Median visit length	.8	.6	.3
		$P = .03$	
Banana (days 1 and 6)			
Latency	1.7	4.7	6.2
Total time	6.7	5.4	5.5
Median visit length	.9	.6	.2
		$P = .008$	

play activity. These symptoms may last for a month after the mother's return. Simple tests given 6 months and even 2 years later strongly suggest that the differences (between infants that have had such a separation experience and infants that have not) are persistent.

Are these data relevant to the human case? The rhesus monkey has no verbal language and a much less complex social development than man. Furthermore, its social environment is quite different from that found in any human culture. Parallels between monkey and man must therefore be scrutinized carefully before being used as a basis for generalization. But the facts show that a brief separation experience produces in rhesus monkey infants symptoms that are very similar (except for the apparent absence of a "phase of detachment" on reunion) to those in human infants (*25*). While age of separation, within the rather narrow limits used here, was a variable of minor importance, the effects of the separation varied, as in the human case, with the length of the separation experience and the sex of the infant. Differences in the techniques of experimenters, as well as differences in the species, prevent precise comparisons of the roles of the mother-infant relationships; nevertheless, the nature of the relationship appears to be an important variable in both monkey and man. There would seem, therefore, to be strong reasons for thinking that we are dealing with comparable phenomena. If that is the case, the fact that monkeys function at a simpler conceptual level than man limits the complexity of the explanatory hypotheses necessary in the human case. In addition, the finding that such a brief separation experience, involving removal of the mother but no exposure to a strange environment, can produce effects lasting for months or years in rhesus monkeys strengthens the evidence that long-term effects may occur also in man. Finally, this analysis provides bases for attempts to predict individual differences in the effects of a period of separation on rhesus infants, and the parallels with man suggest that examination of the same variables in the human case would be worthwhile.

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